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This Task Order continues earlier work aimed at establishing performance measures for monitoring the economic competitiveness of the freight sector as part of the implementation of the California Sustainable Freight Action Plan (CSFAP). The purpose of this task order is to define competitiveness in California's freight sector, and work with industry, public and state and local government stakeholders to establish performance measures and targets relative to the implementation of the CSFAP. The task order is in support of the Governor's Office of Business and Economic Development (GO-Biz), which is taking the lead role in establishing these new definitions and metrics in relation to the state's greenhouse gas (GHG) reduction goals and development of a sustainable freight system for California.

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Economic Competitiveness, Definitions and Metrics Task Order 020

Final Report

October 2018

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INTRODUCTION

Task Order Purpose

This Task Order continues earlier work aimed at establishing performance measures for monitoring the economic competitiveness of the freight sector as part of the implementation of the California Sustainable Freight Action Plan (CSFAP). The purpose of this task order is to define competitiveness in California's freight sector, and work with industry, public and state and local government stakeholders to establish performance measures and targets relative to the implementation of the CSFAP. The task order is in support of the Governor's Office of Business and Economic Development (GO-Biz), which is taking the lead role in establishing these new definitions and metrics in relation to the state's greenhouse gas (GHG) reduction goals and development of a sustainable freight system for California.

The main objective of this research is to build on previous work with public agencies and industry groups to establish a set of measures that would accurately depict the competitive state of California's freight economy, and arrive at targets that could be used to evaluate competitiveness over time. In collaboration with the Economic Competitiveness Working Group, we defined competitiveness and the freight sector, evaluated data sources for potential metrics, and generated test metrics and comparable groups. The next step in this process is to generate the entire set of baseline metrics and establish a method for annual monitoring. This will be done in a later stage of the project.

The CSFAP

As per Executive Order B-32-15 by Governor Brown, the California Sustainable Freight Action Plan (CSFAP) was initiated in July 2016. The Plan provides the vision for California's freight sector to be more efficient, more economically competitive and less polluting. The freight sector is vital for California as the nation's largest contributor for international trade and domestic commerce. It is also clear that the freight sector is responsible for a high portion of the pollution within the state of California. In order to combat climate change, the state of California has already set ambitious targets to reduce greenhouse gas emissions. The Plan aims at integrating investments, policies and programs within the state of California and offers a unified approach to improve efficiency, transition to zero emission technologies and improve the state's freight sector competitiveness. As part of the freight sector vision for 2030 and beyond, the Executive Order has directed the state agencies to set targets for the three main aspects: improve efficiency, transition to zero emission and increase economic competitiveness. At the time the CSFAP was approved, economic competitiveness targets and metrics had not been selected.

Prior Work

Under the previous task order contract, METRANS conducted three meetings with the Economic Competitiveness working group, one being a full day workshop. Outcomes of this work included a working definition of economic competitiveness, a high-level definition of the freight sector, a discussion of potential metrics and agreement on approach for continuing the work and fulfilling the requirements of the CSFAP.

This research aimed at developing economic competitiveness and growth metrics to track the health of the freight sector while implementing the Plan. The metrics will help evaluate the strategies proposed by the Plan and track any economic impact. The research started after the first meeting held on the 25th of January 2018. The first phase included freight sector definitions. It was agreed to include freight sector activities as well as freight related activities. The North American Industry Classification System (NAICS) was used to track different activities as it is the standard used by most economic studies. Possible data sources were examined and different statistical programs were considered to collect the required data to develop the indicators that make up the metrics. Available data sources and proposed competitiveness indicators were then presented in the second meeting held on the 4th of April 2018. The final metrics and indicators were presented in the last meeting held on the 8th of June 2018. The results also included comparison with some of the identified competitive states.

RESEARCH AND RESULTS

This project has the following tasks: 1) Definition of the freight sector; 2) Definition of economic competitiveness; 3) Measuring economic competitiveness; 4) Identifying economic competitiveness targets. Strong emphasis was placed on carefully defining terms in order to develop metrics that accurately reflect the sector's performance, as well as to select the best available data sources for measurement.

Task 1: Definition of the freight sector

1.1 Definition

The working group agreed on the following broad definition of the freight sector:

The freight sector constitutes all transportation based and transportation dependent enterprises involved in the supply chain from point of origin to point of consumption.

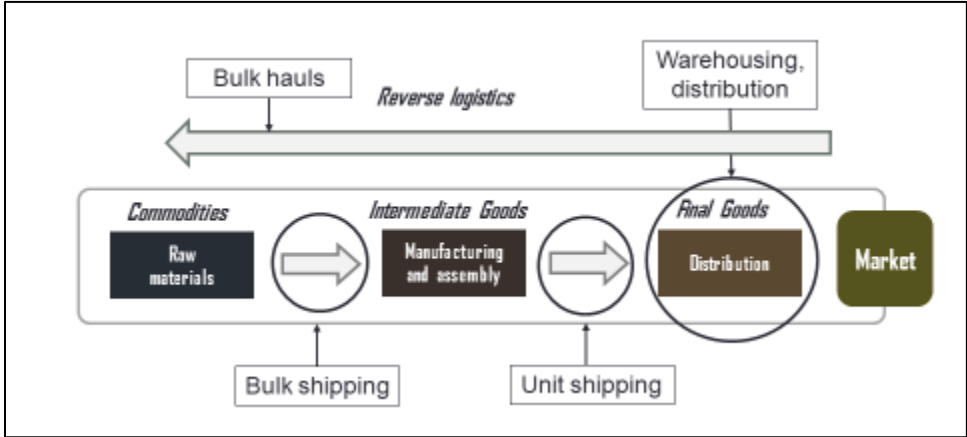
It includes:

1. All carriers
2. All transportation service providers involved in moving, handling, managing, or planning the flow of cargo
3. All transportation dependent activities
4. All cargo owners or intermediaries
5. Reverse logistics chains
6. Transportation infrastructure

This definition is quite broad, as it includes "all cargo owners or intermediaries", meaning retail, wholesale and manufacturing, as well as transportation infrastructure, both public and private. Justification is presented in Figure 1, an example of a retail supply chain. Shipping connects the production, distribution, consumption, and waste processes. Strictly speaking, each of the stationary activities is dependent on the transport that links each element of the supply chain. In addition, the velocity and reliability of the supply chain depends in part on the supply and quality of infrastructure, from public highways and airports to private railways and terminal facilities.

