

SOUTHERN CALIFORNIA INDUSTRY CLUSTER SERIES

GOODS ON THE MOVE!

TRADE AND LOGISTICS in
SOUTHERN CALIFORNIA

The Industry, its Jobs and
its Economic Contribution

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GOODS ON THE MOVE!

TRADE AND LOGISTICS IN SOUTHERN CALIFORNIA

THE INDUSTRY, ITS JOBS AND ITS ECONOMIC CONTRIBUTION

A SOUTHERN CALIFORNIA INDUSTRY STUDY

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Executive Summary

What we learned in this study

Trade and logistics are at the heart of the Southern California economy. With a population nearing 20 million, the region represents one of the largest consumer markets in the U.S. However, this consumer market is not the only reason that such a massive amount of trade and movement of goods takes place here; the region serves as a gateway for the rest of the nation as well.

The movement of goods is a vital component to the economic health of a region's economy. Distribution networks are critical to providing businesses with parts and materials needed for successful operations as well as supplying products to local consumer markets that are then retailed to satisfy its demand. The trade and logistics industry cluster provides tax revenue to all levels of government and a diverse array of jobs for residents with varying levels of education, skills and wages.

This report examines the trade and logistics industry cluster in Southern California (herein defined as Los Angeles, Orange, Riverside, San Bernardino and Ventura counties), beginning with a discussion of recent trends, followed by the quantification of its size in the region, how it has changed over the past decade (2005 to 2015), and its contribution to the regional economy. Occupations in the industry are identified and an overview of programs to prepare the workforce is provided. The report concludes with a brief discussion of innovation taking place in trade and logistics industries, which may influence how they evolve in the future. The findings of this report are summarized as follows:

Recent Industry Activity

- The trade and logistics industry cluster in the U.S. produced goods and services valued at \$1.5 trillion in 2015, accounting for 8.3 percent of national GDP. Of all industries in the trade and logistics cluster, wholesale trade is responsible for almost seventy percent of the cluster's total value-added.
- Growth in trade and logistics value-added from 2005 through 2015 has consistently been faster than the growth of overall national GDP with the exception of 2009.
- A total volume of 14.4 billion tons of freight valued at \$17.5 trillion was moved in the U.S. via the various modes of transportation—a daily average of 39.5 million tons and \$48.0 billion. Almost eighty percent of the total freight flow in 2015, measured in terms of both volume and value, was moved via truck.
- The largest freight forwarders in the world in 2015 (by reported gross revenue) all have operations in Southern California; they include DHL, Kuehne + Nagel, DB Schenker, and Nippon Express.

**Trade and
logistics
in the U.S.
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8.3 percent of
national GDP
in 2015.**

A total volume of 598.3 million tons of freight valued at \$1.7 trillion moved throughout Southern California in 2015.

- Mergers and acquisitions have been changing the landscape of the logistics industry resulting in a consolidation of players; in the world of third party logistics (3PL), 2015 was a year of large deals with eleven acquisitions valued over \$100 million.

The Southern California Experience

- A total volume of 598.3 million tons of freight valued at \$1.7 trillion moved throughout Southern California across the various modes of transportation, a daily average of 1.6 million tons valued at \$4.7 billion.
- In terms of total freight flow in Southern California, the lion's share of both volume and value is domestic in nature, accounting for 78 percent and 64 percent of flow, respectively. A total volume of 468.8 million tons of domestic freight, valued at \$1.1 trillion, moved throughout the region in 2015.
- Foreign trade flows are higher in value compared to domestic trade flows, with an average value of \$4,800 per ton versus \$2,300 per ton. Splitting foreign trade into import and export trade flows show the average value per ton for imports exceeded that of exports, at \$5,900 per ton and \$3,300 per ton respectively.
- Trucks are the dominant mode for freight moving in Southern California by both volume and value, moving 502.1 million tons valued at close to \$1.2 billion in 2015.
- In all parts of Southern California, industrial vacancy rates have been declining over time, with the most recent rates in each county falling to four percent or below. With the continued decline in vacancy rates, the tight market results in the steady increase of average asking lease rates.
- Los Angeles County represented more than half (59.2 percent) of wholesale trade payroll employment in the region in 2015 with 223,120 jobs.
- Most wholesale trade operations are relatively small in terms of the number of employees, operations with up to four employees account for over half of the sector's establishments; however, establishments with fifty employees or more provide 45 percent of jobs.
- In 2015, the Inland Empire (Riverside and San Bernardino Counties combined) and Los Angeles County were home to roughly ninety percent of jobs in warehousing and logistics industries in Southern California, with fifty and forty percent of jobs, respectively.
- Southern California is home to a large number of 3PLs who capitalize on the region's established goods movement infrastructure.

Sizing Things Up

- The trade and logistics industry cluster employed 580,450 workers in Southern California in 2015. This was an increase of 9.7 percent since 2005, driven by the 55.1 percent increase in warehousing and logistics jobs.
- The average annual wage in the trade and logistics industry in 2015 was \$63,130, approximately fourteen percent higher than the average wage for all other industries in Southern California (\$55,310).

The average annual wage earned by trade and logistics workers in 2015 was \$63,130.

- Wages were highest in the support activities for water transportation at \$111,120, followed by air transportation (\$75,710), and wholesale in electronic markets and conducted by brokers and agents (\$74,270). However, the majority of workers in trade and logistics are employed in wholesale trade (376,610), causing the overall cluster average annual wage to be weighted towards the mid-range of the wage scale.
- Real wage growth from 2005 through 2015 has been mild in Southern California and in the trade and logistics industry, increasing by 2.8 percent and 2.6 percent respectively. Real wages grew in wholesale trade (5.3 percent) and transportation (4.7 percent), but wage growth in the cluster overall was weighed down by warehousing and logistics industries, with a nine percent decline in real wages over the period.
- The trade and logistics cluster as a whole fails to demonstrate regional specialization with a location quotient of 1.2, but component industries vary; support activities for water transportation (LQ of 2.7) maintains the highest competitive strength.

Value-added generated by Trade and logistics accounts for 13.1 percent of the regional domestic product.

Spreading the Wealth

- In addition to the 580,450 direct payroll jobs in trade and logistics, an additional 273,840 jobs were supported in 2015 through indirect effects and 310,490 jobs were supported by induced effects.
- The industry cluster contributed \$135.0 billion in value-added, accounting for 13.1 percent of the regional gross product, and generated \$75.7 billion in labor income and fiscal tax revenues reaching \$42.6 billion (direct, indirect and induced).
- Trade and logistics generates \$224.6 billion in economic output annually related to the direct industry spending of \$131.9 billion, \$43.5 billion of which is labor income paid to employees. In addition to direct spending, industry-related expenditures indirectly generate \$47.2 billion in spending at supplier businesses in the region, and compensation paid induced further spending of \$45.6 billion in 2015.

Work, Work, Work

- The occupational makeup of the workforce is concentrated in transportation occupations, which accounted for 31.4 percent of the jobs in the industry, followed by office and administrative occupations accounting for 26.8 percent of industry jobs.
- Over the next five years, an expected 21,430 new job openings will be created and an additional 69,910 replacement workers will be needed due to employment churn.
- Southern California is home to numerous educational institutions and programs that offer targeted training for work in trade and logistics-industries.

Trade and logistics in Southern California generates \$224.6 billion in economic output annually, sustained by direct spending of \$131.9 billion, which includes \$43.5 billion in labor income paid to its employees. Additionally, industry-related expenditures indirectly generates \$47.2 billion in spending at supplier businesses in the region, and compensation paid to employees induced further spending of \$45.6 billion.

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Introduction

Goods on the move.

Trade and logistics are the heart of the Southern California economy. With a population nearing 20 million, the region represents one of the largest consumer markets in the U.S. However, this consumer market is not the only reason that such a massive amount of trade and goods movement takes place here; the region serves as a gateway for the rest of the nation as well.

With the busiest port complex in the U.S., an extensive rail network and intermodal facilities, and a multitude of interstate highways, the region possesses the infrastructure to connect to population centers across the country, and transport goods in less time than if they were to be shipped to other parts of the nation directly. In addition, a significant percentage of U.S. exports pass through Southern California en route to international customers.

The trade and logistics industry cluster includes wholesale trade, transportation industries that move goods, and warehousing and logistics and is valued at \$1.5 trillion nationally. The cluster accounted for 8.3 percent of U.S. GDP in 2015. The industry cluster does not include retail trade and transportation industries that involve the movement of people, and goods transported via pipeline.

What is Goods Movement?

The term goods movement is liberally used. In this report it refers to all industries involved in the transport and distribution of products domestically and abroad. It includes import and export activity, transportation services, freight arrangement, storage of goods, and the repackaging and redistribution of products to retailers.

The movement of goods is a vital component to the economic health of a region's economy. Distribution networks are critical to providing businesses with parts and materials needed for successful operations as well as supplying products to local consumer markets that are then retailed to satisfy its demand. Trade and logistics industries provide tax revenue to all levels of government and a diverse variety of jobs for residents at multiple levels of education, skills and wages.

While the benefits of the trade and logistics industry are numerous, there are negative externalities related to its activity that need to be mitigated. These consequences are mainly: environmental issues related to emissions, increased congestion, and external costs incurred by taxpayers to maintain public infrastructure that is heavily used by the industry. Strategies used in mitigation include government mandates and policies, continued investment into infrastructure, and other programs to identify and capitalize on opportunities that exist for goods movement in the region.

The movement of goods takes place across long distances and via multiple modes (air, rail, water, truck). Each mode of transportation used in the movement of goods has its own

**Southern
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for the
movement
of both
domestic
and foreign
goods.**

Decentralization taking place across numerous industries is impacting the trade and logistics industry cluster

infrastructure needs. Across all modes, congestion is a major issue, resulting in increased costs and ship times. When bottlenecks occur, it affects the flow of distribution at all levels. Investment into additional infrastructure, while taking place, struggles to keep pace with the industry's current and future needs.

With transportation routes connecting consumer and producer markets across geopolitical boundaries, a regional approach is best suited to understand current issues and predict future needs for trade and logistics industries and to lessen potential negative impacts to the region. With population growth and expanding international trade volumes, increased levels of freight traffic have resulted, with expectations that it will continue to increase. Expansion of infrastructure to handle expected increases in freight traffic have been underway, but funding is a concern and key new additions have run into legal roadblocks under the authority of certain environmental statutes in California.

Trade and Logistics Companies in a State of Flux

Decentralization taking place across numerous industries is impacting the trade and logistics industry cluster. Warehousing and wholesale trade facilities are being located closer to population centers to cut down on the costs of shipping, in terms of both money and time. Manufacturing industries are becoming more decentralized as well, with the rise of smaller operations that specialize in the production of components eclipsing the large manufacturing operations of the past, which entailed complete start to finish production. The benefits of specialization in multiple local facilities now carry more weight than economies of scale enjoyed by large-scale operations, affecting distribution.

Heavy merger and acquisitions activity has been taking place in the third party logistics (3PL) industry, and is expected to persist as the dominant companies continue to evolve into one-stop-shops offering complete supply chain solutions instead of single specialized functions.

Technological advancements in e-commerce also influence operations in trade and logistics, while their evolving business models are resulting in an overlapping of services. For example, Amazon is currently expanding their fleet of transportation equipment (trucks, airplanes, etc.) and taking steps to engage in freight forwarding activities. However, this blurring of the lines between the two industries results not out of the e-retailer's want to enter into the trade and logistics industry as a service provider, but from their desire to internally increase efficiencies and cut costs related to the transportation of the goods sold on their platforms.

In trade and logistics, technological advancements include automation across all industries in the cluster. Trends include the use of robots, autonomous vehicles, 3D printing, virtual reality and application software,

While gains are being made in goods movement in terms of efficiencies and in transparency, it may displace some workers in the cluster. Additionally, companies in trade and logistics industries are finding it difficult to meet their current employment needs, especially for specific occupations such as truck drivers and management positions in logistics, which may become a more pressing problem as the industry continues to grow.

About This Report

This report is the fourth in our Industry Cluster Series, which examines industry clusters in the larger Southern California region in detail. Industry *clusters* are distinct from more commonly-recognized industry *sectors* as they are formed by firms that are in related industries, that sell related products, employ similar types of labor and have a common geographic concentration of activity.

This clustering of activity is believed to indicate regional specialization and competitiveness and offers the best opportunity for encouraging and sustaining economic development.

As important as they are in driving economic activity, industry clusters are even more significant when they are essentially export industries. By selling goods and services to the global audience, such clusters bring new dollars into the region, which recirculate through their supply chains to local firms and employees, supporting resident households and businesses and allowing them, in turn, to prosper and grow.

Because such industry clusters are not dependent on the local market for their business, these are the very industries that are most able to locate where they find conditions most hospitable – in terms of access to capital and land, cost-effective raw materials, and a qualified and available labor pool.

It is the distinction between traded clusters and local clusters that drives our analysis in this report. By understanding the current and historic trends of our leading competitive industry clusters, we can understand the challenges and opportunities, and tailor our economic development programs and policies to strengthen our existing specialties and build them into flourishing, thriving and growing industries. We can ensure that we have a workforce ready and able to fill the jobs of the future in our strongest industry clusters, and remain competitive in a fast-changing global economy. We can focus our public policy and programmatic efforts on those industries which are most likely to provide the highest wages which, in turn, produce the largest impacts on the local economy and the best return on investment, and those that are at risk of moving elsewhere.

Our discussion proceeds in several parts:

First, we provide an overview of the trade and logistics industry in terms of its productive activity at the national and state level. Our discussion of the industry is only in relation to the movement of goods; we do not focus on the types of goods moved. Our focus is on the Southern California region defined by the five counties of Los Angeles, Orange, Riverside, San Bernardino and Ventura.

Southern California Five-County Region



Following this, we focus on the metrics of the industry cluster – its size in terms of employment and wages and how these have performed over the past ten years.

Third, we examine the supply chain of the industry cluster – what goes into the making of the cluster? What recipe of goods and services is needed to provide the industry with its necessary inputs? With this quantified, we estimate the overall contribution of the cluster to the regional economy through its multiplier impacts.

Fourth, we consider the supply of workers into the industry. It employs a full spectrum of workers, from new job entrants to highly-specialized and experienced labor. The occupational makeup of the industry cluster is examined and regional workforce development programs outlined. An occupational forecast is provided to outline future workforce needs.

This comprehensive picture of an industry cluster is meant to inform policymakers and local stakeholders as we together develop regional strategies to bring jobs and prosperity to the Southern California economy.

Complete discussion and description of methodologies and data sources are provided in the Appendix, along with more detailed data tables that expand on the exhibits shown throughout.

Southern California Logistics Airport - Global Air Cargo Map



Source: City of Victorville

With air routes connecting to locations worldwide, the air cargo routes at the Southern California Logistics Airport, located in the city of Victorville, illustrates how the region serves as a global gateway. The airport specializes in air cargo, military freight, and aviation and aerospace related businesses such as Boeing, Federal Express, G.E., Leading Edge Aviation Company, and Pratt & Whitney.

Recent Industry Activity

Past performance.

The United States engages in trade with nations across the globe. Both inland ports and coastal ports participate in this trade, and their geographic location often determines the strength of their activity. The rise of economies in Asia and their manufacturing prowess have influenced trade patterns to favor trade with Asia and away from Europe, enhancing the relevance of ports on the west coast of the United States.

Goods move in two directions. Imported goods and goods produced domestically are transported across the U.S. by multiple modes, including air, rail, water and truck, into distribution channels. These same channels are used to move goods to ports for export into foreign markets.

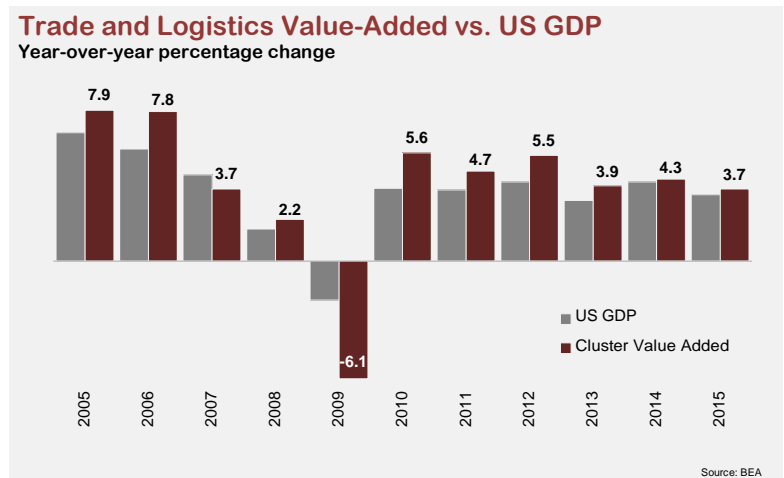
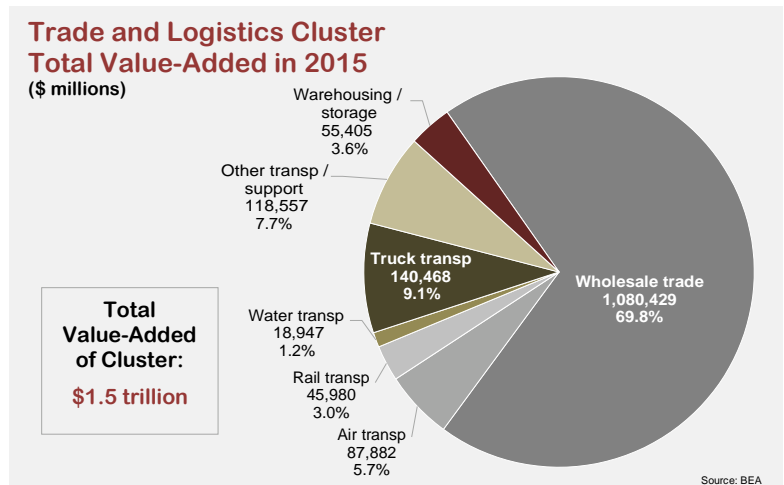
The trade and logistics industry cluster is a vital part of the economy, as is measured by the contribution it makes to the national gross domestic product and in the volumes and values of freight moved.

The Value of Trade and Logistics

The trade and logistics industry cluster in the U.S. is valued at \$1.5 trillion in 2015, accounting for 8.3 percent of national GDP. Wholesale trade is responsible for the lion's share of total value-added, comprising six percent of U.S. GDP, while transportation industries and warehouse and storage industries account for 2.4 percent and 0.3 percent of U.S. GDP, respectively.

Of all industries in the trade and logistics cluster, wholesale trade is responsible for \$1.1 trillion, almost seventy percent of the cluster's total value in 2015. Of transportation industries, truck transportation is the largest contributor representing 9.1 percent, followed by air transportation with 5.7 percent. Warehousing and storage industries account for 3.6 percent of the total value-added of trade and logistics.

Value-added in the industry has grown since 2005, with the exception of a decline of 6.1 percent at the bottom of the Great Recession in 2009. Indeed, growth in trade and logistics value-added has consistently been faster than the growth of overall national GDP with the exception of that one year.



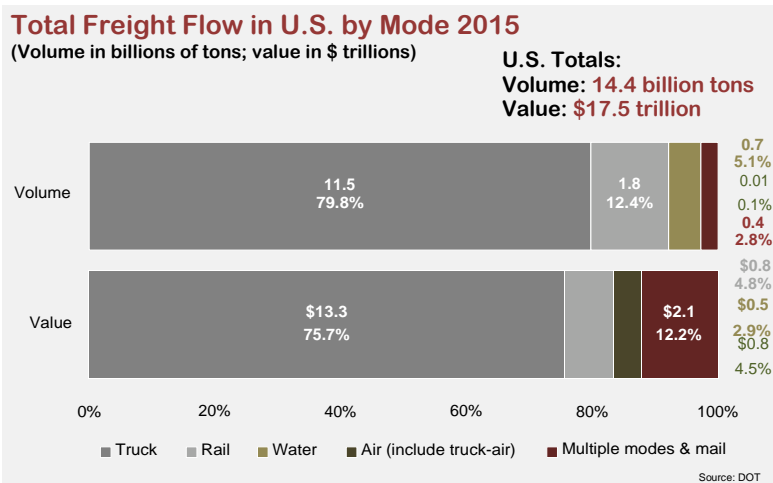
A total volume of 14.4 billion tons of freight valued at \$17.5 trillion was moved across the U.S. in 2015.

