

CHAPTER 5 MANUFACTURING



This chapter provides an overview of the contribution of the manufacturing sector to the economy and the use of transportation by the sector. The manufacturing sector consists of establishments engaging in the mechanical, physical, or chemical transformation of materials, substance, or components into new products. Establishments performing these activities typically are plants, factories, or mills.¹

In absolute dollars, the sector uses the third largest amount of transportation services. Per dollar of output, the manufacturing sector requires slightly more transportation services than most other sectors. The sector relies heavily on truck transportation services, shipping the most tons and largest value of product by truck, and employing more in motor vehicle occupations than any other transportation occupation. The sector uses slightly more for-hire truck transportation services than in-house truck operations.

Table 5-1 Overview of the Manufacturing Sector's Contribution to Gross Domestic Product (GDP) and Use of Transportation

Manufacturing	Value	Year (latest year data is available)
Contribution to GDP	\$2,097.7 billion	2014
Use of transportation	\$212.5 billion	2012
Amount of transportation required to produce a dollar of output	3.7¢	2012
Number of transportation and material moving workers	967,080	2014
Median annual wage of transportation and material moving workers	29,670	2014
Transportation and material moving workers as percent of sector's work force	8.0%	2014
Number of trucks used	783 thousand	2002*
Truck miles accumulated	15,385 million	2002*
Shipments made by manufacturing industry		2012
Value	\$5.7 trillion	2012
Tons	4.2 trillion	2012
Ton-miles	1.3 trillion	2012
Average miles per shipment	713	2012

NOTE: Table presents latest data available, as of Feb. 1, 2016.

*Data on number of trucks and truck miles accumulated was last collected in the Vehicle Inventory and Use Survey for 2002.

SOURCE: Data for this table is drawn from figures and tables presented throughout this chapter.

¹ U.S. Department of Labor, Bureau of Labor Statistics, Industries at a Glance, www.bls.gov/iag/tgs/iag_index_naics.htm, as of Sept. 1, 2015

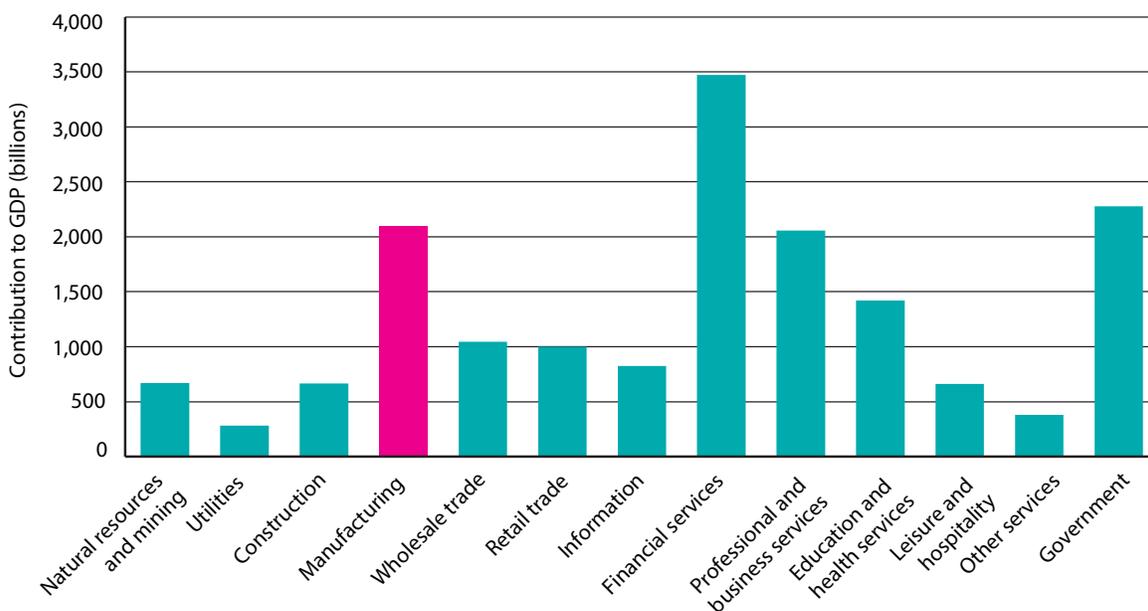
In 2014 the manufacturing sector was the third largest contributor to the national economy next to the financial services sector (the largest contributor) and the government second (the second largest contributor). The manufacturing sector contributed \$2,097.7 billion (12.1 percent) to the national economy, as measured by Gross Domestic Product (GDP) (figure 5-1). The manufacturing sector contributes to the economy by combining raw materials (many produced by other sectors) to make finished products. The manufacturing sector, for example, makes bread from the wheat that the natural resources and mining sector produces.

The upper mid-west (Illinois, Ohio, Indiana, and Michigan), known for manufacturing, contributed significantly to national manufacturing activity in 2014. The largest amount of manufacturing activity, however, occurred in California (\$255.6 billion), followed by Texas (\$239.1 billion), Illinois

(\$98.9 billion), North Carolina (\$98.6 billion), Ohio (\$98.3 billion), Indiana (\$94.1 billion), and Michigan (\$89.5 billion) – each of which accounted for four percent or more of national activity in the manufacturing sector (figure 5-2, table 5-2).