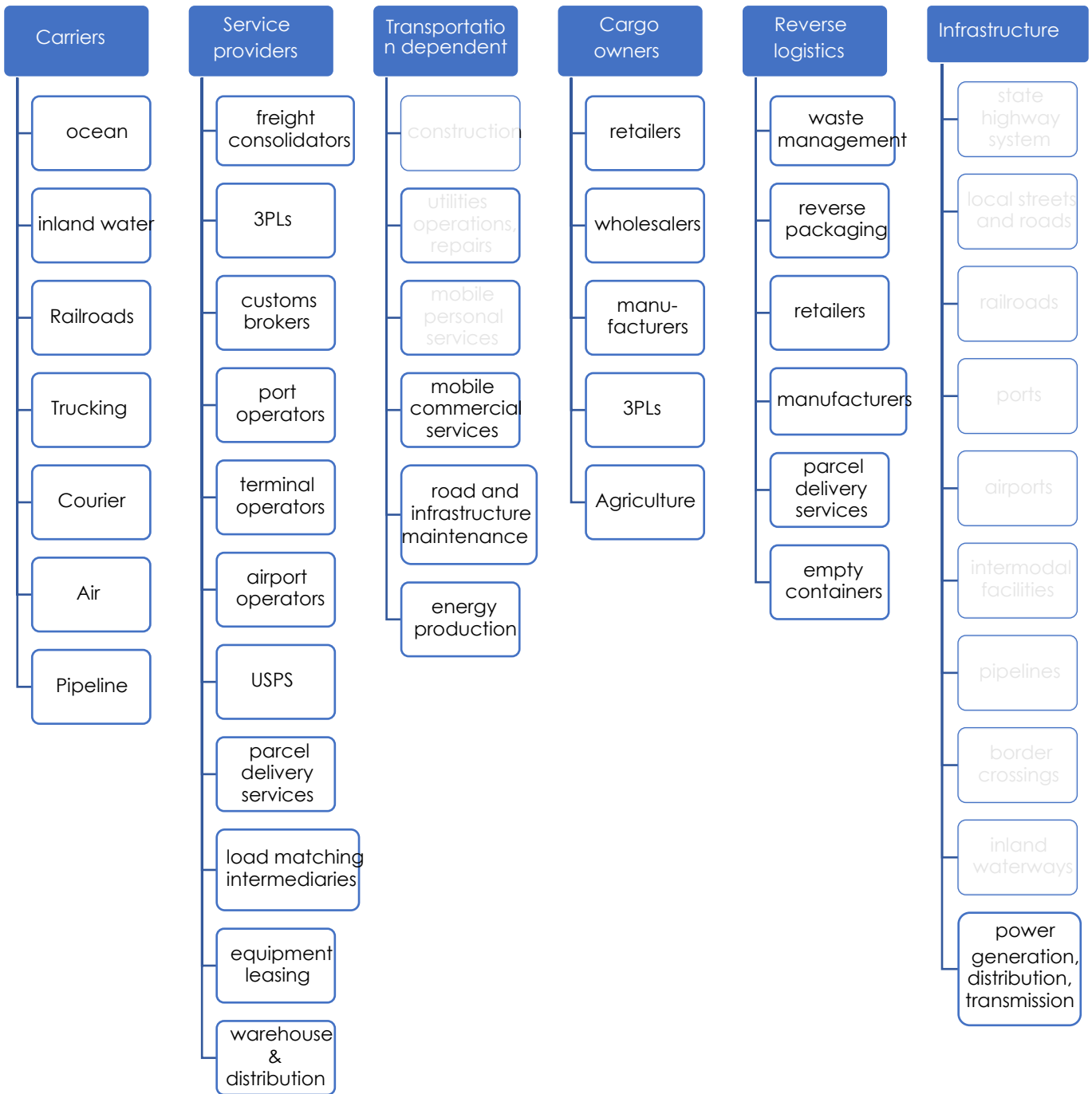
However, a broad definition of the freight sector creates problems for measuring economic competitiveness. First, the size of the retail, manufacturing, and wholesale sectors dwarfs the more traditional concept of freight sector. Second, performance of the transport system cannot be measured in the same way as performance of the freight sector, we further discuss these issues in Task 3 below.

Figure 1: Example of retail supply chain



Once defined, the freight sector definition must be made operational. All of the economic activities within each of the subsectors above must be fully enumerated. See Figure 2. This enumeration is the result of discussions of the first meeting of the working group, held on January 25, 2018. There are many activities or sub-sectors that are part of each aspect of the freight sector listed above. For example, “All carriers” includes each of the transport modes. “All transportation service providers” includes 11 activities, from port or intermodal operations to third party services to the USPS. The set of activities included provides the basis for examining data sources that can be used to measure the freight sector as defined here.

Figure 2: Freight sector enumerated by group



1.2 Data and Sources

1.2.1 Industry codes

The next step in creating an operational definition to measure freight sector performance is to identify the data that provides the best accuracy, consistency, and detail consistent with our definition. The obvious choice for mapping to economic data is the National Industrial Classification System (NAICS), developed by the US Bureau of Commerce. NAICS is a business establishment classification system with up to 6-digit granularity, with each higher level nested from lower levels. There are about 1000 unique 6-digit codes. Many different data sources are produced by federal and state governments based on the NAICS system. As would be expected, the more granular the code or geography, the more missing data there is due to confidentiality requirements.¹ See [<https://www.naics.com/business-lists/counts-by-naics-code/?#countsByNAICS>] for more information on NAICS.

At the 2-digit level, the “freight sector” is typically defined as NAICS 48-49, transportation and warehousing. Table 1 shows the 3-digit codes included in 48-49. It can be seen that many of the activities in our definition are included, but some are not (e.g. waste management), and some included activities are not freight (e.g. transit and ground passenger). In order to map our definition to NAICS, we must eliminate the non-freight activities in 48-49 and add freight activities measured outside of 48-49. We therefore chose to use 6-digit NAICS as the basis of generating performance measures.

Table 1: 3-digit composition of NAICS 48-49

Code	Description
481	Air transportation
482	Rail transportation
483	Water transportation
484	Truck transportation
485	Transit and ground passenger
486	Pipeline transportation
487	Scenic and sightseeing
488	Support activities for transportation
491	Postal service
492	Couriers and messengers
493	Warehousing and storage

Even using NAICS 6-digit coding, it is not possible to generate a perfect mapping to our definition. First, in some cases, six digits NAICS codes could not be broken down to capture the exact activity listed. Some NAICS codes include more than just one type of activity. Second,

¹ See [<https://www.naics.com/business-lists/counts-by-naics-code/?#countsByNAICS>] for more information on NAICS.

transportation dependent activities could not be broken down to capture only the transportation portion within these sectors. Sectors like construction and utilities (NAICS codes 23 and 22 respectively) must be either included or excluded as a whole. The same issue was faced with Cargo owners (retailers, wholesalers and manufacturers; NAICS codes 44-45, 42 and 31-33 respectively); these were included as a whole. Similarly, mobile services (NAICS code 81) was broken down to capture the activities that included transportation, but it was not possible to break down the transportation portion in each activity. In the next phase of the research we will determine whether there is potential bias from either over-counting or undercounting these subsectors. Finally, it is not possible to capture transportation infrastructure with NAICS. Value of any establishment held (e.g. private) infrastructure is part of that sector's economic productivity. Public infrastructure is not establishment based by definition and hence is not captured in NAICS.²

Tables 2 through 6 show the mapping of each group to 6 digit NAICS. Some entries are given in 2 or 4 digit NAICS; this means all the nested codes are included. It can be seen that overall, we are able to capture our definition with 6-digit NAICS. The least information is available for reverse logistics, but we assume the reverse activity is included in the general service activity. For example, the return packages processed by a parcel delivery service would be part of all courier service activity. The most problematic is transportation dependent services, as it is largely a judgement call to determine what services are in fact (commercial) transport dependent. This is an area for additional work in the next phase.