Freight Transportation across the Nation

The movement of commodities is tracked by the U.S. Department of Transportation through its Bureau of Transportation Statistics (BTS) and the Federal Highway Administration (FHWA). The Freight Analysis Framework (FAF) provides detailed data on freight flows by various modes of transportation by region of its origin and destination from 2012 to 2015.

The distribution of volume and value of total freight flow in the U.S. in 2015 by transportation mode is shown below. A total volume of 14.4 billion tons of freight valued at \$17.5 trillion was moved in the U.S. via the various modes of transportation—a daily average of 39.5 million tons and \$48.0 billion.

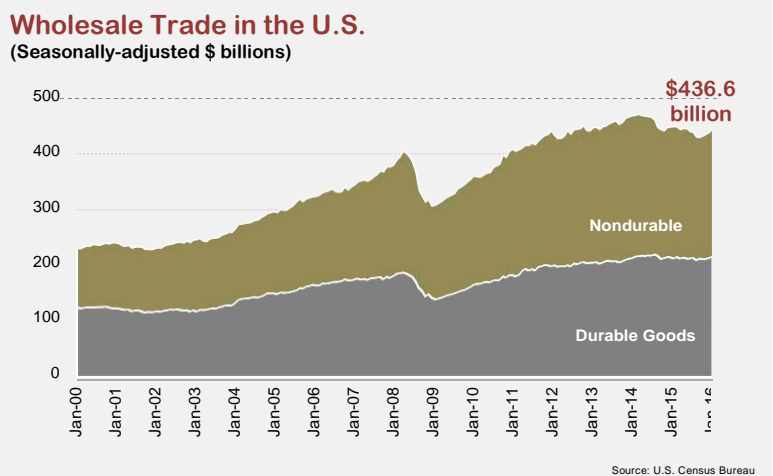
Almost eighty percent of the total freight flow in 2015, measured in terms of both volume and value, was moved via truck. Shipments made by rail accounted for a larger share of volume compared to value (twelve percent versus five percent), while the opposite holds true for air cargo.



Wholesale Trade

In the distribution of goods, wholesale trade firms act as an intermediary between importers and producers, and retail businesses, governments and bulk buyers, such as institutions or other manufacturers. Quantities sold by wholesalers are in bulk, or large batches, requiring the stocking of large inventories to meet demands of customers.

Monthly gross sales in wholesale trade establishments declined significantly as a result of the Great Recession, but rebounded, with reported gross sales higher than the pre-recession peak of \$402.7 billion (in June 2008) beginning from the end of the first quarter of 2011 and continuing through 2015. Monthly gross sales in wholesale trade were valued at \$436.6 billion in December 2015, with durable goods and nondurable goods accounting for \$212.7 billion and \$223.9 billion, respectively.



Warehousing and Storage

Large warehouses are the backbone of the trade and logistics industry. Establishments in wholesale trade, warehousing industries and in logistics all require them. While there are exceptions, the majority of warehouse facilities are located on property zoned for industrial uses.

Establishments in warehousing and storage industries provide storage for general merchandise, refrigerated goods, and other warehouse products. These facilities are unique from wholesale trade operations in that they do not own the inventories they house, nor do they participate in the sale of the goods. Their primary function is keeping goods stored securely.

The warehousing industry has been buffeted by a number of trends recently. The continued success of online retailing requires larger inventories and specialized facilities. Intermodal transportation has become the norm, as warehouses become transportation hubs and hotspots for logistics operations providing additional services. As foreign labor becomes less competitive, costs associated with transporting goods internationally have increased, and with consumers demanding ever-faster delivery times, the role of warehouses has grown. Imports have been increasing over time, requiring more storage facilities and investment into infrastructure to expand capacity for distribution networks,

Warehousing Firms in North America

Company	Total Space (million sq ft)	No. of Warehouses	Presence in SoCal 5
DHL Supply Chain	115	417	yes
XPO Logistics Inc.	65	298	yes
FedEx Corp.	43	180	yes
Americold Logistics	40	180	yes
Ryder Supply Chain Solutions	40	279	yes
OHL	36	130	yes
Ceva Logistics	33	164	yes
UPS Supply Chain Solutions	32.2	535	yes
Kenco Group	31	90	yes
NFI	27.5	90	yes

Source: ATA, Transport Topics

Freight Forwarders

As intermediaries between freight carriers and shippers looking to move product, freight forwarders coordinate the shipping of goods across multiple modes of transport and find/offer storage if needed. They purchase space in bulk from carriers at wholesale prices and then resell that space to shippers. As such, their profit is determined by the price spread.

Services provided by freight forwarders include contracting vessel space, consolidating cargo, overland shipment tracking, preparation of customs documents, packing and crating, warehousing services, insurance bonding and claims filing, negotiating freight rates, handling of international payments and issuing bills of lading.

The freight forwarding industry in 2015 was rocked by several events. International trade flows were adversely affected by slower economic growth in China. Coupled with the decline in oil prices, the resulting drop in freight volumes led to a surplus of capacity and put additional downward pressure on freight rates. Volatility in exchange rates resulted in a stronger U.S. Dollar, simultaneously making domestic exports relatively more expensive and foreign imports relatively cheaper.

The largest freight forwarders in the world in 2015 (by reported gross revenue) include DHL (\$29.6 billion), Kuehne + Nagel (\$21.1 billion), DB Schenker (\$17.2 billion), and Nippon Express (\$15.8 billion); UPS, ranked eighth (\$8.2 billion). All of these companies have operations in Southern California.

Additional challenges exist in the ocean freight forwarding industry, notably vessel sharing agreements (VSAs), an alliance of multiple shipping lines established to reduce operational costs and compete with larger rivals. Members of these alliances share vessels, slots, shipping lanes and even port operations and, while they may be beneficial for shipping lines, this increased competition among carriers translates into lost profit for freight forwarders as spreads are squeezed.

All 25 of the largest freight forwarders in the world in 2015 (by gross revenue) have operations in Southern California

Largest Freight Forwarders in 2015
(ranked by gross revenue, turnover and freight forwarding volumes)

Rank	Company	Gross Revenue (\$US M)	Ocean TEUs (000s)	Air Metric Tons (000s)	Presence in SoCal5
1	DHL Supply Chain & Global Forwarding	\$29,562	2,930.0	2,109.0	Yes
2	Kuehne + Nagel	\$21,100	3,820.0	1,250.0	Yes
3	DB Schenker	\$17,160	1,942.0	1,128.0	Yes
4	Nippon Express	\$15,822	855.0	711.4	Yes
5	Sinotrans Limited	\$7,314	2,801.3	522.6	Yes
6	Expeditors	\$6,617	1,043.9	872.5	Yes
7	Panalpina	\$6,091	1,593.9	836.2	Yes
8	UPS Supply Chain Solutions	\$8,215	615.0	935.3	Yes
9	DSV	\$7,574	855.3	311.2	Yes
10	Hellmann Worldwide Logistics	\$3,987	888.3	561.2	Yes
11	CEVA Logistics	\$6,959	642.7	451.0	Yes
12	Bolloré Logistics	\$4,998	844.0	580.0	Yes
13	GEODIS	\$5,864	677.5	299.0	Yes
14	DACHSER	\$6,264	568.5	275.3	Yes
15	Agility	\$3,907	513.5	372.7	Yes
16	Yusen Logistics	\$3,835	547.0	344.0	Yes
17	Kerry Logistics	\$2,723	785.6	282.2	Yes
18	Kintetsu World Express	\$3,729	463.0	457.0	Yes
19	C.H. Robinson	\$13,476	485.0	115.0	Yes
20	Uti Worldwide	\$3,696	512.6	353.3	Yes
21	Toll Group	\$5,822	542.0	114.0	Yes
22	Damco	\$2,740	744.0	180.0	Yes
23	Hitachi Transport System	\$5,612	330.0	190.0	Yes
24	Logwin	\$1,175	593.0	137.0	Yes
25	NNR Global Logistics	\$1,683	140.5	264.1	Yes

Source: A&A's Top 25 Global Freight Forwarders List

At the end of 2015, sixteen of the largest container lines were in four steamship line coalitions: 2M, CKYHE, G6, and the Oceans Three. A reshuffling of these alliances is expected to occur with members of the G6, CKYHE and the Oceans Three forming two new coalitions in 2017, The Alliance and The Ocean Alliance.

Customers looking to carry smaller volumes of freight can turn to a non-vessel-operating common carrier (NVOCC), which consolidate multiple clients' goods and contract with vessel-operating carriers for shipment.

Beginning in 2016, Amazon acquired status as an NVOCC. In other words, Amazon's subsidiary in China (Beijing Century JOYO Courier Service Co.) is now essentially a freight forwarder. This new designation opens the door for the giant e-commerce retailer to earn additional revenue through providing maritime shipping services to its many vendors in China. This comes on the heels of the retailer entering into trucking and air cargo, with thousands of trailers just purchased for its U.S. deliveries, and a proposed logistics operations dedicated to overnight

domestic air operations with approximately 20 cargo aircraft. When it becomes able to transport its own freight, Amazon will have less reliance on existing freight forwarders and on shipping giants such as UPS and FedEx.

2015 was a year of large deals in the 3PL world, with eleven acquisitions valued over \$100 million

Third Party Logistics (3PL)

Third party logistics (3PL or TPL) provide distribution and fulfillment services to client companies. Often 3PLs are global companies. While there are a number of third party logistics providers in operation in the U.S., the majority of the market share is held by approximately fifty 3PLs. Where once the services provided by 3PLs were limited to transactional warehousing and transportation activities, the industry has been evolving to expand services into such areas as packaging, shipment consolidation, cross-docking, processing merchandise returns and repairs, and more.

The growth of e-commerce in recent years has translated into increased demand for logistics services. Third party logistics are seeking to meet consumer demands for shorter delivery times by building new warehousing facilities equipped with advanced features and located in key areas that have become hubs for logistics and goods movement activity.

Mergers and acquisitions have been changing the landscape of the logistics industry resulting in a consolidation of players in the industry, leaving concentrations of small niche providers and very large 3PLs. Larger 3PLs have been rapidly expanding their services through mergers and acquisitions.

XPO Logistics, FedEx and Roadrunner Transportation Systems have made multiple purchases, bringing several smaller logistics operations into the fold. All three companies have operations located in Southern California.

Recent acquisitions for XPO Logistics, a global company based out of Connecticut, include the companies of New Breed Logistics, UX Specialized Logistics, Bridge Terminal Transport Services, Norbert Dentressangle, and Con-Way, for a combined purchase price of \$7.3 billion. Of these five target companies, all have a presence in Southern California. Four of the five transactions were valued over \$100 million. Acquisitions were made to increase capacity in warehousing operations in China and Southeast Asia, onboard additional European operations, and gain several large contracts.

FedEx acquired two companies over the period for a total of \$6.3 billion: GENCO (\$2.0 billion) and TNT Express (\$4.3 billion). Looking to compete with other combined service providers, such as UPS Supply Chain Solutions and DHL Supply Chain Solutions, the acquisition of GENCO added significant capacity to FedEx's Value-Added Warehousing and Distribution (VAWD) network. The purchase of TNT Express bought a sizeable road delivery network in Europe.

Roadrunner Transportation Systems spent \$150 million acquiring Active-Aero Group and Stagecoach Cartage and Distribution.

In the 3PL world, 2015 was a year of large deals, with eleven acquisitions valued over \$100 million compared to only five the year prior. From 1999 onward, 2015 posted the highest number of these deals, followed by 2007, the pre-recession peak, with nine acquisitions valued over \$100 million each.

DSV's acquisition of UTi Worldwide Inc. is an example of a local 3PL involved in the recent mergers and acquisitions activity in the logistics industry. UTi Worldwide, with a corporate headquarters located in the City of Long Beach, is a global company who employs about 21,000 people across 58 countries with revenue of \$3.9 billion (USD). It was one of the largest providers of logistics and supply chain services based in the U.S. The Denmark based DSV Group, purchased UTi for \$1.35 billion, with the deal closing in January 2016. Combined, the two companies will be one of the largest transportation, logistics and supply chain services providers worldwide.

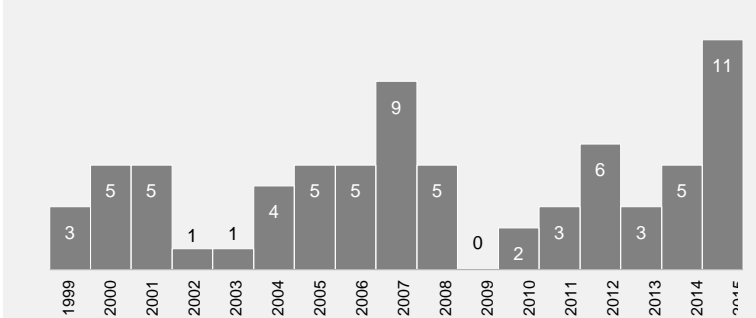
Looking forward, more mergers and acquisitions between small- and medium-sized 3PLs are expected.

Top Logistics Companies in North America 2015

Company	Net Revenue	Gross Revenue (millions)	Presence in SoCal 5
UPS Supply Chain Solutions	\$3,108	\$5,900	Yes
XPO Logistics Inc.	\$2,841	\$5,536	Yes
J.B. Hunt Transport Services	\$2,660	\$5,816	Yes
C.H. Robinson Worldwide	\$2,268	\$13,476	Yes
Expeditors International of Washington	\$2,188	\$6,617	Yes
Ryder Supply Chain Solutions	\$1,925	\$2,443	Yes
DHL Supply Chain	\$1,815	\$3,300	Yes
FedEx Corp.	\$1,625	\$3,178	Yes
Ceva Logistics	\$1,570	\$2,452	Yes
Americold Logistics	\$1,555		Yes
Uti Worldwide	\$1,330	\$3,696	Yes
Schneider	\$1,275	\$3,480	Yes
Kuehne + Nagel Inc.	\$1,197	\$5,230	Yes
Penske Logistics	\$1,150	\$1,430	Yes
NFI	\$1,130	\$1,200	Yes

Source: A. A. Transport Topics

Number of 3PL Aquisitions over \$100 Million



Source: A&A, Inc.

The lion's share of total trade flow in Southern California is domestic in nature, accounting for 78 percent of volume and 64 percent of value in 2015.

Southern California Experience

Total Freight Flows

Over time, growth in global interconnectivity and in population and economic activity in the U.S. has increased the nation's dependence on the efficient transportation of freight. Demand is driven by the concentration of both consumers and industry. As such, the nation's largest metropolitan areas, which include the Los Angeles region, are hot spots of freight activity, moving large volumes of goods in and out of their markets. These areas serve as hubs to other less densely-populated areas as well as other nearby metros.

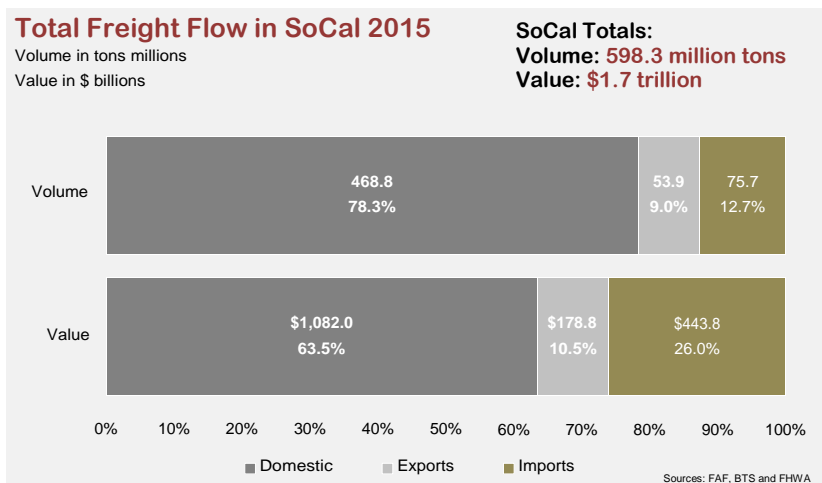
Freight flow data by mode of transportation, specific to the Southern California region is available through the Freight Analysis Framework (FAF). Freight flows include movement out of the region as well as movement within the region itself, unless otherwise noted.

A total volume of 598.3 million tons of freight valued at \$1.7 trillion moved throughout Southern California across the various modes of transportation, a daily average of 1.6 million tons and valued at \$4.7 billion.

In terms of total freight flow in Southern California, the lion's share of both volume and value is domestic in nature, accounting for 78 percent and 64 percent of flow, respectively. A total volume of 468.8 million tons of domestic freight, valued at \$1.1 trillion, moved throughout the region in 2015.

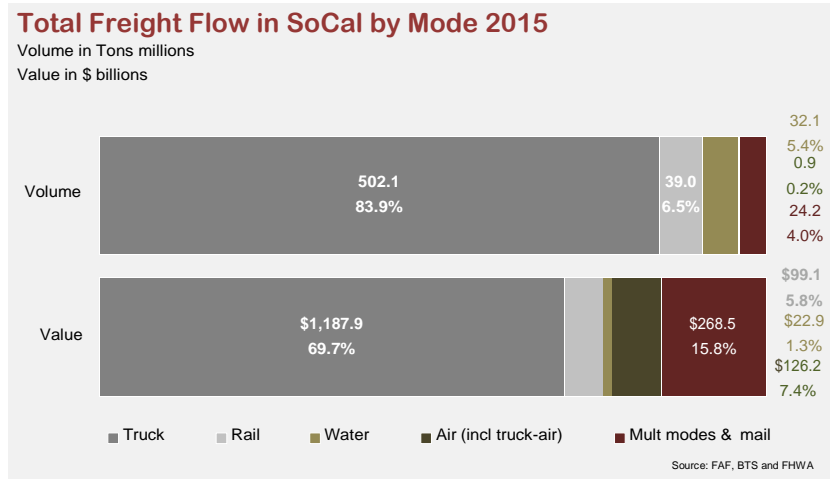
Freight flow through the region related to foreign trade (import and export flows) accounted for the remaining 22 percent of volume and 36 percent of value. Import trade flow, the transport of goods from foreign origins, accounted for 13 percent of volume and 26 percent of value of total flow in the region, shipping nearly 76 million tons valued just under \$444 billion in 2015. Export trade flows have the smallest share of total freight flow volume (9 percent) and value (11 percent), moving 53.9 million tons valued at \$178.8 billion in Southern California.

Comparing the 2015 distribution of volume versus value of freight flow in Southern California reveals foreign trade flows are higher in value compared to domestic trade flows, with an average value of \$4,800 per ton versus \$2,300 per ton. Splitting foreign trade into import and export trade flows show the average value per ton for imports exceeded that of exports, at \$5,900 per ton and \$3,300 per ton respectively.



Almost 600 million tons of freight valued at \$1.7 trillion moved through the Southern California region in 2015.

The modal split of volume and value of total freight flow in the Southern California region in 2015 is shown at right. Trucks are the dominant mode for freight moving in Southern California by both volume and value, moving 502.1 million tons (Mtons) valued at close to \$1.2 billion. Rail ranked second by volume, moving 39.0 million tons, followed by water (32.1 Mtons), multiple modes and mail, which includes both intermodal freight and shippers who utilize parcel services (24.2 Mtons), and air (0.9 Mtons). In terms of value, multiple modes and mail ranked second in the region in 2015 moving goods valued at \$268.5 billion, followed by air (\$126.2 billion), rail (\$99.1 billion), and water (\$22.9 billion).