² The omission of the economic value of public activity will lead to unavoidable distortions. For example, if a state DOT contracts road repair to a private company, it will be captured in NAICS, but if road repair is done by the DOT it will not be captured.

Table 2: All Carriers

Number	Group	NAICS description	NAICS code
1	Ocean carriers	Deep sea freight transportation	483111
		Coastal and Great Lakes transportation	483113
2	Inland water carriers	Inland water carriers	483211
3	Railroads	Railroads-Shortlines	482112
		Classes-line haul-571 Carriers-including passengers	482111
4	Trucking	Trucking-general freight trucking, local	484110
		general freight trucking, long distance, truckload	484121
		General freight trucking, long distance, less than truckload	484122
5	Couriers	Couriers	491110
		Couriers and express delivery	492110
		Local messengers and local delivery	492210
6	Air transport	Air transport	481112
		Nonscheduled chartered air transportation	481212
7	Pipeline	Pipeline-Oil	486110
		Gas	486210
		Refined Petroleum Product	486910
		All other	486990

Table 3: Service Providers

Number	Group	NAICS description	NAIC488310S code
1	Freight consolidators	Freight transportation arrangement	488510
2	3PLs	Freight transportation arrangement	488510
3	Customs brokers	Freight transportation arrangement	488510
4	Port operators	Port and harbor operations Marine cargo handling Navigational services to shipping Other support activities for water transport	488310 488320 488330 488390
5	Terminal operators	Support activities	488119 488190
6	Airport operators	Support activities	488119 488190
7	USPS	USPS	491110
8	Parcel delivery services	Couriers and express delivery services	492110
9	Load matching	Freight transportation arrangement	488510
10	Equipment leasing	Truck, utility trailer, and RV (Recreational Vehicle) rental and leasing	532120
11	Warehouse & distribution	Warehousing and distribution Refrigerated warehousing and storage Farm product warehousing and storage Other warehousing and storage	493110 493120 493130 493190

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Number	Group	NAICS description	NAICS code
1	Repair and maintenance services	Maintenance and repair of machinery, equipment, and vehicles Appliance repair and maintenance Re-upholstery and furniture repair Funeral homes and services Pet care services (except veterinary) Environment, conservation and wildlife services Communication equipment repair and maintenance	811000 811412 811420 812210 812910 813312 811213
2	Mobile commercial services	Other electronic and precision equipment repair and maintenance Commercial and industrial machinery repair and maintenance (not auto or electronic)	811219 811310
3	Road and infrastructure maintenance.		488490
4	Energy production	Electric power generation, transmission and distribution	2211

Table 5: Cargo Owners

Number	Group	NAICS description	NAICS code
1	Retailers	Retail Trade	44-45
2	Wholesalers	Wholesale Trade	42
3	Manufacturers	Manufacturing	31-33
4	Agriculture	Specialized Freight (except Used Goods) Trucking, Local	484220

Table 6: Reverse Logistics

Number	Group	NAICS description	NAICS code
1	Waste management	Waste management and remediation services	562
2	Reverse packaging	N/A – cannot be separated out	
3	Retailers	N/A – cannot be separated out	
4	Manufacturers	N/A – cannot be separated out	
5	Parcel delivery services	N/A – cannot be separated out	
6	Empty containers	N/A – cannot be separated out	

1.2.2 Data Sources

Several data sources were examined to determine whether and how metrics could be generated based on our freight sector definition. As a starting point, we seek data that is published at least annually, is consistent over time, available in constant dollars, and available at the state level. We examined seven data sources with contrasting advantages and disadvantages.

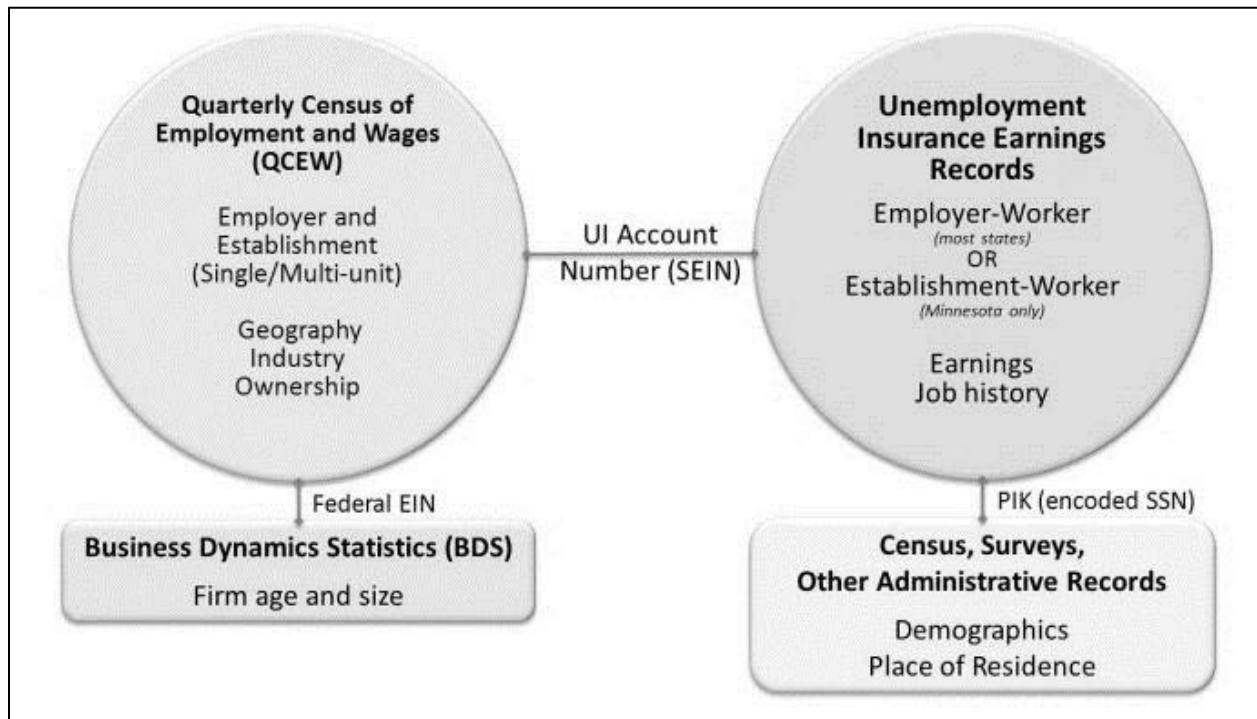
Quarterly Workforce Indicators [1]

https://lehd.ces.census.gov/doc/QWI_101.pdf

Description: QWI provides quarterly local labor market statistics by 2 to 4-digit NAICS industry, worker demographics, employer age and size. The main source of QWI is the Longitudinal Employment and Household Dynamics (LEHD) data. LEHD is a massive longitudinal database covering 95% of the US private sector. It is employer based, meaning that only establishments with employed workers are included.

Data Sources: LEHD relies on several administrative records on employment collected by the states, Social security data and federal tax records. Figure 3 below presents a data diagram of the composition of QWI and how each data source is linked to the other using common identifiers including PIK (Protected Identification Key, an encoded Social Security number), SEIN (State Employer Identification Number) or Federal EIN (Employer Identification Number). Having many data sources requires common identifiers to correctly merge the data.

Figure 3: Construction of QWI



Source: US Census, 2017

Quarterly Census of Employment and Wages (QCEW) [2]
<http://www.labormarketinfo.edd.ca.gov/qcew/cew-select.asp>

Description: The Quarterly Census of Employment and Wages (QCEW) is a quarterly count of employment and wages reported by employers by 2 to 6-digit NAICS code.

Data Source: QCEW microdata are collected from unemployment insurance (UI) accounting system in each state. The states receive a Quarterly Contributions Report (QCR) from all private sector employers, as well as from state and local governments covered under the UI program. The reports contain only employment and wages data, for each employer's installations within each state. The QCEW conducts two surveys in addition to collecting administrative data. Approximately one-third of all private sector U.S. businesses with more than three employees are contacted annually to verify their main business activity and physical location address via the Annual Refiling Survey (ARS). Eligible multiple-establishment employers are required to report quarterly employment and wage data via the Multiple Worksite Report (MWR). Both surveys collect data via paper forms and electronically.

Non-Employer Statistics (NES) [3]

<https://www.census.gov/programs-surveys/nonemployer-statistics/about.html>

Description: NES is an annual data series that provides economic data in 2 to 6-digit NAICS code for businesses that have no paid employees and are subject to federal income taxes. The most common example is sole proprietorship.

Data Sources: NES data relies on statistical data obtained through business income tax records that IRS provides the census bureau. Data are then processed through automated and analytical reviews.

Statistics of US Businesses (SUSB) [4]

<https://www.census.gov/programs-surveys/susb/about.html>

Description: SUSB provides annual data on the distribution of economic data by enterprise size and industry, number of firms and establishments, annual payroll, and employment. NAICS level is 2 to 6-digit NAICS code. SUSB excludes non-employer businesses, private households, railroads, agricultural production, and most government entities.

Data Sources: SUSB data relies on the Business Register (BR). BR includes the Census Bureau's economic censuses and current business surveys, quarterly and annual Federal tax records, and other departmental and federal statistics.

Economic Census [5]

<https://www.census.gov/programs-surveys/economic-census/technical-documentation/methodology.html>

Description: The Economic Census is the US government's official five-year measure of American businesses and economy. NAICS level is 2 to 6-digit NAICS code.

Data Sources: The Economic Census data are based on a complete enumeration of all known employers in some sectors and a sample in some other sectors. It excludes railroads and USPS.

Survey of Business Owners (SBO) [6]

<https://www.census.gov/programs-surveys/sbo/technical-documentation/methodology.html>

Description: SBO provides 2 to 6-digit NAICS code data on some economic and demographic characteristics of businesses and business owners.

Data Sources: SBO data is collected using a survey that is mailed asking respondents to report it back electronically. Surveys are mailed to a random sample of businesses selected from a list of all firms. The list of all firms is collected from business tax returns and data collected on other economic census reports. SBO excludes Rail Transportation (NAICS 482) from the survey.

Bureau of Economic Analysis [7]

https://www.bea.gov/regional/pdf/GDPState/0417_GDP_by_State_Methodology.pdf

<https://www.bea.gov/regional/pdf/GDPMetro2015.pdf>

Description: BEA provides data by state and metropolitan area. Data are available only at 2-digit NAICS code. Data available are GDP, compensation of employees, taxes on production and imports, subsidies and per capita real GDP.

Data Sources: GDP by state is estimated in ten consecutive steps. It includes data from BEA's state personal income accounts, tax data from the Census Bureau, federal and state government agencies, and other data from the Census Bureau. GDP for metropolitan areas by industry is generally calculated in two steps: first by multiplying the ratio of county to state earnings for the industry by the state level GDP and then, summing up all counties in a metropolitan area to generate GDP by that industry.

Table 7 summarizes the data sources described above and presents their respective advantages and disadvantages. Because annual data is preferred for this analysis, the 5 year sources are not adequate. However, since revenue data are only available from the economic census in 5 year increments, estimates had to be generated as described in Task 3 below. Our analysis relies on data with as little lag as possible, making QWI and QCEW particularly attractive. We also want to include as much of the entire sector as possible. For example, we know that independent operators make up a significant portion of the trucking industry. Thus data sources that omit independent operators (QWI, QCEW) will have to be supplemented. We retained all the data sources as candidates, with selections made in Task 3.

Table 7: Summary of potential data sources

Data Source	Frequency	Latest data available	NAICS digits	Variables	Exclusions
Quarterly Workforce Indicator (QWI)	Quarterly	Q2 2017	2-4	Employment, employment change, earnings	Firms with no employees
Quarterly Census of Employment and Wages (QCEW)	Quarterly	Q4 2017	2-6	Employment, earnings	Public sector not covered by unemployment insurance program
Non-Employer Statistics (NES)	Annual	2015	2-6	N of establishments, revenues	Firms with employees
Statistics of US businesses (SUSB)	Annual	2014	2-6	N of firms, establishments, employment, annual payroll, revenues	Firms with no employees, RR, USPS
Economic Census	5 years	2012	2-6	N of establishments, employees, ave payroll per employee, total annual payroll, revenues	Firms with no employees, RR, USPS
Survey of business owners (SBO)	5 years	2012	2-6	N of firms with or without employees, revenues, payroll	RR
Bureau of Economic Analysis (BEA)	Annual	2016	2	GDP, real GDP, per capita real GDP	

Task 2: Definition of "Economic Competitiveness"

2.1 Definition

The working group agreed on the following definition of economic competitiveness:

The California freight sector's ability to 1) successfully compete with freight sectors in other states as measured by using existing comparable metrics, and 2) increase the productivity of freight and related sectors and contribute to the growth of California's economy.

Economic competitiveness is affected by policies, institutions, and investments that influence the freight sector's productivity.