Goods shipped via air and multiple modes are significantly higher in value, with an average per ton value of \$138,500 and \$11,100 respectively, while truck and rail have a much lower, yet comparable, average per ton value of \$2,400 and \$2,500, respectively. Freight moved via water is much larger in volume versus value, with freight averaging a value of only \$700 per ton.

As freight volumes continue to grow, all transportation industries will face increased exposure to congestion. Without adequate investment to increase each system's capacity, future levels of congestion will continue to lead to a loss in delivery speed and reliability, and result in higher shipping costs.

Industrial Real Estate Market in Southern California

Large warehouses are synonymous with the trade and logistics industry cluster; establishments in wholesale trade, warehousing industries and in logistics require them. Over time, the demand for larger scale warehousing operations has increased continuously.

In all parts of Southern California, industrial vacancy rates have been declining over time, with the most recent rates in each county falling to four percent or below (according to CBRE). Los Angeles County has consistently remained the tightest market in the region followed by Orange County; even through the Great Recession, these markets reported vacancy rates under five percent. The industrial markets in the Inland Empire and in Ventura County saw vacancy rates rise significantly over the recession with rates peaking at 9.4 percent (4Q 2008) and 7.7 percent (2Q 2010) in the Inland Empire and Ventura County respectively. Since then, both areas have seen their industrial markets tighten.

With the continued decline in vacancy rates, tighter markets have resulted in a steady increase of average asking lease rates.

Robust demand for industrial property exists in the Inland Empire, driven by the expansion of e-commerce and increased port activity. The region has proved advantageous for logistics operations and a considerable amount of land is available for future industrial projects to address the high levels of demand present in the market. As such, the outlook for the market continues to be positive.

	Industrial Space Added and Pipeline	
	Space Added in 2015	Under Construction
Los Angeles County	3.6 million sq ft	2.8 million sq ft
Orange County	1.1 million sq ft	625,000 sq ft
Inland Empire	20.8 million sq ft	16.7 million sq ft
Ventura County	n/a	n/a
Southern California	25.5 million sq.ft.	20.2 million sq.ft.

More than 25 million square feet of industrial space was added in Southern California in 2015.

Over time, the demand for larger scaled warehousing operations has been continually increasing.

Wholesale Trade in Southern California

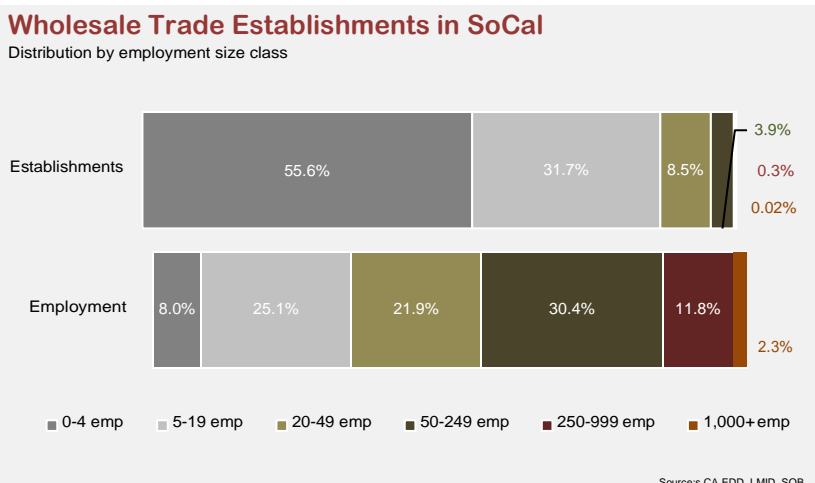
Proximity to some of the busiest ports (San Pedro Bay Ports complex and LAX specifically) and home to one of the largest manufacturing hubs in the nation, Southern California is a natural choice for merchant wholesalers to site their operations.

The wholesale trade industry exists in different concentrations throughout Southern California. Los Angeles County is a hotbed of wholesale trade, with clusters of activity existing in districts throughout the county; the fashion district, toy district, flower district, jewelry district, and so on. As such, the county represented more than half (59.2 percent) of wholesale trade employment in the region in 2015, with 223,120 jobs. Orange County ranked second in terms of wholesale employment with close to 80,000 jobs (21 percent) in the industry primarily because of its automotive (auto auction), furniture and flower wholesale operations. The Inland Empire (Riverside and San Bernardino Counties) had 61,240 wholesale jobs, accounting for 16 percent of region's total jobs in the industry in 2015.

Wholesale trade is by far the largest industry in trade and logistics by employment overall. However, most operations are relatively small in terms of the number of employees. Employment size for roughly half of all wholesale trade establishments falls between zero to four employees. Wholesale trade establishments with 20 or more employees only represented about 13 percent of all establishments in the sector.

While operations with up to four employees accounted for over half of the sector's establishments, in terms of overall employment among all size classes, they only represented eight percent of wholesale employment in the region. In fact, though the larger wholesale operations were fewer in number, they provide the bulk of jobs in the industry.

Wholesale establishments with between 20 to 49 employees account for approximately ten percent of establishments, but provide the largest share of employment in the industry with nearly a quarter of all wholesale jobs. Establishments with fifty employees or more provided 45 percent of jobs in the wholesale industry in establishments which represent only 13 percent of all establishments in the sector.



Warehousing and Logistics in Southern California

Warehousing and logistics industries in Southern California have been growing in size and number over the last few decades for a number of reasons. The large population here continues to grow, representing one of the largest consumer markets in the U.S. Increased global connectivity has resulted in a rise in international trade moving through the region's major ports. Finally, over the last decade, the phenomenon of just-in-time delivery strategies combined with on-demand consumers commanding shorter delivery times has led to decentralization in these industries. Warehousing and logistics firms are now positioned throughout the region to provide a more localized approach to distribution.

The leading warehouse real estate markets in the U.S. include the Southern California region, with an expected absorption of approximately 32 million square feet in 2016 (according to CBRE), followed by the Dallas, Atlanta and Chicago markets. The pipeline of properties for the warehousing industry in Southern California will only satisfy about 74 percent of absorption, while the other top markets referenced are in equilibrium; the pipeline (supply) is roughly equal to absorption (demand).

Major players in the warehousing industry exist, with millions of square feet dedicated to their operations, in facilities sited across North America, many of which are also players in other logistics industries as well (3PL and freight forwarding). All prominent players have a presence in the Southern California region, notably DHL Supply Chain, FedEx Corp, and UPS Supply Chain Solutions.

The concentrations of employment in warehousing and logistics industries vary as well among the different counties in the Southern California region. In 2015, the Inland Empire (Riverside and San Bernardino Counties) was home to half the jobs in these industries and Los Angeles County accounted for an additional forty percent; Ventura and Orange Counties combined, accounted for less than ten percent of warehousing and logistics employment in the region.

As warehousing and logistics operations in Los Angeles and Orange Counties realized that to siting their operations in the Inland Empire would result in lower costs, they began to move east. Today, massive warehouses have become ubiquitous, popping up all along the 10 freeway and in western Riverside County, to house large distribution centers and e-commerce operations. Additional draws for the industry to the Inland Empire include easy access to the region's network of freeways, that extends in all directions, proximity to major ports (sea, air and inland), and access to the two major Class I rail lines operating across the region, BNSF (Burlington Northern Santa Fe) Railway and the UP (Union Pacific) Railway. In addition to warehousing and storage operations, many 3PLs are also setting operations in the Inland Empire to take advantage of these attributes. In fact, Ontario International Airport is home to the UPS Western Region hub.

The Southern California region is home to numerous operations for a large number of 3PLs that capitalize on the region's established goods movement infrastructure. The Inland Empire (Riverside and San Bernardino Counties) has developed into a logistics hub and it continues to be a key market for growth. Unishippers Global Logistics and UPS are examples of large 3PLs working to expand their activities in the region.

Unishippers Global Logistics announced it was concentrating growth efforts in the Southern California five-county region, specifically in Orange, Riverside and San Bernardino Counties. The company earned in excess of \$450 million in revenue in 2015 providing service to over 50,000 customers. They estimate approximately ten percent of this revenue was attributable to activity in the Southern California area (including San Diego). Looking forward, the company expects to expand operations in Southern California by marketing thirty franchise territories based in the area.

UPS is a global 3PL that is expanding its footprint in the region. Currently, Ontario International Airport is home to a UPS® Regional Air Hub, the company flies 38 daily flights to and from the airport and completed construction in September 2015 of an UPS ground sorting facility, outfitted to accommodate tractor-trailers for the transference of goods for overland distribution. Goods are moved through this air hub, serving customers across the western portion of the United States; a region the size of almost one third the nation, including the states of Alaska and Hawaii. Construction on the expansion of the existing

Today, massive warehouses have become ubiquitous in the Inland Empire, popping up all along the 10 freeway and in western Riverside County.

The Inland Empire has developed into a logistics hub and it continues to be a key market for growth.

sorting facility is already underway. When complete, the size of the building will have increased to almost 900,000 square feet and include automated sorting systems in both the original facility and the new expansion, doubling the hourly package processing capacity. To handle the new capacity at this location, the company plans to hire an additional 500 or more employees in the near future, including drivers and package handlers.

The demand for large scaled warehousing operations has been continually increasing. The Inland Empire, with its relatively cheaper real estate, more industrial zoned land, freeway network, and a built-in pool of potential workers, is now home to many such facilities built to meet this demand, each over one million square feet in size. Tilt-up construction continued to abound in 2015, adding more stock to its industrial real estate market. Warehouse facilities of one million square feet or more are currently planned and in various stages of construction in the Inland Empire cities of Redlands, Moreno Valley and Beaumont.

There are benefits to building these massive warehouses on greenfield sites in the Inland Empire. Increased efficiencies related to specialized facility design and reliability of new equipment introduce cost savings. The availability of large industrial sites is more prevalent in the Inland Empire, and the cost is significantly cheaper compared to its more urban and densely populated neighbors, Orange and Los Angeles Counties. Finally, permitting and other required processes take less time, translating into shorter turnaround times to complete development.

These newly built massive warehouses are not only increasing their footprint on land, but also are literally reaching new heights, with technological advancements in the industry, specifically automation and robotics, allowing for the vertical stacking of inventories; new facilities are often about 40 feet high at minimum. Advancements in technology are increasing productivity, notably inventory management systems, transportation management systems, picking solutions, voice activated interfaces, and even virtual reality applications. This technological advancement has allowed for increases in speed and efficiency and decreases in costs.

The City of Moreno Valley and its Million Square Foot Warehouses

The City of Moreno Valley, located in Riverside County, has become home to numerous large-scale warehouse facilities over the past several years, beginning with a distribution center for Skechers in late 2011 that measures 1.8 million square feet. In more recent years, a 1.25 million square foot fulfillment center was erected for Amazon and opened in 2014, and an 825,000 square foot regional headquarters and distribution facility for the grocer Aldi opened early 2016. Currently under construction is a 1.6 million square foot distribution center for Deckers Outdoor, another footwear company.

In late 2015, the Moreno Valley City Council approved the **World Logistics Center** project, a 40 million square foot mega warehouse located on 3,800 acres in the east end of the city. Once the development is constructed, it will be one of the largest warehouse complexes nationwide, able to house close to 700 football fields inside its walls. Employment with the logistics center is estimated around 20,000 jobs.

Despite the increasing use of automation and robots in this arena, a certain level of employment will be guaranteed in the warehousing industry due to small batch individual order picking, how capital intensive new technologies are, and concerns over cybersecurity that slow adoption of cloud-based management systems. As such, these facilities still provide significant employment opportunities for residents in the region today. However, employment prospects for tomorrow will dim as these hurdles are overcome and automation of these jobs becomes a reality.

Sizing Things Up

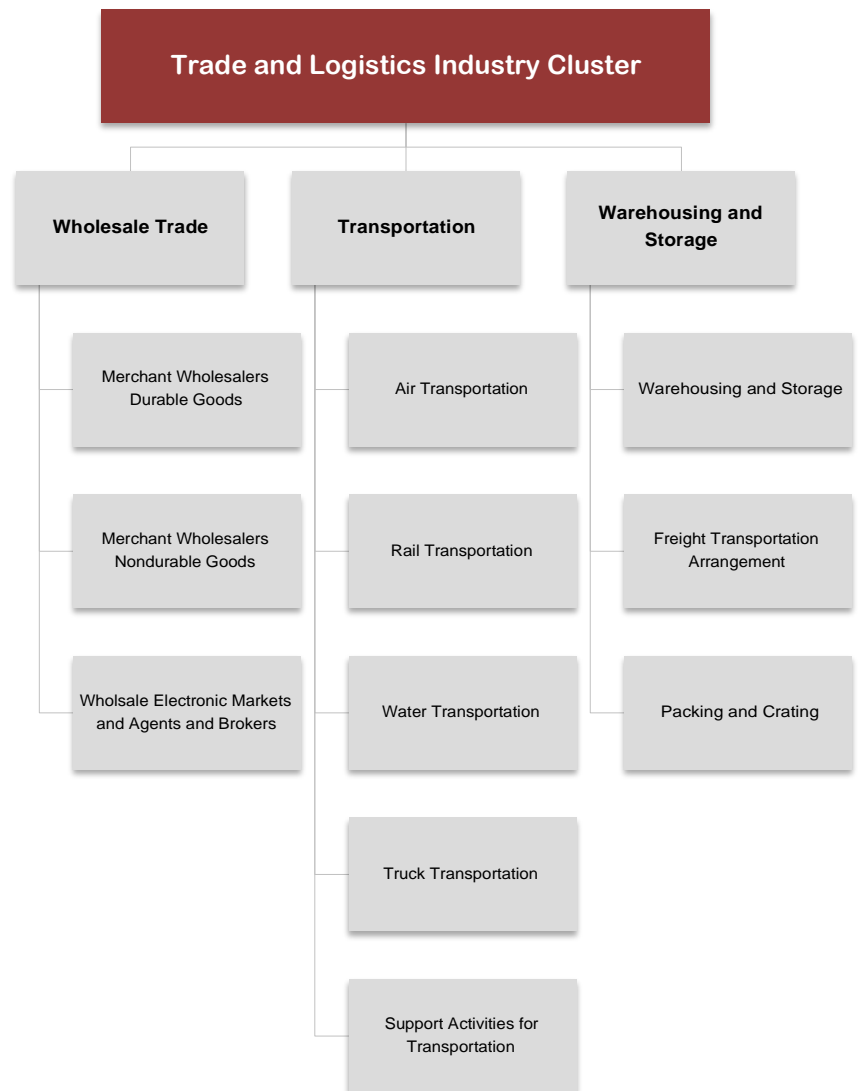
The industry cluster defined.

Southern California is home to a large number of trade and logistics firms. In this section, the cluster is quantified in terms of current and historical employment, establishments and wages by industry at the regional level for the five counties in Southern California that comprise the Los Angeles Combined Statistical Area (CSA). Current employment will be compared to other regions to illustrate regional specialization. We take a systematic approach to measuring the industry by viewing it from its supply side – of what is this industry comprised?

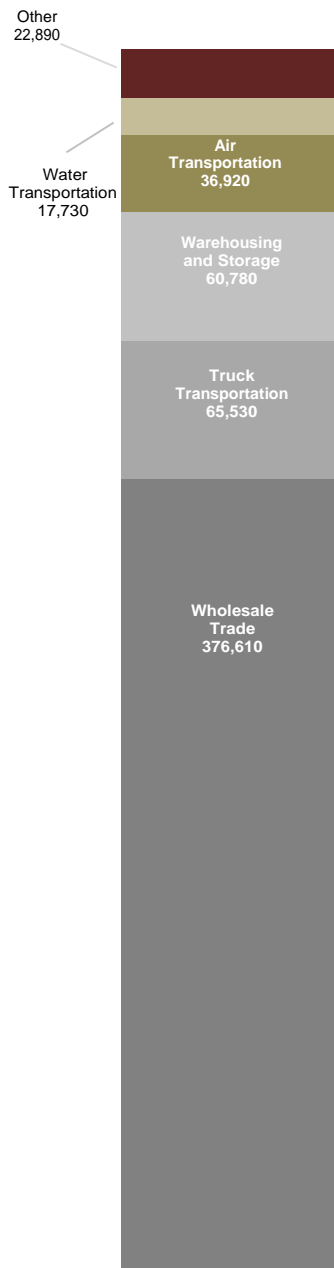
There are many definitions of “Trade and Logistics.” In this report, we adhere, with minor departure, to the definitions produced by the Cluster Mapping Project (CMP) developed by the Harvard Business School (please refer to the Appendix for details). Using a standardized definition allows consistency over regions and time and permits a more nuanced and informed examination. This particular taxonomy provides a distinction between traded clusters (those which produce goods and services that are likely to be traded with markets outside the local economic region) and local clusters that produce goods and services for the local population.

The distinction is important from an economic development perspective as we focus on those industries that are most likely to be the source of new money flowing into the regional economy rather than recirculating existing funds.

Note that the definition and data provided here refers only to private sector economic activity. This certainly undercounts the size of the ecosystem, on which we comment throughout the report.



580,450 Payroll Jobs



The trade and logistics industry cluster includes wholesale trade (NAICS 42), transportation (NAICS 48) and warehousing and storage (NAICS 493).

Wholesale trade is broadly divided into three components: merchant wholesalers of durable goods (those with a normal life expectancy of three or more years); merchant wholesalers of nondurable goods (those with a normal life expectancy of less than three years), and wholesale electronic markets and agents and brokers.

The transportation industry provides transportation services through several different modes, including air, rail, water and truck, and also includes support activities related to these services. Not included in this industry cluster definition are local-serving transportation services such as transit and ground passenger transportation, and scenic and sightseeing transportation, as well as pipeline transportation, which is not considered a trade and logistics industry as such, but a delivery mechanism for specific commodities.

Warehousing and storage is an industry that includes firms operating warehousing and storage facilities. These firms may also provide services that are often called logistics services that can include labeling, repackaging, price marking and ticketing, order entry and fulfillment and transportation arrangements.

Detailed descriptions of the component industries of the trade and logistics industry cluster are provided in the Appendix.

Industry Employment

Using this definition, the trade and logistics industry cluster employed 580,450 payroll workers in Southern California in 2015.

Approximately 65 percent of all cluster employment, or 376,610 jobs, was in wholesale trade, eleven percent each in truck transportation industries and warehousing and storage industries, and just over six percent in air transportation industries.

As a share of all employment, trade and logistics accounted for 7.8 percent of all payroll employment in Southern California in 2015.

Employment growth in the industry cluster was steady prior to the Great Recession, with an average annual growth rate of 2.9 percent. However, as consumers reined in discretionary spending during the recession, the industry suffered from decreased demand and employment fell three consecutive years between 2008 and 2010, shedding approximately 61,360 jobs over the period (a decline of 10.9 percent). Since 2010, recovery has been steady, with employment in 2015 showing an impressive gain of 15.7 percent over 2010, with year-over-year growth from 2014 to 2015 of 2.7 percent. Payroll employment in the trade and logistics cluster in 2015 boasts 17,560 more jobs than the 2007 pre-recession peak (562,900 jobs).

Over the ten year period between 2005 and 2015, employment in Southern California increased by only 4.2 percent. Trade and logistics cluster employment grew by 9.7 percent over 2005, far outpacing the region average.

Much of this growth occurred in warehousing and logistics, which experienced an increase in payroll employment of 55.1 percent over the period, while at the same time, employment in the wholesale trade and transportation industries increased over ten years by 3.5 percent and 8.7 percent, respectively. In nominal terms, the warehousing and logistics industry added 29,090 jobs between 2005 and 2015, followed by wholesale trade (12,710 jobs) and then transportation (9,720 jobs).