This definition requires developing a suitable set of metrics, as well as a suitable comparative group. A composite metric, measuring the performance of the entire freight sector as defined above, would give an overall indicator of competitiveness. The composite metric should be supported by sector specific metrics, given the differences in the competitive environment between sectors. For the composite measure, we use the rest of US as the comparative group. For sector specific measures, we use sector specific comparison groups.

The second part of this definition recognizes that public policy affects competitiveness. For example, investments to reduce freight bottlenecks will increase reliability, contributing to economic competitiveness. Policies that add to the cost of doing business will reduce competitiveness, all else equal. The CSFAP recognizes that plan implementation may have positive or negative effects on the freight sector, and calls for the development of targets and tools that will help evaluate the strategies proposed under the Action Plan to ensure consideration of impacts on economic growth and competitiveness throughout the development and implementation process (adapted from CSFAP, p.10). The tools to evaluate strategies will be addressed in a later phase of this project. Metrics and targets are considered in this project.

2.1.1 Metrics

There are many aspects of economic performance that could be measured. Starting with the composite measure, overall economic performance is traditionally measured by the sector's contribution to GDP. As the sector grows relative to other sectors, its contribution to GDP grows. However, GDP contribution may not be the best indicator for the freight sector. As freight becomes more productive, its share of GDP will decline, all else equal. Thus, a better measure of the economic health of the industry might be net profits or revenue per employee. In the interest of testing a variety of measures and having to consider data limitations, we generated the following list of possible metrics. Data sources are also listed.

1. Financial Performance Measures
 - Revenues (Economic Census)
 - Revenues to Employment ratio (Economic Census & QWI)
 - Profits and debt-to-liabilities ratios (If data becomes available)
2. Workforce Statistics
 - Number of establishments (Economic Census)

- Number of employees(QWI)
 - Employee average revenue(QWI)
 - Total Payroll (QWI)
3. Overall Economic Performance
 - GDP and Real GDP (BEA)

As noted above, a different approach is required for transportation system performance. Below are some examples of transportation system performance that affect economic competitiveness of the freight industry. Due to time constraints, transportation system metrics were deferred to a later phase of the project.

1. System performance
 - Truck delay
 - Accidents
2. Infrastructure
 - Government investment
 - State of good repair
 - Truck parking
3. Public services
 - Highway information
 - Enforcement

Task 3: [Measuring Economic Competitiveness](#)

In order to illustrate how metrics could be generated, we selected three basic metrics: revenues/employee, payroll/employee, and GDP/employee. We use 2016 data.

3.1 Generating the metrics data

We selected QCEW as our source of employee and wage data because it is available directly from the state Employment Development Department (EDD), and statisticians within the department are experts on the details of the data. Revenue data is available at the 6-digit NAICS code level from the Economic Census, but the most recent year available in 2012. GDP data is available annually from BEA, but at the 2-digit level. We therefore develop a method to 1) update the Economic Census data to 2016, and 2) expand the BEA data to 6 digits.

3.1.1 Generating the 2016 revenue estimate

To generate the 2016 revenue estimate from the 2012 Economic Census data, we assume that the ratio of revenue/employee for each NAICS code is constant over time. We use the QCEW data to calculate the change in employment from 2012 to 2016 by 6-digit code, and then apply that change to the 2012 revenue data:

$$\text{Revenue (2016)} = \text{Revenue (2012)} \times \% \text{ change employment, 2012-2016}$$

The assumption that the ratio of revenue/employee is constant over time is strong and may lead to biased estimates. Unfortunately, there is no better option for estimating 2016 revenues given the data limitations. We will be able to check this assumption when the 2017 data is released.

Table 8 gives 2016 estimated revenues based on employment growth for the "All Carriers" group. Tables for the other groups are available in Appendix A. The employment column shows the number of employees within each activity in California in 2016. The employment growth column shows the growth rates from 2012 to 2016 which is used to estimate each activity's revenues. The calculated revenues column shows the estimated revenues (in \$1000) per activity in California for 2016. As already discussed, some activities suffer from suppressions. A calculated revenues cell showing NA means that the revenues data for this specific activity was missing within the economic census of 2012. However, an employment growth box showing NA means that the employment data for that specific activity was suppressed in 2012. In the latter case, there is an empty calculated revenues box for the same activity. It is also clear that railroad data is suffering from possible suppressions as the numbers seem unrealistic given the scale of the industry.

Table 8: Calculated revenues for “All Carriers” activities

	All carriers	Code	Employment (2016)	Employment Growth	Calculated Revenues (\$1000)
1	Ocean Carriers-Deep sea freight Transportation	483111	2,101	6.9%	2,538,666
	Coastal and great lakes freight transportation	483113	719	67.2%	NA
2	Inland water carriers	483211	118	-37.1%	NA
3	Railroads-Shortlines	482112	36	-8.8%	NA
	Classes-line haul-571 Carriers-including passengers	482111	98		
4	Trucking-General Freight trucking, Local	484110	35,733	-14.9%	2,933,516
	General Freight trucking, Long distance, truckload	484121	24,221	-7.6%	4,476,566
	General Freight trucking, Long distance, less than truckload	484122	20,844	32.0%	4,468,641
5	Couriers/Last mile	491110	720	0.7%	NA
	Couriers and express delivery	492110	68,128	36.2%	11,043,201
	Local messengers and local delivery	492210	11,875	56.5%	739,860
6	Air Transport	481112	786	-44.6%	293,086
	Non scheduled chartered air transportation	481212	1,225	14.8%	28,191
7	Pipeline-Oil	486110	581	NA	
	Gas	486210	437	NA	
	Refined Petroleum Product	486910	855	-18.7%	308,891
	All other	486990	21	NA	

3.1.2 Generating the 6-digit level GDP estimate

GDP data were acquired from the Bureau of Economic Analysis. The data are limited to the 2-digit level. In order to expand the GDP data to 6-digit, we again use the QCEW employment data. We calculate the share of each 6-digit sector within the 2 digit sector, and use the shares to allocate GDP:.

$GDP_i = \% \text{ employment}_i \times GDP_j$, where GDP_i is 6-digit sector i , and GDP_j is 2 digit sector j .

This method assumes a close relationship between employment and GDP. We estimated the correlation coefficient for employment and GDP for 22 quarters of data, from Q1 2012 to Q2 2017. The correlation is 0.991, indicating that employment is a very good proxy for GDP.

Table 9 presents GDP estimates for the all carriers group. Tables for the other groups are available in Appendix B. The employment column is the same as in Table 8. The GDP estimate is generated from applying the employment based GDP weight to the 2 digit GDP quantity.

Table 9: 2016 GDP estimates for "All Carriers" activities

	All carriers	Code	Employment	GDP Weight	GDP (\$million)
1	Ocean Carriers-Deep sea freight Transportation	483111	2,101	0.4%	\$264.23
	Coastal and great lakes freight transportation	483113	719	0.1%	90.42
2	Inland water carriers	483211	118	0.0%	14.84
3	Railroads-Shortlines	482112	36	0.0%	4.53
	Classes-line haul-571 Carriers-including passengers	482111	98	0.0%	12.32
4	Trucking-General Freight trucking, Local	484110	35,733	7.0%	4,493.85
	General Freight trucking, Long distance, truckload	484121	24,221	4.7%	3,046.08
	General Freight trucking, Long distance, less than truckload	484122	20,844	4.1%	2,621.38
5	Couriers/Last mile	491110	720	0.1%	90.55
	Couriers and express delivery	492110	68,128	13.3%	8,567.91
	Local messengers and local delivery	492210	11,875	2.3%	1,493.42
6	Air Transport	481112	786	0.2%	98.85
	Nonscheduled chartered air transportation	481212	1,225	0.2%	154.06
7	Pipeline-Oil	486110	581	0.1%	73.07
	Gas	486210	437	0.1%	54.96
	Refined Petroleum Product	486910	855	0.2%	107.53
	All other	486990	21	0.0%	2.64

We generated the estimates in Tables 8 and 9 for all groups included in the freight sector as defined by the Working Group. As mentioned earlier, some of the industry sectors included are much larger than the traditional sector 48-49. To present a sense of these scale differences, Table 10 gives the estimated 2016 GDP by group, as well as the size of that group relative to sectors 48-49. Thus "All Carriers" makes up about 26% of 48-49, and freight transport service providers make up over 40%. All transportation dependent activities are about 24%. In contrast, cargo owners are nearly 9 times as large due to retail and manufacturing. We therefore separate

cargo owners when presenting examples of metrics in Task 4. The argument for including cargo owners is the GDP value they represent of the imports and exports of the ports. Adding up all these GDP values, the total freight sector as defined as per this project constitutes about 29% of the total state GDP in 2016.

Table 10: Freight sector group GDP as share of 48-49 GDP

Category	GDP (\$million)	% of sector 48-49
All carriers	16,913	26.3%
Freight Transportation Service Providers	27,003	41.9%
All Transportation dependent activities	15,626	24.3 %
Reverse Logistics	5,919	9.2%
Cargo Owners	578,042	897.4%

3.1.4 Comparables

As noted earlier, for the composite metrics, the rest of the US is the comparison group. As examples for sector level comparisons, we selected trucking and ports. Discussions with the working group resulted in the selection of Arizona, Nevada and Utah as the potential competitor states for trucking, and Virginia and Georgia as potential competitor states for port activity.

3.2 Generating the metrics

This section is divided in two parts. The first part covers California indicators for the year 2016. The second part covers the comparison with competitor states within two activities: trucking and ports.

3.2.1 2016 California Indicators

We generated a baseline set of indicators for 2016 based on the three groups of measures: financial performance, workforce statistics and overall economic performance. We noted earlier that our definition of the freight sector is quite broad. Including cargo owners means including sectors that are much larger than the conventionally defined freight sector. In calculating performance measures, these sectors are likely to dwarf any changes that might happen within the more narrowly defined sector. To show how including cargo owners could affect the measures, we calculate all measures with and without cargo owners.

1. Financial Performance Measures (Source: Economic Census)

Revenues and revenues per number of employees were calculated for every activity under each of the five main groups. All activities under the same category were then added up to make up the revenues estimates per group. Table 11 shows Financial Performance Measures in 2016. It can be seen that cargo owners' revenue is larger than the more conventionally defined freight

sector by a factor of about 20. Revenue per employee is about three times as large, illustrating how different the cargo owner sectors are from the freight sector. Table 11 also shows that there are large differences within the various segments of the freight sector. Revenue per employee is lowest for all carriers and highest for reverse logistics (waste management). The largest group by total revenue is freight transportation service providers.

Table 11: Total revenue and revenue/employee, 2016

	Category	Revenues (\$1000)	Rev/Emp (\$)
1	All carriers	26,830,619	159,234
2	Freight transportation service providers	58,871,710	213,721
3	All transportation dependent activities	7,308,628	77,908
4	Reverse logistics	12,686,885	258,726
	Total freight sector	105,697,842	180,124
5	Cargo owners	2,093,670,647	559,124
	Total freight and freight related	2,199,368,489	507,778

2. Workforce Statistics (Source: QCEW)

Workforce statistics include number of employees, number of establishments, total payroll and payroll per employee. These indicators were gathered for every activity and then summed up within each group. Results are given in Table 12. Comparing the two tables shows that the difference in employees between the freight sector and cargo owners sector is about 6 times, while the difference in total revenues is about 20 times. However, payroll per employee within the freight sector is about two third the payroll within the cargo owners sector. Within the freight sector groups, freight transportation service providers dominate. Payroll per employee falls into low and high groups. The low group includes all carriers and freight service provider, and the high group includes transportation dependent activities and reverse logistics.

Table 12: Workforce related measures, 2016

	Category	Emp	N Estab	Total Payroll (\$1000)	Payroll/ Emp (\$)
1	All carriers	168,498	8913	5,147,194	30,548
2	Freight Transportation Service Providers	275,461	7498	9,699,852	35,213
3	All Transportation dependent activities	93,811	7134	5,256,799	67,672
4	Reverse Logistics	49,036	2,108	3,004,921	61,280
	Total freight sector	586,806	25,653	23,108,766	39,381
5	Cargo Owners	3,744,554	201,045	225,910,792	60,330

Total freight and related	4,331,360	226,698	249,019,558	57,492
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3. Overall Economic Performance (Source: BEA)

The third measure is overall economic performance, as measured by GDP and GDP per employee. We use the same method of calculating GDP for each activity and then summing up all activities under each group. Results are shown in Table 13. Cargo owners account for nearly 9 times as much GDP as the rest of the freight sector, and within the rest of the freight sector, freight transportation service providers' account for the vast majority of GDP. GDP per employee for the freight sector is just over two thirds of the cargo owners group.

Table 13: GDP and GDP per employee

	Category	GDP (\$million)	GDP / Emp (\$)
1	All carriers	16,913	100,374
2	Freight transportation service providers	27,003	98,030
3	All transportation dependent activities	15,626	166,566
4	Reverse logistics	5,919	120,707
	Total freight	65,461	111,554
5	Cargo owners	578,042	154,369
	Total freight and freight related	643,503	148,568

3.2.2 Benchmark comparisons

As a final illustration of how metrics can be used at the subsector level, we compare performance of trucking and ports relative to competitor states. For trucking we use Arizona, and for ports we use Georgia. Because trucking and port activity fall within our first two freight sector categories, we use only these categories in calculating the performance measures. We use only the QCEW data, as project time constraints did not allow for constructing databases from Economic Census and BEA for other states. A single baseline year cannot provide comparative performance information (a single year gives no information on change over time); we use the change from 2015 to 2016 to illustrate the subsector comparisons.