Wages in the Trade and Logistics Industry

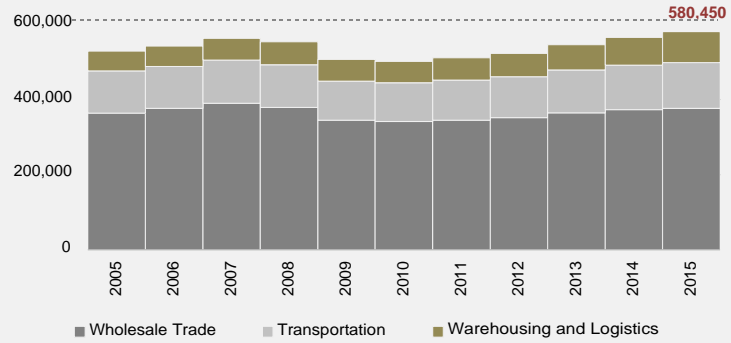
Employees in trade and logistics industries earn a range of annual wages. In the support activities for water transportation industry, for example, the average annual wage was \$111,120 in 2015, which includes marine cargo handling and other highly-compensated activities in the industry. Conversely, in support activities for road transportation, which includes towing and street sweeping services, it was just \$36,950.

Because the majority of workers in the trade and logistics cluster are employed in wholesale trade (376,610), the overall cluster average annual wage at \$63,130 in 2015 was weighted towards the mid-range of the wage scale.

Wage growth over the past ten years has been mild. Inflation-adjusted wages in the Southern California region increased by 2.8 percent – equivalent to an annual average growth rate of a mere 0.3 percent.

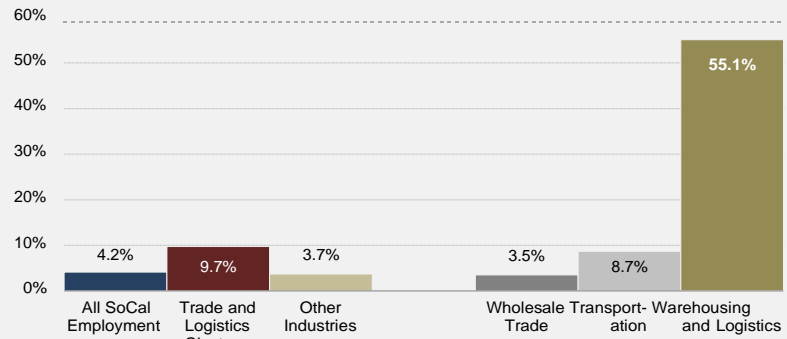
Wage growth in trade and logistics has been similarly weak, increasing by 2.6 percent over the ten-year period, an annual average growth rate of 0.3 percent.

Payroll Employment by Subsector 2005 to 2015



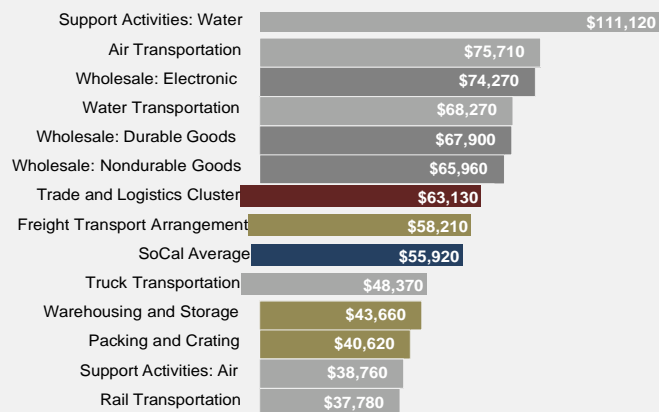
Sources: CMP; QCEW; Estimates by LAEDC

Payroll Employment Growth Since 2005



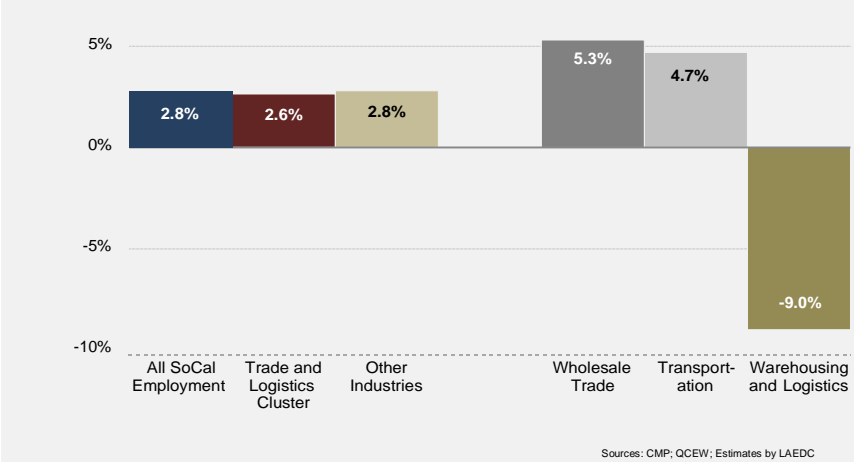
Sources: CMP; QCEW; Estimates by LAEDC

Average Annual Earnings by Industry 2015



Sources: QCEW; Estimates by LAEDC

Real Wage Growth Since 2005



Wage growth has been fastest in the wholesale trade industry which experienced an increase of 5.3 percent between 2005 and 2015.

At the other extreme, wages in the warehousing and logistics industry fell by 9.0 percent (in real terms) over the period. As seen above, this is a very small subsector of the overall industry cluster, but it has been the fastest growing in terms of employment.

The combination of employment growth and the real wage decline in the warehousing and logistics industry implies the industry is placing less and less value on workers in their

warehouses, possibly due to a plentiful supply of low-skilled workers in the region available to fill these jobs, combined with the industry expectation that these jobs will face increasing levels of automation in the near future.

Overall, it is clear that the wholesale trade and transportation industry segments are growing moderately and paying increasingly higher wages, while the industries associated with warehousing and logistics are adding more workers but with downward trending levels of compensation.

Southern California is gaining competitive strength and becoming a leading powerhouse in trade and logistics industries.

Competitiveness and Regional Advantage

A region's competitiveness in an industry is a function of many factors, including the attractiveness and value of the product itself, the costs of inputs such as labor and energy, the productive capabilities of individual companies, and the geographic concentration of the industry. Industries that are highly-concentrated in a region are likely to be more competitive. Clear examples would include entertainment in Los Angeles and communication equipment in Orange County as industries with regional strengths because there is a clustering of firms and workers in these industries that enable them to be more specialized, more nimble, and hence more competitive.

A common metric to capture competitiveness is *employment concentration* or *location quotients*. A location quotient for an industry in Southern California shows the percentage of total employment in the industry compared to the average percentage nationwide. For example, if four percent of employment in the region is in the motion picture industry compared to two percent across the nation, the location quotient for the motion picture industry in Southern California is two, indicating that Southern California is relatively more specialized in motion pictures production.

Similarly, a location quotient equal to one indicates that the employment concentration in Southern California is equal to that elsewhere, meaning the region is not highly-specialized in that industry. Higher location quotients imply a competitive advantage. While there is some variation in this metric, it is thought that the threshold to demonstrate regional specialization (and competitiveness) is a location quotient of at least 1.2.

Using this threshold, it appears that the trade and logistics industry cluster which as a whole fails to demonstrate regional specialization with a location quotient of 1.2.

Location quotients of the component industries in the cluster also vary. Industries associated with the largest job gains in the region tend to be more competitive—and their competitiveness has grown over the past ten years—while those with declining or relatively flat employment are losing competitive strength.

The region maintains a significant competitive strength in support activities for water transportation, with a location quotient of 2.7; the employment concentration has increased since 2005. Truck transportation and support activities for road transportation have both added jobs over the period, but have experienced a decline in their location quotient, indicating regional employment growth is overshadowed by larger job gains taking place elsewhere. Packing and crating functions are increasingly becoming a part of wholesale and warehousing and logistics operations. As such, that industry is experiencing declines in both employment and competitiveness.

It is important to remember that the location quotient as used here reflects *employment levels*, and not the value of product produced or sold. It is certainly true that this industry, as with many other industries, has become more efficient in terms of labor productivity. A declining employment location quotient may indicate a decline in the competitive strength gained from employment clustering or an innovation in production processes that are less labor-intensive than in other regions, and have thus become more productive than other regional industries.

While employment has declined in several component industries of the cluster, the change in the location quotient provided some insight into the *relative strength* of the industry compared to the national average. It could be that employment has fallen in the industry everywhere, and the drop in Southern California employment is simply a reflection of the industry’s declining labor intensity.

Location Quotients of Trade and Logistics Industries		
	Location Quotient 2015	Change since 2005
Wholesale Trade:		
Wholesalers: Durable goods	1.2	↑
Wholesalers: Nondurable goods	1.4	↑
Wholesale electronic markets	0.8	↓
<i>Subcluster</i>	1.2	↑
Transportation:		
Air Transportation	1.0	↑
Support Activities for Air Transportation	1.3	↑
Rail Transportation	0.9	↑
Support Activities for Rail Transportation	1.0	↑
Truck Transportation	0.8	↓
Support Activities for Road Transportation	1.5	↓
Water Transportation	1.1	↑
Support Activities for Water Transportation	2.7	↑
<i>Subcluster</i>	1.0	↑
Warehousing and Logistics:		
Warehousing and storage	1.4	↑
Freight transportation arrangement	1.8	↑
Packing and crating	1.0	↓
<i>Subcluster</i>	1.5	↑
TOTAL	1.2	↑

Sources: CMP; QCEW; Estimates by LAEDC

Spreading the Wealth

Impacts of the trade and logistics industry are felt across the economy.

Trade and logistics impacts a broad spectrum of industries through its supply chain.

The extent to which an industry’s impact extends to other sectors of the economy and into the hands of households depends in great measure on the share of the industry’s value (i.e., revenues) that is recirculated within the region. The total economic contribution of the trade and logistics industry cluster to the Southern California economy multiplies through its supply chain and payroll spending throughout the region, the impacts of which are examined here.

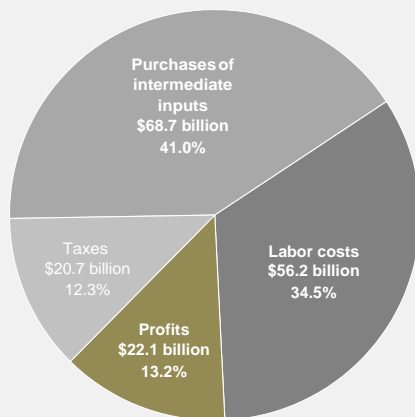
Where the Industry Spends Its Revenues

Firms generate revenues through sales of their products and services, and use those funds to purchase the inputs needed to produce product, to pay their workers, to pay taxes on production and profits, and to generate a return on capital in the form of profits. Industries can vary substantially in the shares claimed by each of these components.

In 2015 (the most recent year for which full data is available), the trade and logistics industry cluster spent \$68.7 billion on intermediate inputs into production, accounting for 41.0 percent of all outlays. Labor payments reached \$56.2 billion, accounting for more than one third, and the industry distributed \$22.1 billion in profits. Tax payments represent more than 12 percent of all outlays.

The overall impact that an industry has on the broader regional economy depends upon the expenditures made within the economic region. In general, outlays for labor costs occur within the region, and households are supported by these earnings.

Composition of Gross Output (2015)



Sources: BEA; Analysis by LAEDC

If most of the inputs used in production are purchased from local suppliers, those firms enjoy demand for their products and can increase their own hiring, supporting additional households in the region. If, on the other hand, most of the inputs are purchased elsewhere in the nation, then these purchases have no impact locally (other than perhaps in their transportation and storage) and the industry itself will generate fewer indirect effects.

Determining the source of inputs can be done through detailed surveys of firms, but this is often cost-prohibitive and is instead usually estimated using econometric techniques that take into account the region’s ability to provide the needed inputs, regional price differences and the cost of transporting goods to and from other regions. Together, labor costs and regional purchases of intermediate inputs determine the spillover, or multiplier impacts of the industry.

Economic Contribution of Trade and Logistics Industry Cluster

The concept of economic contribution answers the question, “What contribution does this industry make?” and measures not only the direct activity but also indirect and induced activity. As outlined above, this contribution is dependent on the payments made to suppliers of intermediate goods and services in the region and payments made to workers, who usually live locally and spend most of their incomes on household purchases from local suppliers.

In addition to the 580,450 direct payroll jobs in the trade and logistics industry cluster, an additional 273,840 jobs were supported in 2015 through indirect effects of supply chain purchases that are not made within the trade and logistics cluster itself, and 310,490 jobs were supported through the household spending of employees in the trade and logistics industry cluster and its supply chain.

Labor income (which includes wages and benefits) earned by all trade and logistics- supported employment in Southern California reached \$75.7 billion in 2015. Together, the industry cluster produced \$135.0 billion in value-added.

The overall impacts are widely distributed across many sectors of the economy through indirect and induced effects, including in administrative and waste services, health and social services, real estate and rental and leasing, and retail trade. (Please see Exhibit A-5 in the Appendix for complete and detailed contribution by industry sector.)

The total fiscal impact of the economic activity attributable to the trade and logistics industry cluster in 2015, including direct, indirect and induced activity, reached \$42.6 billion. This includes, property taxes paid, sales taxes on consumption purchases, income and profits taxes paid on net earnings, and payroll taxes for and by employees.

Total Economic Contribution of Trade and Logistics Industry Cluster (2015)

	Direct	Total
Output (\$ millions)	\$131,850	\$224,640
Employment (jobs)	580,450	1,164,790
Labor Income (\$ millions)	\$43,540	\$75,710
Value-Added (\$ millions)	\$80,330	\$134,980

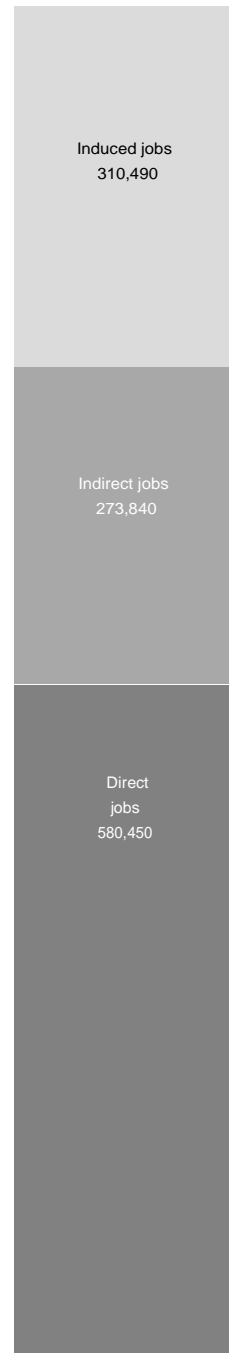
Source: Estimates by LAEDC

Total Fiscal Impacts by Type

	\$ millions
By Type of Tax:	
Personal income taxes	\$ 8,780
Social insurance	8,420
Sales and excise taxes	11,050
Property taxes	7,700
Corporate profits taxes	3,310
Other taxes	3,380
Total	\$ 42,640
By Type of Government:	
Federal	\$ 20,570
State	11,460
County	8,140
Cities	2,470
Total	\$ 42,640

Source: Estimates by LAEDC

1,164,790 total jobs



The overall impact of the trade and logistics industry is largely due to its regional purchases.

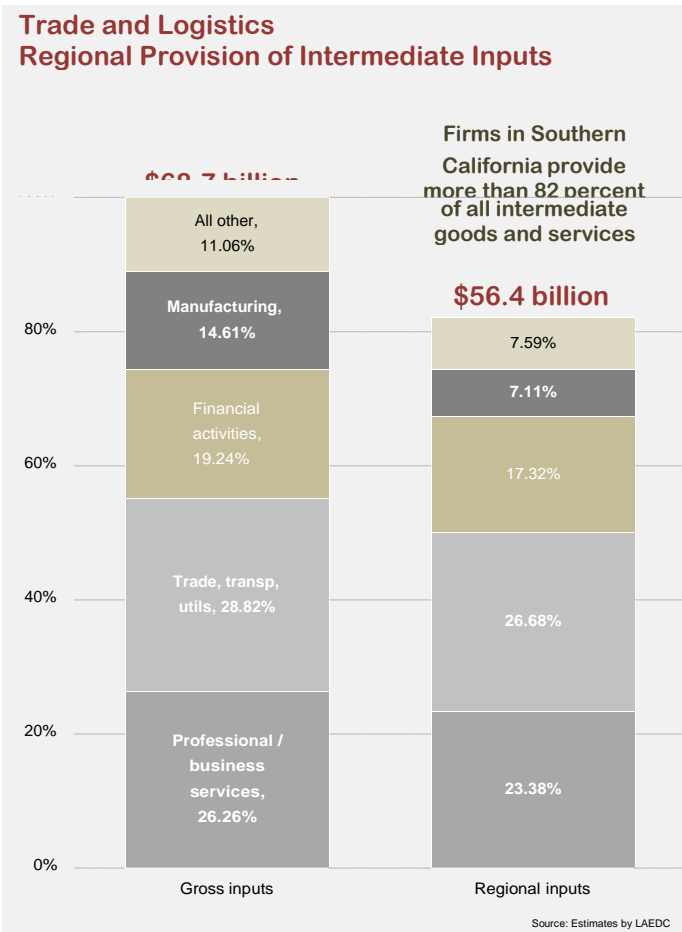
Supply Chain Analysis

The intermediate purchases of the trade and logistics industry cluster comprise an important part of the overall economic contribution of the industry. It was shown above that these accounted for 41.0 percent of the industry outlays, or \$68.7 billion in 2015 (the most recent year for which data is available).

Gross inputs are a combination of goods and services. In this industry cluster, the top three goods and services it purchases are real estate services, petroleum products and support services together accounting for approximately 22 percent of all intermediate purchases. A complete list of gross and regional input purchases by industry sector is provided in Exhibit A-5, with a detailed list of the top 50 inputs by value in Exhibit A-6.

Regional Purchase Gap

The ability of a region to fill the demands of its industries speaks to the richness and diversity of the regional economy. Not all regions can effectively compete, or wish to compete, with suppliers of specific goods and services based elsewhere. Industries making purchases of goods elsewhere are clearly benefiting from lower costs, better quality or other advantages to importing intermediate goods rather than purchasing from local firms.



From an economic development perspective, it may be preferable, however, to develop deep and broad local supply chains in order to capture a larger share of industry purchases, especially those that can be economically supported within the region.

The percent of all inputs purchased regionally are shown in the right panel of the exhibit. In general, trade, transportation and utilities are purchased from regional suppliers. Firms in the trade and logistics industry cluster purchase almost 93 percent of these services from suppliers in the region. Similarly, the region is able to supply the industry with more than 89 percent of its needs for professional and business services.

In contrast, less than 49 percent of the industry’s purchases of manufactured goods occur in the Southern California region. The impact on the overall regional supply pipeline is the amount of funds spent elsewhere – a lost opportunity. In terms of value, the industry spends more than \$12.3 billion with firms outside the Southern California region.

Work, Work, Work

About the kinds of jobs that make this industry cluster successful.

The work that people do in their jobs is commonly classified using the Standard Occupational Classification (SOC) system, developed by the Bureau of Labor Statistics. Workers are classified into particular occupations with similar job duties, skills, education and training. In Southern California, there are approximately 650 detailed occupations represented in the workforce that are not generally industry-specific but may be common to many industries.