1. Trucking Comparison

Results of the trucking comparison are given in Tables 14-16 below. Only trucking related activities, under "All Carriers" and "Freight transportation service providers", were used for these calculations. By all measures, the California freight sector is much larger than that of Arizona, as expected. The California freight sector also appears to be performing better. The growth of the number of employees in California in 2016 was about as twice that of Arizona. The number of establishments in California increased by about 5%, while the number decreased in Arizona. Total payroll increased by more than the increase in employees for California, while in Arizona total payroll increased less than the increase in employees.

Table 14: Total number of TRUCKING employees comparison, California and Arizona, 2015-2016

Category	CA Employees (2016)	% Change	AZ Employees	% Change
TRUCKING - All carriers	161,521	6.8%	35,553	3.9%
TRUCKING - Freight Transportation Service Providers	30,121	4.9%	3,023	-0.2%
Total	191,642	7.0%	38,576	3.7%

Table 15: Total TRUCKING establishments comparison, California and Arizona, 2015-2016

Category	CA Estab	% Change	AZ Estab	% Change
TRUCKING - All carriers	8,501	5.5%	1,208	-4.9%
TRUCKING - Freight transportation service providers	2,178	3.7%	254	-4.5%
Total	10,679	5.4%	1,462	-4.6%

Table 16: Total TRUCKING payroll comparison, California and Arizona, 2015-2016

Category	CA Total Payroll (\$1000)	% Change	AZ Total Payroll (\$1000)	% Change
TRUCKING - All carriers	\$4,450,859	9.2%	1,363,151	3.2%
TRUCKING - Freight Transportation Service Providers	1,790,960	5.1%	170,939	1.1%
Total	6,241,819	8.7%	1,534,090	3.1%

2. Ports comparison

Ports related activities in the state of Georgia were compared to California activities from 2015 to 2016 using the same three indicators used in trucking. Results are shown in Table 17 below. Unfortunately, due to data suppression in the 2015 QCEW California data, we were able to compute changes only for the "All Carriers" category. Table 17 shows the tremendous size difference in the port sectors of these states. Although employment increased more in percentage terms in Georgia than California, total payroll decreased in Georgia. These numbers do not seem entirely reasonable, as it is hard to imagine how such a large increase in employment could lead to a large decrease in total payroll, which implies an ever larger reduction in payroll per employee. The validity of the data merits examination.

Table 17: Port state level comparison, "All Carriers" category, 2015-2016

	Employment	Establishments	Payroll (\$1000)
California			
Total	2,820	126	358,856
Percent change	13.9%	-0.7%	14.7%
Georgia			
Total	255	26	14,078
Percent change	18.8%	2.6%	-8.6%

Task 4: Targets

The issue of targets was discussed at meetings conducted on April 4 and June 8, 2018. The working group did not feel it had enough information to set a target; in the group's view target would be arbitrary. Therefore, target setting was deferred to a later phase of the project.

CONCLUSIONS

This project accomplished the following:

- In collaboration with the Economic Competitiveness Working Group, we developed a detailed definition of the freight sector, and of economic competitiveness. These definitions provided the structure for developing metrics to measure economic competitiveness
- Data sources were examined and evaluated based on availability, consistency, validity and detail. All data sources are based on NAICS codes, and we selected 6-digit NAICS to obtain the best possible alignment of data and freight sector definition.
- Some data (revenue and GDP) were not available annually, or were limited to 2 digit NAICS. We developed methods to estimate revenue and GDP at the 6 digit or freight group level.
- We calculated example metrics to measure financial performance, workforce performance, and overall economic performance by freight group for 2016. These examples illustrate that freight group level metrics can be generated.
- We calculated example metrics to illustrate how comparisons could be conducted for specific industry segments. We used workforce performance for trucking and ports, using comparison data from Arizona and Georgia respectively.

Limitations and scope for improvements

We discovered several shortcomings in the data that will need to be addressed. First, there are data suppression problems whenever the numbers are low within a 6 digit sector. Suppression is not consistent over years, hence data will have to be adjusted for consistency each year. Second, data are sparse for the railroads. More research is necessary to understand how and why railroad data are omitted, and whether data can be obtained from another source. Third, the data sources we have used to generate example metrics do not include the self-employed. Because of the

prevalence of owner-operators in the trucking sector, it will be necessary to supplement QCEW, BEA, and EC data with another source, most likely NES.

Our sample calculations provided some insights that will be useful in the next phase of this work. First, the cargo owner sector is so large relative to the more traditionally defined freight sector that it would overwhelm any composite metric. At a minimum, the cargo owner group should be kept separate from the other freight groups.

Second, it is worth rethinking the inclusion of utilities and construction in freight dependent activities. These sectors are much larger than any of the others in the group, and have notably different characteristics with respect to revenues, payroll and GDP. Transportation activity must account for a relatively small share of total revenue or GDP; therefore we recommend deleting these sectors from the group. Waste management (reverse logistics group) is a similar case, but transportation may constitute a relatively large portion of costs and employees. Possibilities for examining the waste management sector in more detail.

Third, establishing comparison groups requires obtaining the same data and doing the same conversion estimates for each state included. If the base comparison group is the US, then data from all 49 other states will have to be processed and checked. We expect that some of what was done can be automated, but will remain labor intensive. It will therefore be important to decide on a small set of metrics and a limited number of comparison groups so that the process of annual competitiveness evaluation can be accomplished as efficiently as possible.

Further considerations

As this work moves to the next phase, the following tasks should be considered. First, the working group should consider a target, or a process for making a decision about a target. Second, a final set of metrics and comparison groups should be established and the 2016 and 2017 computations should be conducted. Third, it will be important to decide what organization will have responsibility for calculating the metrics and monitoring progress toward the target over the course of the CSFAP. Fourth, a stable funding source for continuation of this work should be identified. Finally, specific provisions of the CSFAP should be identified for analysis of impacts on the freight sector.

Appendix A: (Calculated Revenues by Group)

	All carriers	Code	Employment (2016)	Employment Growth	Calculated Revenues (\$1000)
1	Ocean Carriers-Deep sea freight Transportation	483111	2,101	6.9%	2,538,666
	Coastal and great lakes freight transportation	483113	719	67.2%	NA
2	Inland water carriers	483211	118	-37.1%	NA
3	Railroads-Shortlines	482112	36	-8.8%	NA
	Classes-line haul-571 Carriers-including passengers	482111	98		
4	Trucking-General Freight trucking, Local	484110	35,733	-14.9%	2,933,516
	General Freight trucking, Long distance, truckload	484121	24,221	-7.6%	4,476,566
	General Freight trucking, Long distance, less than truckload	484122	20,844	32.0%	4,468,641
5	Couriers/Last mile	491110	720	0.7%	NA
	Couriers and express delivery	492110	68,128	36.2%	11,043,201
	Local messengers and local delivery	492210	11,875	56.5%	739,860
6	Air Transport	481112	786	-44.6%	293,086
	Non scheduled chartered air transportation	481212	1,225	14.8%	28,191
7	Pipeline-Oil	486110	581	NA	
	Gas	486210	437	NA	
	Refined Petroleum Product	486910	855	-18.7%	308,891
	All other	486990	21	NA	