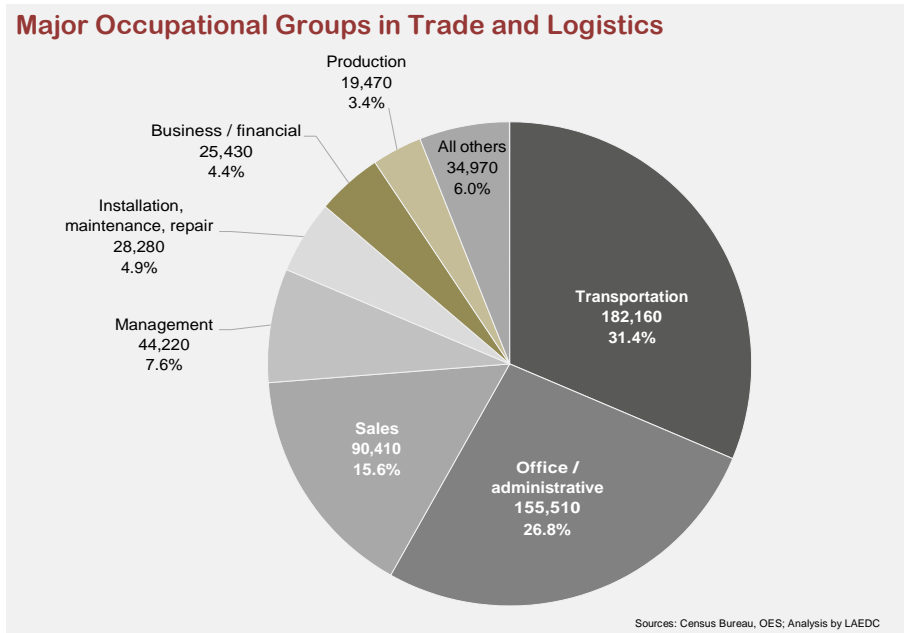
The trade and logistics industry cluster offers occupations across the skills spectrum, but is weighted towards transportation workers, laborers and order and shipping workers. While some of these workers may be highly skilled, they are more likely to learn their occupational skills on-the-job and less likely to need higher levels of education.

In total, there are just over 182,000 workers in transportation and material moving occupations, the largest major occupation group in the trade and logistics industry cluster. Within that occupational group, however, there are a variety of detailed occupations that are more descriptive of the type of work being done. For example, occupations such as heavy and industrial tractor and truck drivers and operators, flight attendants, and water vessel captains and crew are all in this category of workers.

There are 155,510 workers in office and administrative occupations, such as shipping and receiving clerks, order fillers and customer service representatives. Business and financial occupations including accountants and auditors, market research analysts and business operations specialists accounted for more than 7,350 workers.

Exhibit A-8 in the Appendix lists the top 50 detailed occupations in the industry cluster by current employment.

More than 31 percent of jobs in the industry are in transportation occupations, and 27 percent are in office and administrative occupations.



Future Workforce Needs

Given the expected growth of the industry over the next five years, and assuming a fairly consistent composition of occupations within the industry, the skills needed over the next five years can be reasonably projected.

At its current projected rate of employment growth, industry employment is expected to grow moderately primarily due to significant growth in warehousing in some areas of Southern California. That industry segment is still quite small in terms of employment, hence the projected occupational needs are small.

Many of the overall job openings expected over the next five years may be due to the retirement of existing workers rather than to new job openings being created.

Replacement needs are estimated by the Census Bureau and depend on many factors, including the age profile of the existing workforce, and skills acquisition through on-the-job training (leading to promotion).

5 Year Trade and Logistics Occupational Needs in Southern California by Major Occupational Group

SOC	Occupational Group	New Jobs	Replacement Jobs	Total Job Openings
11-0000	Management occupations	1,480	4,600	6,080
13-0000	Business and financial	880	2,490	3,370
15-0000	Computer and mathematical	470	840	1,310
17-0000	Engineering	180	590	770
19-0000	Life, physical, social science	40	140	180
27-0000	Arts, entertainment, sports and media	200	680	880
29-0000	Healthcare practitioners and technical	30	80	110
33-0000	Protective services	40	80	120
37-0000	Building/grounds maintenance	110	280	390
41-0000	Sales and related occupations	3,110	9,330	12,440
43-0000	Office and administrative	5,920	17,210	23,130
49-0000	Installation, maintenance / repair	980	2,820	3,800
51-0000	Production	680	2,280	2,960
53-0000	Transportation / material moving	7,010	21,760	28,770
	<i>All Others</i>	300	6,770	7,030
		21,430	69,910	91,340

Sources: CMP; Census Bureau, OES; Estimates by LAEDC

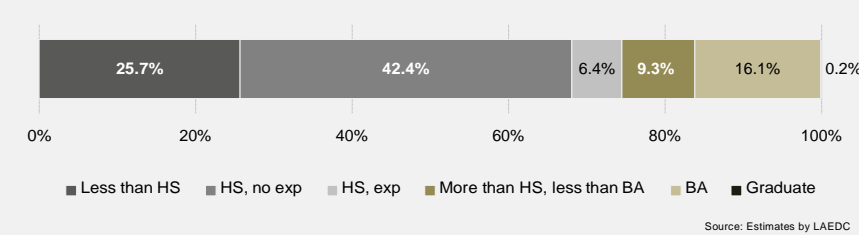
Overall, it is expected that 21,430 new job openings will be created in the industry in Southern California over the next five years. The industry will need an additional 69,910 replacement workers over the same period.

The highest number of openings will be found in occupations related to transportation and material moving, such as drivers and warehouse workers. Approximately 7,010 new jobs and 21,760 replacement jobs will be added over the next five years. Office and administrative

occupations will provide the second highest number of openings, with 5,920 new jobs created over the next five years and 17,210 jobs needing replacement workers. That the number of replacement workers is greater than the number of new jobs is an indication that the existing workforce is reaching retirement.

A full list of projected occupational openings is shown in Exhibit A-7 in the Appendix.

Educational Requirements for Entry Level Positions



Source: Estimates by LAEDC

Of all openings over the next five years, approximately 42 percent will require a high school diploma but will need no experience. More than 25 percent can be filled by entrants without a high school diploma. Slightly more than nine percent will require some post-secondary schooling, and 16.1 percent will need a bachelor's degree.

Preparing the Workforce

As the industry cluster grows, its need for workers will intensify. However, many occupations will be filled by local residents who may be moving from another job (or another occupation) or transitioning out of unemployment. Some of these candidates may need industry-specific training or skills upgrades.

Entry-level and lower-skilled jobs associated with trade and logistics industries traditionally require primarily on-the-job training. For positions such as these, educational attainment has little to do with job preparedness. Rather, most jobs call for candidates with a high school diploma (or equivalent), and the educational attainment of a majority of low-skilled warehouse and transportation workers is less than or equal to such qualifications. This implies that employers are more likely to value transferable skills and experience than educational attainment for such positions.

In recent years, trade and technical schools, as well as community colleges, have formed targeted programs aimed at reducing the time spent by new entrants in on-the-job training to create an occupation-ready workforce. Industry-specific curriculum has been developed to provide individuals interested in pursuing careers in the trade and logistics industry cluster with the knowledge and skills required to successfully perform their job duties.

Included in these are:

- Aviation related
- Maritime related
- Rail related
- Commercial drivers
- Warehouse workers
- Freight brokers and agents
- Supply chain, logistics and purchasing managers

Exhibit A-11 in the Appendix lists trade and logistics degree and certificate programs that are currently offered at regional colleges.

Aviation Related

Airplane pilots receive certifications and ratings that specify the vehicles they are qualified to operate, as well as any services they may offer. These certifications and ratings are detailed in the U.S. Department of Transportation's Federal Aviation Administration's (FAA) Federal Aviation Regulations (FAR's) 14 CFR Parts 141 and 61. Certifications include student, sport, recreation, private, commercial, flight instructor, and airline transport pilot (ATP).

Prospective pilots must earn a student pilot certification, which requires written and oral exams, as well as a flight test. Subsequent certifications are earned by logging additional flight hours and performing increasingly demanding flight tasks. Pilots holding student, sport, recreational, or private pilot certificates are generally restricted from providing any profit-earning services, while commercial and airline transport pilots who fly professionally are subject to different standards. Commercial pilots with instrument ratings have the same privileges as airline

Colleges and universities around the region offer a variety of programs to prepare workers for trade and logistics jobs.

FAA Certified Flight Schools in the Region

County	City	Institution
Los Angeles	El Monte	Universal Aviators Academy Inc
		Star Helicopters Llc
		Sky Creation Inc
	Hawthorne	Accelerated Flight Training Llc
		Angel City Flyers Inc
		Los Angeles Helicopters Llc
Long Beach	Candace A Larned Enterprises Inc	
	Santa Monica Aviation, Inc	
Santa Monica	American Flyers Inc	
Orange	Costa Mesa	Helistream Inc
	Fullerton	Aviation Facilities Inc
	Sunrise Aviation Company Inc	
Santa Ana	American Airplane Exchange Inc	
	Lake Elsinore	Adventure Flights Inc
		California Aviation Services
Riverside Flight Academy		
Riverside	Western Helicopters Inc	
San Bernardino	Chino	M I Air Corporation
	Redlands	Aero Tech Academy Inc
Ventura		Uhi Inc
	Camarillo	Channel Islands Aviation Inc
	Oxnard	Sanbarcollbuscom Inc
	Ventura	Sanbarcollbuscom Inc

Source: FAA

transport pilots, they may carry persons or property for compensation or hire.

In terms of logged flight time, a candidate for certification as a commercial pilot must log at least 250 hours, whereas a candidate for an ATP must log at least 1,500 hours.

As an ATP certification requires more logged flight time, as well as a bachelor's degree, large commercial passenger and cargo carriers desire such pilots over those with commercial certifications. Commercial pilots with less experience may be hired for agricultural purposes, as charter pilots, as emergency medical service helicopter pilots, for aerial photography, etc.

Pilot training institutions are largely based in airports-- there are 23 FAA approved training institutions within 16 of the five-county region's airports. FAA certified institutions can guarantee high quality training, dedicated facilities, and a variety of services; they may also require less training hours for students.

Maritime Related

Maritime industries host a variety of career opportunities for those who prefer apprenticeships, on-the-job training, and steady promotions following years of work experience. Promotion is typically determined by a worker's level of on-the-job experience, rather than external training or education.

Prospective workers must be in the proper physical shape, be able to pass a drug test, and apply for and receive a Transportation Worker Identification Credential (TWIC) from the Transportation Safety Administration (TSA). In order to work on a commercial cargo ship, one must attain the Merchant Mariner Credential (MMC) by first gaining ample experience, selecting a rating (e.g. deck, engineering, steward), and submitting the proper application and paperwork.

Able Body (AB) Seaman and Captains

Ordinary seaman (OS) positions are largely open to any person who is physically capable of laborious tasks like manning rigging, cleaning, and painting. This means that no previous sea-serving experience or training courses are required, as workers will learn on-the-job as part of either the deck or engine crew. Once the required level of experience has been attained, one may take courses and examinations with the U.S. Coast Guard in order to become certified as an Able Body (AB) Seaman or Qualified Member of the Engineering Department (QMED). Local U.S. Coast Guard offices are in Long Beach, Marina Del Rey, Los Angeles, Norwalk, Corona Del Mar, and Newport Beach. AB seamen can perform as a wide range of position titles (e.g. Deck Hand, AB Seaman, AB Tahnkerman, AB Watchman, mate, etc.) with various duties. The position, responsibilities, and income of an AB seaman are determined by one's experience and subsequent class.

Before becoming a captain, one must accrue sufficient experience and logged hours working on a ship. Similar to that of aeronautical pilots, ship captain licenses follow a multi-tiered structure in which greater privileges and responsibilities may be awarded to captains who are highly skilled and have logged extensive work experience.

Prospective captains must apply with the USCG and may have to take an exam at a regional office; no training is required outside of on-the-job experience. Captain credentials are based on total days of service, waters served upon, and tonnage of vessels used. Captains may start from the bottom as OS and work their way up through the ranks by earning promotions and gaining ratings, or they can train at merchant mariner

academies and get fast-tracked into a captain's position. Set guidelines for what size boat may be operated, the maximum distance from shore to which a captain may travel, how many commercial passengers may be carried on a vessel, and whether or not a vessel is to be inspected by the USCG.

Mariner Pilot

Rather than existing as part of a ship's crew, a mariner pilot will meet vessels just beyond a harbor, port, river, or other challenging geography and guide them to their final destinations. Mariner pilots must have an impressive track record and proven skills in order to become licensed. As with most occupations in this industry, no external training is required. Instead, captains familiar with a specific geography must submit the proper application and documents to the USCG, take a written test at a regional office, and take a pilot examination in their selected geography.

Qualified Member of the Engineering Department (QMED)

QMED work deals largely with technology, and thus need skills that are more technical. As a result of this, QMED's require a fundamental knowledge of mechanical and electrical engineering principles and applications so that the position holder can monitor, carry out, and repair all technical operations on the ship (primarily in the engine room). Though much will be learned on the job, a potential candidate would benefit from a post-secondary or graduate education related to electronics or mechanics from a trade school, community college, or four-year university.

Though no specific programs exist in the area, the Danish shipping company, Maersk, provides its successful, entry-level applicants with the company's "Engineering Cadet Training Program." This program is structured to include management, mechanical engineering, electrical certification, automation, design and systems maintenance management. The program is setup so that entry level workers can gain skills and experience needed to work their way up to senior, chief, and specialist jobs. Target candidates are generally healthy high school graduates with good eyesight.

Rail Related

The Federal Railroad Administration (FRA) requires railroads to have a formal program for certifying conductors and engineers that includes a formal process for training new hires.

At **LA Metro**, rail drivers all have previous bus driving experience, and are given a seven-week training course before formally beginning the position.

At **Union Pacific**, entry level positions (e.g. Switchperson, Brakeperson) require no previous railroad experience. After putting in enough time, these workers can be promoted to conductor or locomotive engineer positions. The former is in charge of the train, crew, and cargo, while the latter operates the locomotive. The company also offers a three-year apprenticeship for inexperienced rail car repair hires. In this program, trainees receive classroom lectures, workshops, field training, and a ramping up of on-the-job responsibilities. Work assignments are designated within the general region of each Union Pacific hub. In L.A. County, the company has locations in Commerce, Long Beach, Panorama City, and City of Industry.

Amtrak is the only national passenger rail service, and its one and only training program for new engineers exists in Wilmington, Delaware. Attendees receive 440 hours of classroom training in the form of lectures, workshops, and tests. This includes five crucial tests in which students must pass with a grade of 90% or above; those who do not are subsequently dropped from the program. Upon completion of this program, graduates

LA Metro offers a free, four-week "Bridge Academy" bus operator training. Each participant who passes the screening process and completes the full course is guaranteed an interview.

return to their home base and receive 12 to 18 months of on-the-job training under a veteran conductor.

Commercial Drivers

Truck, bus, taxi, and other commercial drivers must apply for a commercial driver license (CDL) through the Department of Motor Vehicles (DMV). Doing so requires the passage of a traffic laws and signs test, as well as a driving skills test using the proper commercial vehicle. Available certificates and endorsements are displayed in the exhibit below.

To receive an ambulance driver certificate, one must undergo emergency medical training, apply at the DMV, and pass a written and medical examination. Those aiming to be certified as school bus, youth bus, school pupil activity bus, general public paratransit vehicle, farm labor vehicle, or vehicle for developmentally disabled person’s drivers must enroll in the California Highway Patrol’s (CHP) School Bus Program and pass an examination with the DMV. General public paratransit certifications are required for those carrying less than 24 passengers, including school children. The certification requires 40 hours of driver’s education and behind-the-wheel training; applicants for renewal must receive two hours of refresher training for each year of certification.

Achieving an endorsement for a double trailer requires a knowledge and skills test with the DMV. Triple trailers are not legal in California.

Those seeking the Radioactive Material Driver Certificate must undergo similar training, including a driver’s education course and an examination with the DMV. Acquiring a hazardous materials endorsement requires the passage of a knowledge test, for which preliminary training and education are strongly recommended. Training courses are often offered through truck driving schools, unions, employers, and colleges.

Certifications & Endorsements for Commercial Drivers

Abbreviations	Certification
AMB	Ambulance
F/L	Farm Labor
GPPV	General Public Paratransit Vehicle
HAM	Hazardous Agricultural Materials
RM	Radioactive Materials
SCH	School Bus
SPAB	School Pupils Activity Bus
VDDP	Vehicle for Developmentally Disabled Persons
YOB	Youth Bus
TTD	Tow Truck Driver Clearance
Code	Endorsements
D	Double Trailer
HM	Hazardous Materials
TV	Tank Vehicle
PV	Passenger Transportation
T	Triple Trailer

Sources: : California Department of Motor Vehicles

The Teamsters Union has many chapters located within the 5- county region. These local chapters offer training and support services for truck drivers, including a 40-hour basic hazardous waste worker course, an 8-hour hazardous materials transportation awareness course, and a 10-hour general industry safety and health outreach course. Teamsters training courses are free of charge to union members, are offered in-house or on-site, fulfill specific training requirements of OSHA, DOT and DOE, and result in student certification. The hazardous materials transportation course is available to drivers, dock, port, and warehouse workers, and teaches them to identify hazardous materials, to recognize HAZMAT incidents, to protect themselves and to provide information to more highly trained responders. Completing this course earns workers a DOT HAZMAT AwarenessCard.

There are several private options in the region, including the Dootson Truck Driving School in Arcadia and Buena Park, which have an open schedule of weekday, night, and weekend classes and the Montebello-based TGA Truck Driving School, which offers programs catered to new drivers, as well as renewals and all four endorsements (double, triple, tank, and hazardous materials). The Dolphin Trucking School, located in Commerce, provides Class A and B CDL training through class lectures and skill-building workshops. It offers payment plans to its students, and works with unemployment offices. Additionally, it provides lifetime-job placement service, to ensure its graduates can secure a job in the industry.

The exhibit on the right lists local driver training institutions in the region.

The Dolphin Trucking School in Commerce works with unemployment offices to provide training for Class A and B CDL. Additionally, it offers a lifetime-job placement service, to ensure its graduates can secure a job in the industry, even after completion of the program.

Commercial Driver Training in Southern CA		
County	City	Institution
Los Angeles	Arcadia	Dootson Truck Driving School
	Baldwin Park	EI Monte Truck Driving School
	Bellflower	Toro School of Truck Driving
	Chatsworth	Alliance School of Trucking
	City of Industry	Camino Real Truck and Bus Driving School
	Commerce	Dolphin Trucking School
	El Monte	Edison Truck and Bus Driving School
	Huntington Park	Professional Trucking School
	Lake Balboa	Exclusive Trucking School
	Lancaster	Hi-Desert Trucking School
		GSF Truck Training
		Universal Truck Driving School
	Los Angeles	Toro School of Truck Driving
	Montebello	TGA Truck Driving School
Pomona	Dynasty Trucking & Bus School	
Sylmar	GSF Truck & Bus Driving Schools	
Orange	Anaheim	California Career School
	Buena Park	Dootson School of Truck Driving
	Fullerton	Toro School of Truck Driving
	Santa Ana	America Truck Driving School
	Santa Ana	California Truck Driving Academy
	Santa Ana	United Truck Driving School
Riverside	Corona	American Truck Driving School
		CRST Training School
	Riverside	United Truck Driving School
	Temecula	United Truck Driving School
San Bernardino		Advanced School of Driving
		CR England Premier Truck Driving School
		Pilot Trucking School
	Fontana	Roadmaster Drivers School of Fontana
	Ontario	Las Americas Truck Driving School
	San Bernardino	Las Americas Truck Driving School
	Upland	Universal Truck Driving School
Ventura	N/A	N/A

Source: Various, compiled by LAEDC

Warehouse Workers

Only trained and competent operators shall be permitted to operate a powered industrial truck (i.e. forklift). According to the U.S. Department of Labor, all operators must be trained and certified by their organizations. Training consists of a combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video, written material), practical training (demonstrations performed by the trainer and practical exercises performed by the trainee), and evaluation of the operator's performance in the workplace. Organizations may take advantage of external training programs, like those offered by the Teamsters union, but must subsequently provide site-specific information related to

training topics. OSHA does not require licensing, but employers may choose to license their operators. Many warehouse workers, such as shipping or receiving clerks, operate forklifts. A list of regional training programs is provided in the exhibit on the left.

Forklift Driver Training Programs in Southern CA

County	City	Training Company	
Los Angeles		Big Joe Lift Trucks	
	Canoga Park	Southern California Material Handling	
	Canyon Country	Sensible Safety Inc	
	Chatsworth	Forklift Academy Inc.	
	Claremont	IVES Training Group	
	Commerce		Forklifts Los Angeles Hyundai Forklift of Southern California
		Long Beach	Komatsu Forklift
		Crown Lift Trucks	
	Los Angeles		Environmental Outsource, Inc.
			Boman Forklift
			M&M Industrial Equipment Pallet Jack & Forklift Repair
	Montebello		All Valley Safety
			Forklift University, Inc. of Southern California
	Pomona		USA Forklift
			USA Forklift
	San Fernando Valley		All Valley Safety
	Santa Fe Springs		BFC Forklift
			Coast to Coast Forklift Training
			Forklift Nation
	Sylmar		Industrial Compliance Services
Torrance		Creation World Safety	
Van Nuys		USA Forklift	
Vernon		LA Lift Services	
Whittier		United Forklift	
Orange	Anaheim	A-1 Forklift Certification Training Center	
		Prosafe Forklift Training Center	
		Southwest Material Handling Inc.	
	Fullerton	USA Forklift License	
Riverside	Corona	R & J Material Handling, Inc	
	Riverside	AAA Forklift	
		Riverside Forklifts	
San Bernardino	Fontana	Iron Horse Certification	
	Ontario	Superior Forklift Training	
	Rancho Cucamonga		IVES Training Group
			Atlas Forklift Training
	San Bernardino		USA Forklift License
	Upland		All Purpose Safety Training Solutions, LLC
Victorville		Hi Desert Forklift Services	
Ventura	Oxnard	Power Machinery Center	

Source: Various, compiled by LAEDC

Freight Brokers and Agents

Freight agents and brokers coordinate the logistics of freight and cargo shipping by working with global supply chains involving owners, shipbrokers, charterers, cargo owners and cargo receivers. This includes tasks such as advising clients on transportation and payment methods, monitoring the progress of shipments and delivery statuses, notifying relevant parties of shipment arrivals, determining methods of shipping, and preparing and recording the necessary documentation.

The primary difference between brokers and agents is that, while brokers require a license to operate, agents may operate unlicensed under a broker. To become licensed as a broker, one must register with the Federal Motor Carrier Safety Administration (FMCSA) by submitting the necessary application, providing proof of insurance coverage, and designating a processing agent (self-designation is an option). Independent agents may be hired by large transportation logistics companies such as Landstar, Trinity Logistics, and RFX Global Companies.

Neither brokers nor agents require an education beyond a high school diploma, but they may have acquired training through an employer or through a variety of online or in-person programs specific to their career. This training serves to inform prospective agents and brokers on how to follow laws and regulations, create and retain a customer base, and carry out standard tasks and operations.

Training programs for freight brokers and agents exist in many forms, from single-day lectures and webinars to master degree programs. Lloyd's Maritime Academy based out of the United Kingdom provides a

part-time, 12-month, distance learning (online) Diploma for Ship and Port Agents, as well as a similar 18-month Ship Agent MBA through a partnership with Middlesex University London. Employer training varies depending on the firm; between the aforementioned RFX and Trinity Logistics, the former prefers to take on experienced agents that can be quickly integrated into their system, while the latter brings in and trains new agents.

Supply Chain, Logistics and Purchasing Managers

Supply chain managers direct and coordinate the production, purchasing, warehousing, and distribution of services and activities, while aiming to streamline distribution needs, reduce costs, and improve customer service and safety. Logistics analysts and managers maintain and interpret logistics data (e.g. availability, maintainability, reliability, strategic sourcing and distribution, etc.), resolve problems concerning transportation, logistics systems, imports or exports, or customer issues, work with multiple departments to improve efficiency of operations, and prepare reports containing forecasts and recommendations. Purchasing manager's plan and direct purchases, negotiate contracts and sales, interview and hire staff, and prepare and process purchase orders. The majority of workers in these occupations hold bachelor's degrees. Supply chain and logistics managers may pursue further education in the form of a master's degree, while purchasing managers may be hired with an associate's degree.

Local colleges and universities also offer educational programs that could feed into the industry cluster. At California State University, Los Angeles (CSULA), undergraduate students have the option of earning a 21-unit (7-course) certificate in Transportation and Logistics. This program is the result of a partnership between the school's Department of marketing and Office of Extended Studies and International Programs, and aims to help students looking to work in the movement of raw materials and freight to manufacturing, warehousing, and retail facilities through the pursuit of a career in the field of industrial traffic, transportation and logistics. At Long Beach City College, students within the International Business concentration have the option to focus on international business or logistics, in which the coursework revolves around the details of supply chain management and distribution.

California State University, Long Beach's College of Continuing and Professional Education offers a cohort-based, ten course Master of Science in Supply Chain Management. Throughout the course of the program, students are exposed to quantitative, technical, operational, strategic, and behavioral preparation that will give them the skills they need to identify, analyze, and resolve complex supply chain challenges faced by global businesses.

The University of California, Los Angeles (UCLA), is partnered with the local chapter of the Institute for Supply Management (ISM-LA) and the California Association of Public Purchasing Officers (CAPPO) in order to offer an eight-course certificate program in supply chain management. These courses are available online, on campus, or at the workplace, and may be used as continuing education credit hours towards ISM certifications or to help prepare workers for ISM exams.

Brandman University in Orange County offers a Bachelor of Business Administration in Supply Chain Management/Logistics. Students pursuing this degree begin their education with a foundation of business topics including accounting, economics, marketing, business law, and the like. They then round their course of study by learning supply chain and logistics topics such as inventory management, product development, ethical sourcing, and quality control.

The US Census Bureau provides free, online training videos relevant to import and export careers.

Looking Ahead

Future trends and emerging technologies.

The future of transportation industries in Southern California will depend upon the ability of the region to build the requisite infrastructure to support forecasted increases in the volume of goods moved.

The trade and logistics industry has been undergoing a transformation, moving away from the way it has operated and done business in years past. Growth is now more localized, and operations in all sectors in the industry cluster are increasingly becoming more capital- and technology-intensive. Several recent trends observed are expected to continue and accelerate over the near-term. In this section, we briefly cover emerging technologies and other issues that will influence industries in the trade and logistics industry cluster going forward.

Top Upcoming Trends to Watch

Continued growth is expected in Southern California's trade and logistics industry cluster in the near future. The already large consumer market will continue to grow in size, demanding an increased volume of goods to be moved through the region's channels of distribution. Looking ahead, we anticipate the top upcoming trends in trade and logistics to include:

- The future of transportation industries in Southern California will depend upon the ability of the region to build the requisite infrastructure to support forecasted increases in the volume of goods moved.
- Intermodal transportation will continue to be the norm, with warehouses serving as hubs for transportation and logistics.
- Self-driving trucks will become more prevalent as truck transportation industries work to address the continuing shortage of truck drivers.
- The Inland Empire has developed into a logistics hub, and it will continue to be a key market for the logistics industry's growth.
- More localized growth of logistics operations are expected to continue as 3PLs to address consumer demands for shorter delivery times.
- Mergers and acquisitions of 3PLs are expected to continue, but many of these business combinations will be between small- and medium-sized 3PLs, as companies in the small- to mid-sized range choose between growth or the prospect of a buy-out.
- Demand for industrial property is expected to hold steady, with continued downward pressure on vacancy rates that will only moderate over time as new industrial space is developed and comes to market.
- The continued success of online retailing will hold in a growth pattern, bolstering demand and requiring the warehousing of larger inventories in more specialized facilities throughout the region.
- Workforce challenges will remain, domestic outsourcing will continue and jobs filled by outside staffing agencies will continue to depress wages. As trade and logistics industries continue to grow, already hard to fill positions will become an even bigger obstacle.
- The trade and logistics industry cluster will continue to look for ways to increase efficiencies and productivity, maximize capacity and cut costs, most likely through innovations and capital investments in technology.

Technology Innovations

New technologies are employed across different industries to improve efficiency and productivity, optimize capacity and reduce costs. Disruptive technology with potential for cost savings will typically be employed by businesses much sooner than by general consumers. For example, transportation industries are pushing the use of autonomous vehicles in their operations, while overall general consumers remain cautious about their use on public roads. Technological innovation present in the trade and logistics industry cluster include: automation and robotics; 3-D printing; autonomous vehicles and systems; virtual reality; new logistics management software applications; and the use of advanced technology (e.g., radar, ultrasound, GPS, electronic and optical instruments, etc.) in maintenance functions. Examples of how each is used in one of the component industries in the trade and logistics industry cluster follow.

Automation: Rise of the Machines

Automation is taking place across every industry in one form or another, and it is no different in the trade and logistics industry cluster. Trade and logistics industries are moving towards becoming more capital-intensive, versus labor-intensive, through the use of new technology. Automation ranges in size and application according to industry needs.

Automation at ocean ports has been taking place worldwide for some time, but it has recently become more conspicuous in the Southern California region. In particular, the Port of Los Angeles has been transforming its TraPac terminal over the last several years, outfitting it with massive robots; some tasked with moving shipping containers from ships to stacks, and others tasked with loading those stacked containers onto trucks for the next leg of their distribution journey. The Port of Long Beach is not far behind in the race to automate. It too has been outfitting their Middle Harbor terminal with automated equipment, which is slated to be operative by 2020. The use of robotics at the ports will increase throughput (the average volume of goods handled); increase efficiency and safety at port facilities; reduce truck idle times, leading to lower emissions; and result in overall cost savings. The main criticism for the adoption of this technology is that it will displace workers. However, if the region's ports do not remain competitive with cargo throughput levels in a global market, that too will result in a loss of jobs when activity switches to automated ports elsewhere with less congestion issues

Automation is also widespread in warehouse operations. Amazon, for example, is known for their orange Kiva robots, which transport shelving and bins to workers who then pick the products. And many new startups are poised to enter and transform the warehouse robot space. New incarnations of the warehouse robot include the San Jose-based company Fetch Robotics, whose industrial robots simplify point-to-point warehouse product handling by following pickers to catch their selected items, and the French company Locus robots, which lead pickers to where items are located in the warehouse. Most robots found in warehouse operations today work collaboratively with humans because they face challenges with the identification and selection of items from shelves or bins. Future generations of robots, combined with advances in deep machine learning and artificial intelligence, will no doubt overcome these challenges in the near future.

3-D Printing and the Transportation Industry

3-D printing has the potential be a disruptive technology for goods movement industries. Currently, products and many parts (with potential for 3-D printing) are produced and/or assembled at manufacturing facilities and shipped worldwide using transportation

New technologies are employed across different industries to make increases in efficiencies and productivity, optimize capacity and reduce costs.

As with any new and disruptive technology, public uncertainty of autonomous vehicles is expected to wane over time as familiarity increases.

services. If businesses invest in 3-D printers, some items can be printed immediately on site using design schematics, while also providing customers more flexibility in terms of batch size and customization. Although industrial-sized 3-D printers are currently too cost prohibitive for widespread adoption, opportunities exist for companies, e.g., contract manufacturing organizations, which specialize in providing this service for multiple clients. For example, United Parcel Service (UPS) currently has a pilot program where a professional grade 3-D printer has been installed at over 100 UPS stores nationwide, specializing in the production of prototypes or parts with complex engineering.

Autonomous Vehicles

Autonomous vehicles in trade and logistics can be split into two main categories, unmanned aerial vehicles (drones) and self-driving vehicles.

Unmanned Aerial Vehicles (UAVs)

Unmanned Aerial Vehicles (UAVs) are poised to change the way deliveries are made, especially deliveries to remote areas or those with traffic congestion issues. Delivery drones are on the verge of being rolled out by several companies including Amazon, Google and UPS. There is, however, a major caveat -- drones without direct supervision of a human are not currently legal in the U.S. Until they are, delivery UAVs brought online will require a human (labor) component.

Self-driving vehicles

Self-driving vehicles are already being utilized in warehousing operations in the form of autonomous forklifts. In fact, Pennsylvania-based Seegrid Corporation, a leader in connected self-driving vision guided vehicles (VGVs), has been selling autonomous VGV forklifts to factories since 2003.

More recently, the truck transportation and drayage (short-haul) industries are looking towards self-driving trucks as a solution to myriad cost-containment and profit margin concerns. Autonomous trucks have the potential to result in significant cost savings related to increases in fuel efficiency, productivity (no general hours of service guidelines), and decreased reliance on labor and incidence of truck accidents. Additionally, the industry has been facing a shortage of drivers, which is a non-issue with self-driving vehicles.

An autonomous truck made its maiden voyage in the U.S., driving across public roads in Nevada in May 2015. And, the first delivery made by a self-driving truck took place in Colorado, when an autonomous Volvo VNL moved 2,125 cases (51,744 cans) of Budweiser a distance of 120 miles. The truck was controlled by a system developed by San Francisco-based Otto, a startup, which was recently purchased by Uber, that designs, manufactures and operates self-driving vehicles.

Currently, the biggest obstacle to the widespread adoption of autonomous trucks is not technological, but regulatory in nature. The federal government has yet to establish a set of laws specific to autonomous vehicles; however, several states are "beating them to the punch" by enacting their own statewide laws. Another major hurdle to widespread adoption is the public's fear of the new technology, especially full autonomy. As with any new and disruptive technology, these fears are expected to be assuaged over time as familiarity with autonomous vehicles increases.

Virtual Reality in Warehouse Operations

DHL tested the use of augmented reality (as they refer to it) in one of their warehousing operations in the Netherlands. Employees used smart glasses with a virtual reality application that displayed graphics including product aisle, location and quantity. This "vision picking" pilot showed an increase in efficiency of 25 percent during the picking process. DHL is looking into other uses of augmented reality in their transportation and delivery services that may result in additional gains in efficiency in their services.

Mobile Applications

The use of cell phone applications is not new in the trade and logistics industry. Truckers have been using them for years to provide: truck-legal navigation, locate truck stops; provide up-to-date diesel prices to find the cheapest fuel, and for compliance management, using integrated vehicle speed, RPM, and GPS data to assist in electronic logging for hours of service (HOS) compliance, fuel tax reporting, and to manage inspections.

Small trucking carriers and independent trucking companies currently rely upon brokers to connect them to shippers. In this way, the industry is fragmented, making on-demand (i.e. overnight and same day) transactions challenging.

On-demand shipping applications, such as Cargomatic and Convoy, have been developed as a way to streamline the process, eliminating intermediary confusion and directly connecting freight carriers to shippers who require their services. These mobile applications reduce costs for both parties by reducing or eliminating costly brokers fees (which can be up to 45 percent) and by handling the administrative and financial details of transactions, including billing and payment.

Using new mobile applications, shippers are able to post jobs and have the ability to track their goods from pick-up to delivery, and receive progress notifications in real-time. Carriers benefit from using these applications by being alerted of additional jobs on their current route, which present them with the opportunity to pick up additional shipments, when driving with a partially filled truck.

Advanced Technology and Maintenance

Railroads in the U.S. are using technologies including radar, ultrasound, GPS, electronic and optical instruments, and onboard computer systems to monitor their freight rail systems and their equipment traversing rail lines.

Positive Train Control (PTC) technologies have been designed to increase the safety of freight rail transportation by stopping trains in order to prevent certain types of accidents, including derailments resulting from excessive speed, train-to-train collisions, and trains moving onto tracks in error (where maintenance is taking place or due to track switch error). The development and installation of PTC has been aggressively undertaken by privately owned railroads to ensure compliance with the mandate established by the Rail Safety Improvement Act of 2008 (RSIA), whose compliance deadline was moved from December 31, 2015 to 2018 under the Surface Transportation Extension Act of 2015.

Advanced technologies in the form of detection systems, drones used for monitoring, and ultrasonic inspection technology in development, will be used concurrently to ensure the safe and efficient operation of freight railroads across the 140,000-mile national rail network.

Advanced technologies like detection systems, drones for monitoring, and ultrasonic inspection technology, will be used concurrently to ensure the safe and efficient operation of freight railroads.

Technology is not the only game-changer for industries in the trade and logistics industry cluster.

Other Considerations

Technology is not the only game changer relative to the industries in the trade and logistics industry cluster. Labor issues, including disruptions and domestic outsourcing, have the potential to negatively affect the Southern California-based industry in terms of growth for trade volumes and wages respectively.

Air quality and related regulations remain a top concern for the trade and logistics industry; aggressive targets and strict applications have the potential to create costly hurdles. Expanding the freight infrastructure is necessary to alleviate mounting congestion issues across all modes of transportation.

California Sustainable Freight Action Plan

The California Air Resources Board (CARB) is undertaking the California Sustainable Freight Action Plan, a zero emissions freight strategy, which if adopted, may result in additional legislation that establishes new regulations and compliance. The executive order (B-32-15) issued by Governor Brown (July 17, 2015) directs the Secretaries of the California State Transportation Agency, California Environmental Protection Agency, and California Natural Resources Agency to lead other state departments (including the California Air Resources Board, the California Department of Transportation, the California Energy Commission, and the Governor's Office of Business and Economic Development). Efforts are intended to improve freight efficiency, spur the transition to zero-emission technologies and increase competitiveness of California's freight system.

Domestic Outsourcing

Both the warehousing and transportation industries have been increasingly relying on contract employees, retaining temp and staffing agencies, to help fill their workforce needs. While beneficial to the operation, the workers in these positions have not fared as well. Typically, contract employees do not have access to the same benefits (medical, retirement, union, etc.) as in-house employees and often are paid lower wages for the same work performed when compared to direct hires. Additionally, many contract jobs lack long-term stability because they are offered on a per diem or short-term basis. It has been a common practice to rely on contract employment to fill employment gaps in the warehousing industry. And while more sporadic, contract employment services are also used at the Ports of Long Beach and Los Angeles.

Investment into Infrastructure

With limited investment available to expand freight infrastructure, projects must be prioritized. Ocean carriers continually seek the most competitive and efficient route to deliver contracted goods around the globe. Recent consolidation among shipping carriers and advances in ship-building capabilities have led to ever larger ships crossing the oceans, while improved rail technologies are enabling efficient land transfer of goods. The trucking industry is especially sensitive to congestion and can serve as a major goods movement constriction point as the transportation mode that moves the largest amount of freight. In order to ensure that the Southern California region has the capacity to handle future volume of freight, significant investment into goods movement infrastructure will be required. Some investment has already taken place, but concerns abound that current efforts are not enough to address congestion issues with any efficacy. As each mode of transportation has its own systems and needs, we briefly touch on infrastructure for seaports, the highway system and the rail system separately.

Seaports

The size of waterborne ocean carriers have dramatically increased over time. Modern day New-Panamax containerships are able to carry loads of approximately 12,500 TEUs each, a far cry of the first generation of Panamax containerships in the 1980s with a capacity of only 4,000 TEUs. The increasing scale of these vessels requires constant infrastructure upgrades in order to increase capacity enough to accommodate these vessels and process the massive number of TEUs that they carry.

Ports across the globe are investing in upgrading infrastructure to accommodate the changing nature of the vessels deployed by their clients, as well as pursuing less capital-intensive operational efficiencies to reduce costs and increase throughput to gain competitive advantages.