	Freight Transportation Service Providers	Code	Employment (2012)	Employment Growth	Calculated Revenues (\$1000)
1	Freight consolidators	488510	30,121	20.2%	8,949,781
2	3PIs	488510			
3	Customs brokers	488510			
4	Port Operators	488310	579	NA	
	Marine Cargo Handling	488320	15,486	-7%	3,394,758
	Navigational Services to shipping	488330	843	-51.3%	112,189
	Other Support Activities for Water Transportation	488390	460	NA	
5	Terminal operators	488119	6470	NA	
6	Airport Operations	488119			
	Support activities	488190	9,851	29.1%	1,440,559
7	US postal Service	491110	720	NA	
8	Parcel Delivery services	492110	68,128	36.2%	11,043,201
9	Load matching intermediaries	488510	30,121	20.2%	8,949,781
10	Equipment leasing	532120/532411	6091	NA	
11	Warehouse and Distribution	493110	93,923	50.4%	4,144,585
	Refrigerated Warehousing and Storage	493120	8,120	18.8%	893,853
	Farm Product Warehousing and Storage	493130	398	0.3%	62,170
	Other Warehousing and Storage	493190	4150	11.5%	547,370

	All Transportation dependent activities	Code	Employment (2016)	Employment Growth	Calculated Revenues (\$1000)
1	Communication Equipment Repair and Maintenance	811213	870	-8.7%	369,344
	Home and Garden Equipment Repair and Maintenance	811411	218	2.3%	27,855
	Appliance Repair and Maintenance	811412	2,386	38.6%	397,988
	Reupholstery and Furniture Repair	811420	2,146	-3.7%	135,195
	Funeral Homes and Funeral Services	812210	6,959	-0.2%	830,710
	Pet Care (except Veterinary) Services	812910	11,517	52.3%	679,485
	Environment, Conservation and Wildlife Organizations	813312	8,543	20.8%	1,516,107
2	Other Electronic and Precision Equipment Repair and Maintenance	811219	3,350	-14.4%	1,010,730
	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	811310	18,669	11.8%	2,686,341
3	Road and infrastructure maintenance	488490	3,723	3.7%	309,257
4	Energy Production	2211	35,430	59.8%	NA

	Cargo Owners	Code	Employment (2016)	Employment Growth	Calculated Revenues (\$1000)
1	Retailers	44-45	1,728,001	10.1%	530,356,606
2	Wholesalers	42	715995	6.3%	1,029,996,731
3	Manufacturers	31-33	1294761	3.9%	532,448,227
5	Agriculture (Local- included in)	484220	5797	-75.1%	869,084

	Reverse Logistics	Code	Employment (2016)	Employment Growth	Calculated Revenues (\$1000)
1	Waste Management	562	49,036	16.3%	12,686,885

Appendix B: (GDP estimates by Group)

	All carriers	Code	Employment	GDP Weight	GDP (\$million)
1	Ocean Carriers-Deep sea freight Transportation	483111	2,101	0.4%	264.23
	Coastal and great lakes freight transportation	483113	719	0.1%	90.42
2	Inland water carriers	483211	118	0.0%	14.84
3	Railroads-Shortlines	482112	36	0.0%	4.53
	Classes-line haul-571 Carriers-including passengers	482111	98	0.0%	12.32
4	Trucking-General Freight trucking, Local	484110	35,733	7.0%	4,493.85
	General Freight trucking, Long distance, truckload	484121	24,221	4.7%	3,046.08
	General Freight trucking, Long distance, less than truckload	484122	20,844	4.1%	2,621.38
5	Couriers/Last mile	491110	720	0.1%	90.55
	Couriers and express delivery	492110	68,128	13.3%	8,567.91
	Local messengers and local delivery	492210	11,875	2.3%	1,493.42
6	Air Transport	481112	786	0.2%	98.85
	Non scheduled chartered air transportation	481212	1,225	0.2%	154.06
7	Pipeline-Oil	486110	581	0.1%	73.07
	Gas	486210	437	0.1%	54.96
	Refined Petroleum Product	486910	855	0.2%	107.53
	All other	486990	21	0.0%	2.64

	Freight Transportation service Providers	Code	Employment	GDP Weight	GDP (\$million)
1	Freight consolidators	488510	30,121	5.9%	3,788.08
2	3PIs	488510			
3	Customs brokers	488510			
4	Port Operators	488310	579	0.1%	72.82
	Marine Cargo Handling	488320	15,486	3.0%	1,947.55
	Navigational Services to shipping	488330	843	0.2%	106.02
	Other Support Activities for Water Transportation	488390	460	0.1%	57.85
5	Terminal operators	488119	6470	1.3%	813.68
6	Airport Operations	488119	0	0.0%	-
	Support activities	488190	9,851	1.9%	1,238.88
7	US postal Service	491110	720	0.1%	90.55
8	Parcel Delivery services	492110	68,128	13.3%	8,567.91
9	Load matching intermediaries	488510	30,121	5.9%	3,788.08
10	Equipment leasing	532120	6091	1.2%	766.02
11	Warehouse and Distribution	493110	93,923	18.3%	11,811.94
	Refrigerated Warehousing and Storage	493120	8,120	1.6%	1,021.19
	Farm Product Warehousing and Storage	493130	398	0.1%	50.05
	Other Warehousing and Storage	493190	4150	0.8%	521.91

	All Transportation dependent activities	Code	Employment	GDP Weight	GDP (\$million)
1	Mobile Personal Services	81	525,737	NA	56,074
	Mobile Commercial Services				
	Communication Equipment Repair and Maintenance	811213	870	1.6%	870

	Home and Garden Equipment Maintenance	811411	218	0.4%	218
	Appliance Repair and Maintenance	811412	2,386	4.3%	2386
	Reupholstery and Furniture Repair	811420	2,146	3.8%	2146
	Funeral Homes and Funeral Services	812210	6,959	12.4%	6959
	Pet Care (except Veterinary) Services	812910	11,517	20.5%	11517
	Environment, Conservation and Wildlife Organizations	813312	8,543	15.2%	8543
2	Other Electronic and Precision Equipment Repair and Maintenance	811219	3,350	6.0%	3350
	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	811310	18,669	33.3%	18669
3	Road and infrastructure Maintenance	488490	3,723	0.6%	382.56
4	Energy Production	2211	35,430	32.5%	9,413

	Cargo Owners	Code	Employment	GDP (\$million)
1	Retailers	44-45	1,667,847	145,550
2	Wholesalers	42	715,995	142,033
3	Manufacturers	31-33	1,294,761	289,863
4	Agriculture (Local- included in)	484220	5,797	729.04

	Reverse Logistics	Code	Employment	GDP
1	Waste Management	562	49,036	5,919

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