The San Pedro Bay port complex (Port of Los Angeles and Port of Long Beach) has already invested heavily in infrastructure to accommodate the new generation of mega-ships. These massive container vessels require deepening of waterways, the raising bridges and additional equipment for loading and unloading; including the complex's first automated container terminals.

Highway System

The trucking industry is especially sensitive to congestion as the transportation mode that moves the largest amount of freight. Trucks are estimated to have carried about 80 percent of total freight shipments by tonnage and by value in 2015. The FHWA estimates that by 2020, close to 53 percent of urban interstate mileage, the portion of the National Highway System traversed by the most freight trucks, will be congested, resulting in slower speeds, longer trip times, and increased vehicular queueing.

Bottlenecks in the highway system negatively impact delivery schedules, thereby increasing shipping costs and decreasing overall productivity in the industry. As freight volumes continue to grow, the industry will face increased exposure to congestion. Without adequate investment made to add roadway capacity to the highway system, future levels of congestion will lead to greater losses in delivery speed and reliability, resulting in even higher shipping costs.

The Fixing America's Surface Transportation Act ("FAST" Act) is the first federal law enacted in the past decade to provide long-term federal funding for qualifying surface transportation programs. FAST Act was signed into law by Obama in December 2015 as a way to facilitate surface transportation projects intended to alleviate congestion and facilitate freight flows along interstates, highways and other major roads. The Act authorized \$305 billion to fund projects through FY2020. State and local governments, along with metropolitan planning organizations, are eligible to receive funds under the act. While this is a step in the right direction, more efforts will be needed to increase roadway capacity to where congestion is reduced.

Rail Network

The amount of freight moved by rail in the U.S. is expected to increase significantly, requiring further investment to increase capacity and build, repair and maintain infrastructure. Public investment related to rail transportation includes numerous rail crossings (under and over) and grade separations meant to mitigate traffic delays at rail crossings.

BNSF Railway is attempting to undertake a significant capital project of their own, the Southern California International Gateway (SCIG), a \$500 million investment, with \$100

The increasing scale of waterborne vessels requires constant upgrades at the ports to increase capacity and ensure suitable infrastructure to handle the massive number of TEUs they carry.

Growth in the trade and logistics industry cluster is expected to remain positive with more localized growth resulting in new facilities sited across the region and near-term employment gains.

million dedicated to green technologies including electric cranes, ultra-low emission locomotives and use of solar energy. The SCIG is a new intermodal yard to be built on an existing industrial site located within four miles of the San Pedro Bay port complex and with direct access to the Alameda Corridor, which starts the journey of goods to destinations throughout the U.S. This new facility, which is much closer than the existing rail yards located 24 miles from the port complex (near downtown Los Angeles), would reduce the distance loaded trucks would have to travel to transfer containers to rail, thereby reducing truck traffic in the region and on local surface roads and highways.

The proposed SCIG project has stalled under the authority of the California Environmental Quality Act (CEQA), which requires state and local agencies to identify environmental impacts associated with projects in order to mitigate them, if possible. Both BNSF Railway and the Port of Los Angeles are in the midst of appealing a ruling by a lower court that the environmental analysis was inadequate.

Additional costs and delays related to CEQA lawsuits decrease the likelihood that the project will ever break ground. The regional impact of losing this development include the loss of associated employment (with a local hire element), possible increases in congestion due to additional truck traffic, and potential increases in greenhouse gas and other noxious emissions.

Moving Forward

Concerns remain that investment made to prepare local goods movement infrastructure for the expected increase in the volume of goods moved throughout the Southern California region will not manifest quickly enough. Future legislation, regulations and government mandates related to air quality have the potential to present additional hurdles and add extra operational costs for firms in the trade and logistics industry cluster. As such, the trade and logistics industry will continue to look for ways to increase efficiencies and productivity, maximize capacity and cut costs, most likely through innovations in technology. Regardless of challenges faced, growth in the trade and logistics industry cluster is expected to remain positive, with more localized growth resulting in new facilities sited across the region and near-term employment gains.

Appendix

How (and why) we did what we did.

Here we explain why we are interested in learning about our industry clusters in more detail, and how we measure them. Data sources and methodologies are outlined, and a description of the components industries in the aerospace industry cluster is provided. A series of exhibits fill in some of the details that were summarized in the report.

Cluster Theory and Economic Development

Clusters are agglomerations of related industries, consisting of companies, suppliers and service providers, as well as government agencies and other support institutions. By bringing together the talent, technology, information and competing companies, such geographic proximity allows firms to learn from each other, develop specialized labor, shared infrastructure, service providers, and suppliers and support institutions. This local collaboration and competition spurs innovation and productivity, attracting other firms to the region as they seek to benefit from spillovers present in the clustered industry.

We look at the economy by categorizing its industries into clusters rather than aggregating them into larger sectors. Clusters allow us to see industries linked with others through technology, skills, common supply chains, specialized labor pools, infrastructure needs and soon.

Research shows that regions with comparatively strong industry clusters achieve better economic performance through increased job creation, wage growth, business formation and entrepreneurial activity and innovation.

Michael E. Porter, professor in the Harvard Business School at the Institute for Strategy and Competitiveness, is a leading expert on the competitiveness of businesses and his insights have brought focus to how regions can develop competitiveness and economic prosperity by recognizing the importance of industry clusters. Funded by the Economic Development Administration of the U.S. Department of Commerce, Porter's Cluster Mapping Project (www.clustermapping.us) has provided a categorization of industries into industry clusters based on their locational correlation of employment.

A further distinction is made between industry clusters that serve the local market, such as retail industries, health services and restaurants, and those that sell goods and services to larger markets outside the economic region.

Because local industry clusters exist wherever there is a local population base, they are likely to grow at the rate of population growth. They may also provide the majority of the region's jobs.

Traded clusters, on the other hand, are not dependent on local sales but find markets outside the region in which they are located. Because they are exposed to the global

market, they must be competitive in order to thrive and grow, and will choose to locate where there exist locational advantages, such as availability of labor, land and capital suited to their needs, as well as supplier networks and other supporting institutions.

Hence, investments made by such firms in technology, innovation, labor and the upgrading of their goods and services result in improved productivity and efficiency, increasing the firm's competitiveness in the global marketplace, growing the market share of the industry and driving industry growth, which creates higher-wage jobs and regional prosperity.

The first step in this virtuous cycle is to foster an environment where industry clusters can grow organically. Knowing our regional strengths and weaknesses provides us with a useful baseline on which we can build economic development strategies. The full list of traded industry clusters in California for 2014 is in Exhibit A-1; local industry clusters are shown in Exhibit A-2.

Data Sources

All data was obtained from the Bureau of Labor Statistics and the Census Bureau. Annual employment and payroll data are from the Census of Employment and Wages series. Estimates for non-disclosed employment and payroll data were produced using proportional shares of the prior year's data or using midpoint estimates from the County Business Patterns program. Occupational data are from the Occupational Employment Statistics program. Unless noted otherwise, all data is for the 2015 calendar year.

Supply Chain and Output Analysis

Composition of gross output is a metric tracked by the BEA at the state level. It is assumed that the proportion attributable to each component of this metric at the county level is comparable to that at the state level. This seems reasonable given the size of the Southern California region and its economic activity in the state. Estimates of regional purchases of intermediate goods and services are produced using econometric models by the IMPLAN Group, LLC.

Economic Impact and Contribution Analysis

Economic contribution analysis is used to estimate the portion of a region's economic activity that can be attributed to an existing industry sector. The primary economic contribution to the Southern California economy of the trade and logistics industry is the expenditure of billions of dollars towards goods and services from regional vendors. These purchases circulate throughout the regional economy.

The trade and logistics industry also spends billions of dollars every year for the wages and benefits of employees and contingent workers. These workers, as well as the employees of all suppliers, spend a portion of their incomes on groceries, rent, vehicle expenses, healthcare, entertainment, and so on. This recirculation of household earnings multiplies the initial industry spending through such indirect and induced effects.

The extent to which the initial expenditures multiply is estimated using economic models that depict the relationships between industries (such as trade and logistics and its suppliers) and among different economic agents (such as industries and their employees).

These models are built upon data of expenditure patterns that are reported to the U.S. Bureau of Labor Statistics, the U.S. Census Bureau and the Bureau of Economic Analysis of the U.S. Department of Commerce. Data is regionalized so that it reflects local conditions such as wages rates, commuting patterns, and resource availability and costs.

The magnitude of the multiplying effect differs from one region to another depending on the extent to which the local region can fill the demand for all rounds of supplying needs. For example, the automobile manufacturing industry has high multipliers in Detroit and Indiana since these regions have deep supplier networks, while the same industry multiplier in Phoenix is quite small. In another example, the jobs multiplier for the construction industry is higher in, say, Arkansas, than in California because a given amount of spending will purchase fewer workers in Los Angeles than in Little Rock. Multipliers also differ from year to year as relative material and labor costs change and as the production “recipe” of industries change. For example, the IT revolution significantly reduced the job multiplier of many industries (such as manufacturing, accounting and publishing) as computers replaced administrative and production workers.

The metrics used to determine the value of the economic contribution are employment, labor income, value-added and the value of output. *Employment* includes full-time, part-time, permanent and seasonal employees and the self-employed, and is measured on a job-count basis regardless of the number of hours worked. *Labor income* includes all income received by both payroll employees and the self-employed, including wages and benefits such as health insurance and pension plan contributions. *Value-added* is the measure of the contribution to GDP made by the industry, and consists of compensation of employees, taxes on production and gross operating surplus (otherwise known as profit). *Output* is the value of the goods and services produced. For most industries, this is simply the revenues generated through sales; for others, such as retail, output is the value of the services supplied.

Estimates are developed using software and data from IMPLAN Group, LLC which traces inter-industry transactions resulting from an increase in demand in a given region. The economic region of interest in this document is Southern California defined as including the five counties of Los Angeles, Orange, Riverside, San Bernardino and Ventura. The activity is reported for 2015, the most recent year for which a complete set of data is available. Estimates for labor income and output are expressed in 2015 dollars to maintain consistency with the reported industry activity.

The total estimated economic contribution includes *direct*, *indirect* and *induced effects*. *Direct activity* includes the materials purchased and the employees hired by the industry itself. *Indirect effects* are those which stem from the employment and business revenues resulting from the purchases made by the industry and any of its suppliers. *Induced effects* are those generated by the household spending of employees whose wages are sustained by both direct and indirect spending.

Contribution analysis differs from economic impact analysis in that linkages between the individual component industries are removed so that indirect activity is not double-counted as also part of direct activity. For example, firms in the trade and logistics industry purchase transportation services from smaller truck transportation firms, which would then be included as both direct revenue of the trucking firm and as an expense of the trade and logistics industry, resulting in a double-counting of overall revenue. Breaking these inter-industry linkages eliminates this double-counting and is a more accurate method of estimating the economic contribution of the industry cluster.

Industries of Trade and Logistics Industry Cluster

The following industries comprise the trade and logistics industry cluster:

NAICS 42: Wholesale Trade

Establishments in this sector are primarily engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing. This sector comprises two main types of wholesalers (1) merchant wholesalers that sell goods on their own account and (2) business-to-business electronic markets, agents, and brokers that arrange sales and purchases for others generally for a commission or fee.

NAICS 481: Air transportation

Establishments in this subsector provide air transportation of passengers and/or cargo using aircraft, such as airplanes and helicopters. Scenic and sightseeing air transportation and air courier services are not included.

NAICS 482: Rail transportation

Establishments in this subsector provide rail transportation of passengers and/or cargo using railroad rolling stock. The railroads in this subsector primarily either operate on networks, with physical facilities, labor force, and equipment spread over an extensive geographic area, or operate over a short distance on a local rail line. Scenic and sightseeing rail transportation and street railroads, commuter rail, and rapid transit are not included.

NAICS 483: Water transportation

Establishments in this subsector provide water transportation of passengers and cargo using watercraft, such as ships, barges, and boats. Scenic and sightseeing water transportation services are not included.

NAICS 484: Truck transportation

Establishments in this subsector provide over-the-road transportation of cargo using motor vehicles, such as trucks and tractor-trailers. The subsector is subdivided into general freight trucking and specialized freight trucking. This distinction reflects differences in equipment used, type of load carried, scheduling, terminal, and other networking services. Each of these industry groups is further subdivided based on distance traveled, local versus long distance.

NAICS 4881: Support activities for air transportation

This industry includes establishments primarily engaged in providing services to the air transportation industry, including airport operation, servicing, repairing (except factory conversion and overhaul of aircraft), maintaining and storing aircraft, and ferrying aircraft.

NAICS 4882: Support activities for rail transportation

This industry includes establishments primarily engaged in providing specialized services for railroad transportation including servicing, routine repairing (except factory conversion, overhaul or rebuilding of rolling stock), and maintaining rail cars; loading and unloading rail cars; and operating independent terminals.

NAICS 4883: Support activities for water transportation

Establishments in this industry are comprised of establishments primarily engaged in (1) port and harbor operations; (2) providing stevedoring and other marine cargo handling services (except warehousing); (3) providing navigational services to shipping, including marine salvage establishments; and (4) providing other services to water transportation, such as Floating drydocks, ship scaling services and marine cargo checkers and surveyors.

NAICS 4884: Support activities for truck transportation

Establishments in this industry are primarily engaged in (1) motor vehicle towing, light or heavy motor vehicles, local and long distance, and may also provide incidental services, including storage and emergency road repair services and (2) providing other services to road network users, such as bridge, tunnel, and highway operations, pilot car services, driving services (e.g., automobile, truck delivery) and truck or weighing station operations.

NAICS 4885: Freight Transportation Arrangement

Establishments in this industry are primarily engaged in arranging transportation of freight between shippers and carriers. These establishments are usually known as freight forwarders, marine shipping agents, or customs brokers and offer a combination of services spanning transportation modes.

NAICS 488991: Packing and crating

Establishments in this U.S. industry are primarily engaged in packing, crating, and otherwise preparing goods for transportation.

NAICS 493: Warehousing and storage

Establishments in this subsector are primarily engaged in operating warehousing and storage facilities for general merchandise, refrigerated goods, and other warehouse products. These establishments provide facilities to store goods. They do not sell the goods they handle. These establishments take responsibility for storing the goods and keeping them secure. They may also provide a range of services related to the distribution of goods (often referred to as logistics services). Logistics services can include labeling, breaking bulk, inventory control and management, light assembly, order entry and fulfillment, packaging, pick and pack, price marking and ticketing, and transportation arrangement. However, establishments in this industry group always provide warehousing or storage services in addition to any logistic services. Furthermore, the warehousing or storage of goods must be more than incidental to the performance of services, such as price marking. Bonded warehousing and storage services and warehouses located in free trade zones are included in the industries of this subsector.

Exhibit A-1 Traded Industry Clusters of Southern California 2015

Industry Cluster Name	Establishments	Employment	Average Annual Wage	Location Quotient
Trade	32,560	463,910	\$ 63,743	1.2
Business Services	31,750	394,210	89,385	0.9
Hospitality and Tourism	5,600	168,780	39,568	1.0
Entertainment	17,570	164,100	120,541	5.2
Education and Knowledge Creation	3,760	120,120	87,365	0.9
Financial Services	10,290	105,530	132,868	1.0
Marketing, Design and Publishing	9,590	85,570	87,548	1.2
Aerospace Vehicles and Defense	510	73,460	108,834	2.2
Information Technology and Analytical Instruments	1,730	70,640	112,535	1.1
Fashion	3,330	64,540	38,377	2.7
Food Processing and Manufacturing	1,070	45,790	56,409	0.8
Insurance Services	1,400	44,450	97,808	0.6
Biomedical	610	43,720	104,242	1.5
Metalworking Technology	1,340	33,180	53,271	1.3
Plastics	770	29,780	49,867	0.9
Production Technology and Heavy Machinery	970	28,300	68,636	0.6
Construction Products and Services	980	27,430	78,016	0.6
Printing Services	1,840	25,940	47,260	1.1
Furniture	970	21,990	41,366	1.1
Communication Equipment and Services	1,060	21,500	91,669	1.2
Automotive	580	18,180	51,689	0.4
Downstream Metal Products	730	18,110	57,770	0.8
Upstream Metal Manufacturing	450	16,410	59,861	0.8
Lighting and Electrical Equipment	550	16,270	60,026	1.0
Downstream Chemical Products	550	16,230	61,116	1.2
Agricultural Inputs and Services	500	15,000	31,134	0.8
Recreational and Small Electric Goods	780	14,590	52,834	1.6
Paper and Packaging	280	12,610	62,518	0.6
Oils and Gas Production and Transportation	310	11,020	124,071	0.3
Wood Products	400	8,070	38,316	0.4
Vulcanized and Fired Materials	300	7,700	44,660	0.6
Environmental Services	250	7,280	62,779	1.2
Electric Power Generation and Transmission	180	7,030	142,448	0.7
Livestock Processing	110	5,930	42,606	0.2
Trailers, Motor Homes and Appliances	60	3,350	53,492	0.4
Upstream Chemical Products	100	2,490	76,336	0.3
Nonmetal Mining	70	1,300	80,297	0.3
Fishing and Fishing Products	40	450	42,724	0.2
Metal Mining	4	440	81,611	0.2
Forestry	30	240	33,980	0.1
Coal Mining	3	70	91,316	0.0
Tobacco	6	10	25,003	0.0
TOTAL Traded Industry Clusters	133,960	2,215,710	\$ 79,370	1.0

* Data is not disclosed

Sources: CMP; QCEW; Estimates by LAEDC

Exhibit A-2
Local Industry Clusters of Southern California 2015

Industry Cluster Name	Establishments	Employment	Average Annual Wage
Local Health Services	48,300	719,410	\$ 56,885
Local Hospitality Establishments	35,740	693,390	19,813
Local Commercial Services	34,810	521,830	48,495
Local Real Estate, Construction and Development	50,760	476,910	57,670
Local Community and Civic Organizations	244,200	369,250	19,269
Local Retailing of Clothing and General Merchandise	10,980	249,740	24,502
Local Food and Beverage Processing and Distribution	11,290	229,390	36,839
Local Motor Vehicle Products and Services	19,120	219,440	43,898
Local Logistical Services	6,460	123,650	44,377
Local Personal Services (Non-Medical)	16,160	120,740	29,890
Local Financial Services	12,270	114,470	76,468
Local Household Goods and Services	8,000	88,930	36,342
Local Entertainment and Media	5,290	88,790	58,415
Local Education and Training	2,350	56,870	39,468
Local Utilities	1,250	45,470	94,252
Local Industrial Products and Services	3,080	36,360	54,429
TOTAL Local Industry Clusters	510,050	4,144,610	\$ 41,830

Sources: CMP, QCEW: Estimates by LAEDC

Exhibit A-3 Industries of the Trade and Logistics Industry 2015

	Employment	Total Payroll (\$ millions)	Average Annual Wages
SUBCLUSTER: Wholesale Trade			
423 Merchant Wholesalers, Durable Goods	187,250	\$ 12,713	\$ 67,895
424 Merchant Wholesalers, Nondurable Goods Wholesale Electronic Markets and Agents and	152,350	10,049	65,957
425 Brokers	37,010	2,7486	74,271
SUBTOTAL	376,610	\$ 25,510	\$ 67,737
SUBCLUSTER: Transportation			
481* Air Transportation	23,700	\$ 1,795	\$ 75,710
4881 Support Activities for Air Transportation	13,220	512	38,758
482 Rail Transportation	30	1	37,777
4882 Support Activities for Rail Transportation	1,720	81	47,366
483 Water Transportation	3,960	271	68,271
4883 Support Activities for Water Transportation	13,770	1,530	111,121
484 Truck Transportation	57,750	2,793	48,366
4884 Support Activities for Truck Transportation	7,780	287	36,846
SUBTOTAL	121,930	\$ 3,324	\$ 59,620
SUBCLUSTER: Warehousing and Logistics			
493 Warehousing and Storage	60,780	\$ 2,654	\$ 43,660
4885 Freight Transportation Arrangement	20,140	1,172	58,208
488991 Packing and Crating	1,000	41	40,616
SUBTOTAL	81,920	\$ 3,866	\$ 47,199
TRADE AND LOGISTICS INDUSTRY	580,450	\$ 36,646	\$ 63,134

Sources: CMP; OCEW; Estimates by LAEDC

Exhibit A-4 Economic Contribution Across Industries – Trade and Logistics Industry 2015

NAICS	Industry Sector	Direct Jobs	Total Jobs	Direct Labor Income (\$ millions)	Total Labor Income (\$ millions)	Direct Output (\$ millions)	Total Output (\$ millions)
11	Agriculture, forestry and fishing		1,050		\$ 64.5		\$ 94.9
21	Mining		2,030		283.6		903.4
22	Utilities		1,010		148.1		480.1
23	Construction		8,264		460.4		610.8
31-33	Manufacturing		14,070		1,028.1		2,254.4
42	Wholesale trade	376,610	376,610	30,431.0	30,431.0	93,528.7	61,672.1
44-45	Retail trade		51,950		2,023.7		3,365.5
48-49	Transportation and warehousing	203,850	228,200	13,112.9	14,193.3	38,322.7	20,333.3
51	Information		14,900		2,087.8		3,867.1
52	Finance and insurance		44,840		3,528.0		5,600.5
53	Real estate and rental		46,990		1,814.7		11,757.0
54	Profession and technical services		59,160		4,677.0		5,984.6
55	Management of companies		15,040		1,776.1		2,125.7
56	Administrative and waste services		85,090		3,127.7		3,904.4
61	Educational services		13,480		649.4		716.8
62	Health and social services		69,560		3,947.4		4,369.0
71	Arts, entertainment and recreation		14,480		574.3		847.7
72	Accommodation and food services		53,820		1,396.6		1,965.4
81	Other services		48,410		1,946.0		2,805.5
92	Government		15,840		1,555.5		1,323.4
	TOTAL All Industry Sectors	580,450	1,164,790	\$ 43,543.9	\$ 75,712.9	\$ 131,851.4	\$ 134,981.5

Source: Estimates by LAEDC

Exhibit A-5
Trade and Logistics Industry Purchases of Intermediate Goods and Services

NAICS	Industry Sector	Gross Inputs (\$ millions)	% of All Intermediate Purchases	Regional Inputs (\$ millions)	Regional Inputs as % of Gross Inputs
11	Agriculture, Forestry, Fishing and Hunting	\$ 6.9	0.0	1.4	20.9
21	Mining, Quarrying and Oil and Gas Extraction	382.6	0.6	\$ 2,989.8	23.5
22	Utilities	1,401.0	2.0	646.0	46.1
23	Construction	628.6	0.9	561.2	89.3
31-33	Manufacturing	10,042.8	14.6	4,886.2	48.7
42	Wholesale Trade	4,378.8	6.4	4,377.6	100.0
44-45	Retail Trade	313.5	0.5	306.4	97.7
48-49	Transportation and Warehousing	13,712.4	20.0	13,005.1	94.8
51	Information	2,065.3	3.0	1,936.0	93.7
52	Finance and Insurance	4,836.6	7.0	3,583.5	74.1
53	Real Estate and Rental and Leasing	8,386.8	12.2	8,316.7	99.2
54	Professional, Scientific and Technical Services	9,411.2	13.7	8,742.0	92.9
55	Management of Companies and Enterprises Administrative and Support and Waste Management and Remediation Services	4,370.8	6.4	3,355.7	76.8
56	Administrative and Support and Waste Management and Remediation Services	4,266.4	6.2	3,967.3	93.0
61	Educational Services	60.6	0.1	59.6	98.4
62	Health Care and Social Assistance	-	-	-	-
71	Arts, Entertainment and Recreation	203.4	0.3	196.5	96.6
72	Accommodation and Food Services	672.4	1.0	589.6	87.7
81	Other Services	1,747.5	2.5	1,690.6	96.7
92	Public Administration	1,832.3	2.7	88.9	4.9
	TOTAL All Intermediate Purchases	\$ 68,719.8	100.0	\$ 56,400.1	82.1

Sources: IMPLAN Group; Analysis by LAEDC

Exhibit A-6 Detailed Purchases of Intermediate Goods and Services (Top 50 by Value)

NAICS	Industry Sector	Gross Inputs (\$ millions)	% of All Intermediate Purchases	Regional Inputs (\$ millions)	% of Gross Inputs Purchased Regionally
531	Real estate buying and selling, leasing, managing, and related services	5,886.1	8.6	5,880.2	99.9
32411	Refined petroleum products	4,813.8	7.0	3,445.8	71.6
488	Support activities for transportation	4,537.3	6.6	4,532.0	99.9
42	Wholesale trade distribution services	4,378.8	6.4	4,377.6	100.0
55	Management of companies and enterprises	4,370.8	6.4	3,355.7	76.8
5418	Advertising, public relations, and related services	4,127.5	6.0	4,052.6	98.2
492	Couriers and messengers services	3,173.3	4.6	3,123.5	98.4
5241	Insurance	2,495.0	3.6	1,379.2	55.3
493	Warehousing and storage services	2,392.3	3.5	2,391.8	100.0
491	US Postal delivery services	1,796.0	2.6	1,467.5	81.7
0	Noncomparable imports	1,730.6	2.5	-	-
54161	Management consulting services	1,470.8	2.1	1,166.8	79.3
5613	Employment services	1,303.5	1.9	1,297.2	99.5
22112	* Not a unique commodity (electricity from all other sources)	1,155.3	1.7	411.6	35.6
5222-3	Nondepository credit intermediation and related activities	930.3	1.4	928.2	99.8
5324	Commercial and industrial equipment rental and leasing services	929.3	1.4	918.9	98.9
5412	Accounting, tax preparation, bookkeeping, and payroll services	893.1	1.3	875.3	98.0
5215221	Monetary authorities and depository credit intermediation	890.5	1.3	825.0	92.6
5411	Legal services	832.7	1.2	823.4	98.9
484	Truck transportation services	832.1	1.2	814.1	97.8
51721	Wireless telecommunications (except satellite)	814.6	1.2	810.0	99.4
5321	Automotive equipment rental and leasing services	797.7	1.2	747.3	93.7
5614	Business support services	767.1	1.1	552.1	72.0
51711	Wired telecommunications	742.4	1.1	717.6	96.7
533	Leasing of nonfinancial intangible assets	652.4	0.9	652.4	100.0
23	Maintained and repaired nonresidential structures	628.6	0.9	561.2	89.3
562	Waste management and remediation services	620.3	0.9	597.5	96.3
481	Air transportation services	607.2	0.9	436.1	71.8
8113	Commercial / industrial machinery and equipment repair / maintenance	543.8	0.8	543.7	100.0
5619	Other support services	413.7	0.6	399.4	96.5
32311	Printed materials	412.2	0.6	203.7	49.4
5617	Services to buildings	407.4	0.6	406.8	99.8
5616	Investigation and security services	385.3	0.6	384.5	99.8
5413	Architectural, engineering, and related services	384.3	0.6	367.7	95.7
213112	Support activities for oil and gas operations	358.7	0.5	82.6	23.0
81111/2/9	Automotive repair and maintenance, except car washes	351.5	0.5	351.5	100.0
33639	Other motor vehicle parts	330.3	0.5	76.3	23.1
5231-2	Securities and commodity contracts intermediation and brokerage	309.3	0.5	239.9	77.6
5182	Data processing, hosting, and related services	307.3	0.4	228.1	74.2
33632	Motor vehicle electrical and electronic equipment	301.5	0.4	44.6	14.8
54151A	Other computer related services, including facilities management services	301.0	0.4	192.1	63.8
54191/3/9	Marketing research / all other misc. prof., scientific, technical services	292.5	0.4	290.0	99.1
326190	Other plastics products	278.8	0.4	86.9	31.2
5611	Office administrative services	271.3	0.4	271.3	100.0
541512	Computer systems design services	267.7	0.4	134.4	50.2
8114	Personal and household goods repair and maintenance	266.8	0.4	246.9	92.6
8112	Electronic and precision equipment repair and maintenance	250.5	0.4	250.5	100.0
722513	Limited-service restaurant services	235.1	0.3	235.0	100.0
482	Rail transportation services	232.4	0.3	142.1	61.2
5615	Travel arrangement and reservation services	229.9	0.3	229.5	99.8
	<i>All other intermediate purchases</i>	<i>7,019.3</i>	<i>10.2</i>	<i>3,852.2</i>	<i>54.9</i>
	TOTAL All Intermediate Purchases	\$ 68,719.8	100.0	\$ 56,400.1	82.1

Sources: IMPLAN Group; Analysis by LAEDC

Exhibit A-7 Detailed Trade and Logistics Occupations (Top 50 by Employment)

SOC	Occupation Title	2015 SoCal Payroll Jobs	Projected Openings Over SoCal 5 Years	Education Needed for Entry Level	Work Experience Needed for Entry Level	On-the-Job Training to Attain Competency	Average Median Wage CA 2015
41-4012	Sales Reps, Wholesale / Manuf., not Tech / Scientific	55,380	7,710	7	None	MT OJT	56,415
53-7062	Laborers and Freight, Stock, Material Movers, Hand	53,170	10,510	8	None	ST OJT	25,071
53-3032	Heavy and Tractor-Trailer Truck Drivers	39,650	4,820	5	None	ST OJT	42,080
53-3033	Light Truck or Delivery Services Drivers	19,480	2,340	7	None	ST OJT	31,182
43-5071	Shipping, Receiving, and Traffic Clerks	19,460	2,710	7	None	ST OJT	30,830
11-1021	General and Operations Managers	18,370	2,900	3	≥5 years	None	105,564
43-5081	Stock Clerks and Order Fillers	18,170	3,850	8	None	ST OJT	24,153
43-4051	Customer Service Representatives	15,820	2,480	7	None	ST OJT	37,274
41-4011	Sales Reps, Wholesale / Manuf., Tech / Scientific	12,970	1,800	3	None	MT OJT	83,260
43-5052	Postal Service Mail Carriers	12,580	1,760	7	None	ST OJT	58,058
43-9061	Office Clerks, General	12,570	1,830	7	None	ST OJT	31,662
53-7051	Industrial Truck and Tractor Operators	12,390	2,010	8	None	ST OJT	35,238
43-3031	Bookkeeping, Accounting, and Auditing Clerks	11,600	1,000	6	None	MT OJT	41,810
53-7064	Packers and Packagers, Hand	9,960	1,650	8	None	ST OJT	20,242
43-1011	First-Line Supervisors of Office and Administrative	9,740	1,150	7	<5 years	None	56,617
53-3031	Driver/Sales Workers	8,660	1,030	7	None	ST OJT	26,810
43-4151	Order Clerks	8,560	1,500	7	None	ST OJT	33,408
43-6014	Secretaries and Administrative Assistants, Except	7,690	700	7	None	ST OJT	38,045
11-2022	Sales Managers	7,550	1,130	3	<5 years	None	115,795
53-3022	Bus Drivers, School or Special Client	5,360	540	7	None	ST OJT	35,136
53-1021	First-Line Supervisors of Helpers, Laborers, Movers	5,230	1,020	7	<5 years	None	48,587
43-4181	Reservation / Transportation Ticket Agents / Clerks	4,980	550	7	None	ST OJT	38,817
43-5053	Mail Sorters, Processors, Processing Machine Ops.	4,970	530	7	None	ST OJT	55,328
53-1031	First-Line Supervisors of Transp. /Vehicle Ops.	4,860	950	7	<5 years	None	59,018
43-5032	Dispatchers, Except Police, Fire, Ambulance	4,610	790	7	None	MT OJT	37,873
41-1012	First-Line Supervisors of Non-Retail Sales Workers	4,500	430	7	<5 years	None	63,550
13-2011	Accountants and Auditors	4,480	770	3	None	None	72,205
53-2031	Flight Attendants	4,420	540	7	<5 years	MT OJT	43,595
13-1161	Market Research Analysts and Marketing Specialists	4,370	390	3	None	None	71,008
43-5011	Cargo and Freight Agents	4,370	820	7	None	ST OJT	44,408
51-2092	Team Assemblers	4,240	620	7	None	MT OJT	26,667
49-9071	Maintenance and Repair Workers, General	4,060	660	7	None	LT OJT	39,489
13-1022	Wholesale and Retail Buyers, Except Farm Products	3,790	740	3	None	LT OJT	52,838
43-5061	Production, Planning, and Expediting Clerks	3,630	650	7	None	MT OJT	49,259
11-3071	Transportation, Storage, and Distribution Managers	3,620	510	7	≥5 years	None	87,891
49-3031	Bus and Truck Mechanics and Diesel Engine	3,590	470	7	None	LT OJT	51,100
43-3021	Billing and Posting Clerks	3,540	470	7	None	MT OJT	37,538
53-3021	Bus Drivers, Transit and Intercity	3,450	350	7	None	MT OJT	41,481
15-1151	Computer User Support Specialists	3,280	310	6	None	None	56,579
49-3011	Aircraft Mechanics and Service Technicians	3,060	470	5	None	None	64,537
13-1199	Business Operations Specialists, All Other	3,060	280	3	None	None	72,691
41-3099	Sales Representatives, Services, All Other	2,940	440	7	None	MT OJT	58,594
43-5051	Postal Service Clerks	2,810	290	7	None	ST OJT	56,414
53-2011	Airline Pilots, Copilots, and Flight Engineers	2,690	410	3	<5 years	MT OJT	124,981
37-2011	Janitors and Cleaners, Except Maids and	2,620	340	8	None	ST OJT	25,005
41-2031	Retail Salespersons	2,580	590	8	None	ST OJT	23,545
15-1133	Software Developers, Systems Software	2,440	240	3	None	None	122,112
51-9111	Packaging and Filling Machine Operators and	2,420	510	7	None	MT OJT	25,415
51-9061	Inspectors, Testers, Sorters, Samplers, Weighers	2,370	390	7	None	MT OJT	37,334
43-3011	Bill and Account Collectors	2,310	380	7	None	MT OJT	38,512
	<i>All Other</i>	111,070	15,620				
	TOTAL All Occupations	580,460	91,340				\$ 56,840

Education: 1=Doctoral or professional degree; 2=Master's degree; 3=Bachelor's degree; 4=Associate's degree; 5=Postsecondary non-degree award; 6=Some college, no degree; 7=High school diploma or equivalent; 8=Less than high school; On-the-Job Training: LT OJT=Long-term on-the-job training (more than one year); MT OJT=Moderate-term on-the-job training (1-12 months); ST OJT=Short-term on-the-job training (1 month or less) Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-8 Trade and Logistics Educational Programs in Southern California

County	Institution	Program	Type	
Los Angeles	California Polytechnic University, Pomona	International Business	BA	
	California State University, Dominguez Hills	Global Logistics and Supply Chain Management	BS	
		Business Administration - International Business	BS	
	California State University, Long Beach		Business Administration - International Business	BS
			Global Logistics	MA, Cert, Minor
			Supply Chain Management	MS
	California State University, Los Angeles	Business Administration - International Business	MS	
	California State University, Northridge	Global Supply Chain Management	BS	
		Business Administration - Systems and Operations Management	BS	
	Cerritos College	International Business	Cert.	
	College of the Canyons	International Trade-Finance	Cert.	
		International Trade-Marketing	Cert.	
	CSU Los Angeles	Logistics and Transportation	Cert.	
	Glendale City College	Business Administration - International Business	AS	
	Glendale Community College	International Business	AS	
	Long Beach City College	Business International	AA, Cert.	
	Los Angeles City College	International Business	AA, Cert.	
	Mt. San Antonio College	International Business	AS, Cert.	
	Pepperdine University	Global Business	MS	
		International Business	BS	
	Rio Hondo College	International Business	AA, Cert.	
	Santa Monica College	Logistics/Supply Chain Management	AS, Cert.	
	The Master's College	Business Administration - International Business	BA	
	University of California, Los Angeles	Supply Chain Management	Cert.	
	University of La Verne	International Business and Language	BS	
	University of Southern California	Global Supply Chain Management	MS	
		International MBA	MBA	
		Optimization and Supply Chain Management	Graduate Cert.	
	Whittier College	Business Administration - International Business	BA	
	Orange County	Anaheim University	International MBA	MBA
		International Business	Ph.D	
Brandman University		International Business	MBA	
		Supply Chain Management & Logistics	BBA	
		Supply Chain Systems	BBA	
		Supply Chain Systems - Applied Studies	BA	
		Supply Chain Systems - Organizational Leadership	BA	
California State University, Fullerton		International Business	BA	
Coastal Community College		Supply Chain Management	AA, Cert.	
Concordia University		International Business	BA	
Fullerton College		International Business management	AS, Cert.	
Orange Coast College		International Business	Certification of Specialization	
Pepperdine University Graduate Campus		Global Business	MS	
		International MBA	MBA	
Saddleback College		Global Business	AS, Cert.	
Santa Ana College		Global Trade Skills	Cert.	
		International Business	AA, Cert.	
University of Phoenix		Business - Supply Chain Management	BS	
		Management - Supply Chain Management	BS	
Riverside		Riverside City College	International Business	Cert.
San Bernardino	California State University, San Bernardino	Administration International Business Concentration	BA, MA	
		Administration Supply Chain and Transportation Management Concentration	BA, MA	
		International Business	Minor	
		Supply Chain Management	Cert., Minor	

MS = Master of Science, MA = Master of Arts, MBA = Master of Business Administration, BS = Bachelor of Science, BA = Bachelor of Arts, AS = Associate of Science, AA = Associate of Arts, Cert. = Certificate
Sources: Various, compiled by LAEDC

About the Authors

The IAE team

Christine Cooper, Ph.D. *Senior Vice President, LAEDC*

Dr. Cooper leads the LAEDC Institute for Applied Economics. Her work involves research in regional issues such as economic impact studies, regional industry analysis and forecasts, workforce development analysis and policy studies.

Prior to joining the LAEDC, Dr. Cooper was co-founder of a start-up in Hong Kong concentrating on equity transactions and computer accessories manufacturing, expanding production into China and distributing products globally. She was co-founder of the first authorized Apple Computer retailer in China. She has been a lecturer at California State University, Long Beach and at the Pepperdine Graziadio School of Business and Management.

Dr. Cooper earned a Bachelor of Arts in Economics from Carleton University in Ottawa, Canada, and a Ph.D. in Economics from the University of Southern California.

Shannon M. Sedgwick *Economist*

In her current capacity as an Economist at the LAEDC, Ms. Sedgwick develops subject-specific information and data interpretation for economic impact, demographic, transportation and industry studies. Her work focuses on demographics, industry clusters and occupational analysis.

Before joining the LAEDC, Ms. Sedgwick managed an industrial and steel supply company located in the Inland Empire. There she identified and targeted a diverse customer base, and analyzed product and customer patterns in the local industrial market to successfully increase revenues.

A Southern California native, Ms. Sedgwick received her Bachelor of Arts in Economics from the University of Southern California (USC) with a minor in Architecture.

Somjita Mitra, Ph.D. *Senior Economist*

Somjita Mitra joined the LAEDC Institute for Applied Economics as an Economist in June 2013. She is involved in planning, designing and conducting research and analysis.

Her focus is in regional analysis, economic impact studies and the industrial and occupational structure of local economies.

Before joining the LAEDC, Dr. Mitra was an economist for a litigation consulting company evaluating economic damages, identifying key economic issues and developing necessary analytical and empirical frameworks.

Dr. Mitra received her Bachelor of Arts in Economics and Political Science from the University of California, Los Angeles and her Master of Arts in Politics, Economics and Business as well as her Ph.D. in Economics from Claremont Graduate University.

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