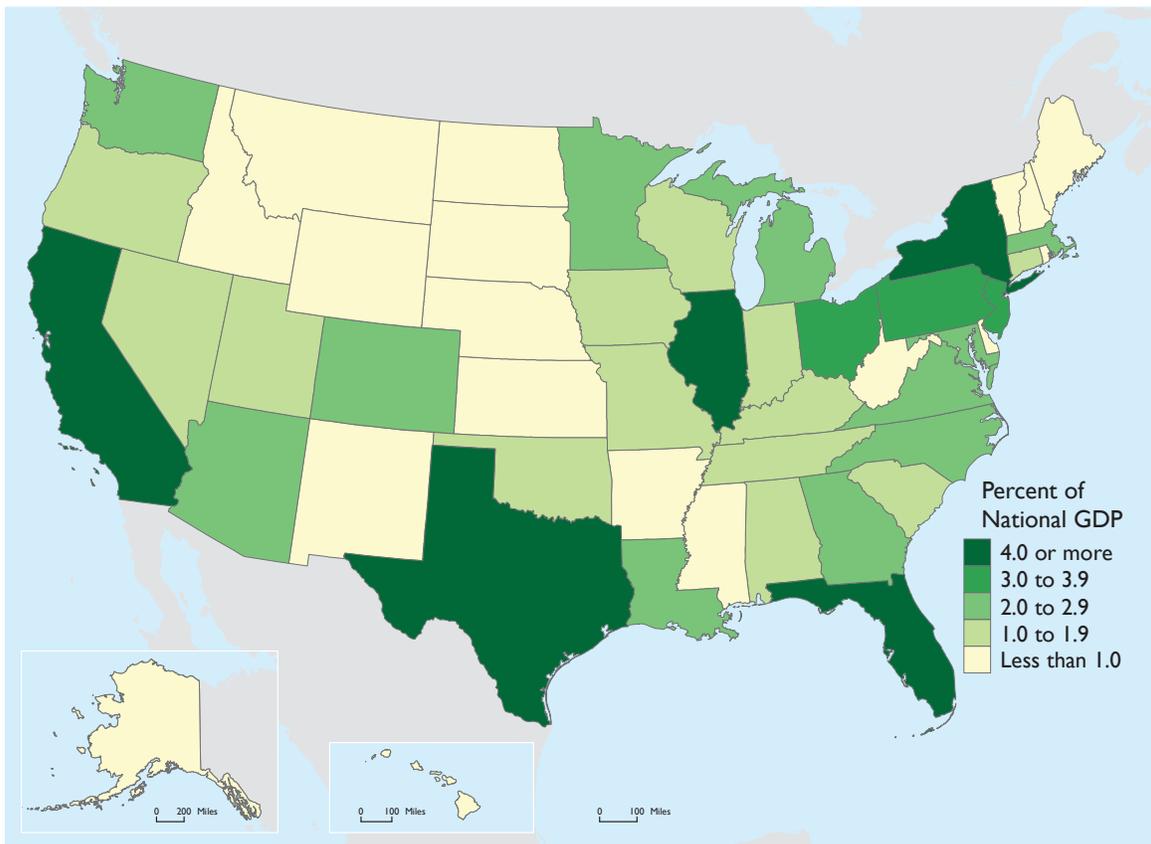
Computing the percent of manufacturing sector activity as a percent of a Gross State Product (GSP), rather than as a share of GDP, also provides useful insights to U.S. production. Nationally, California, Texas, and Illinois produced the most manufactured products in 2014. However, manufacturing activity accounted for only a modest share of economic activity (15.0 percent or less), as measured by GSP, within California, Texas, and Illinois. In contrast, manufacturing accounted for a relatively large share of GSP in Indiana (29.6 percent), Oregon (26.3 percent), Louisiana (21.3 percent), North Carolina (20.5 percent), and Michigan (20.0 percent). (see Appendix A)

Figure 5-1 Manufacturing Sector’s Contribution to Gross Domestic Product, 2014



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product by State, available at <http://bea.gov> as of November 2015.

Figure 5-2 State Contributions to Manufacturing Related GDP (percent of national GDP related to manufacturing), 2014



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product by State, available at <http://bea.gov> as of November 2015.

Table 5-2 States Contributing 4.0 Percent or More to National GDP Related to Manufacturing in 2014

State	Manufacturing (Manufacturing related GDP = \$2,097.7 billion)			All products and services (Total National GDP = \$17.2 trillion)	
	Manufacturing related GDP (billions)	Percent of national GDP related to manufacturing	Rank (1=contributes most to national GDP related to manufacturing, 51=least)	Dollar contribution to national GDP (billions)	Rank (1=contributes most to national GDP, 51=least)
California	255.6	12.2	1	2,305.9	1
Texas	239.1	11.4	2	1,641.0	2
Illinois	98.9	4.7	3	736.3	5
North Carolina	98.6	4.7	4	481.9	9
Ohio	98.3	4.7	5	576.1	7
Indiana	94.1	4.5	6	318.1	16
Michigan	89.5	4.3	7	448.2	13

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product by State, available at <http://bea.gov> as of November 2015.

The manufacturing sector was the third largest user of transportation services in 2012 (\$212.5 billion). The manufacturing sector relies heavily on for-hire transportation services – using more for-hire air, rail, truck, and water transportation services (\$122.5 billion) than in-house transportation operations (\$69.7 billion) (figure 5-3).

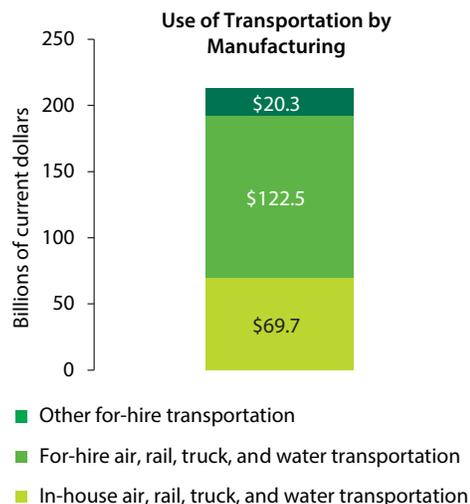
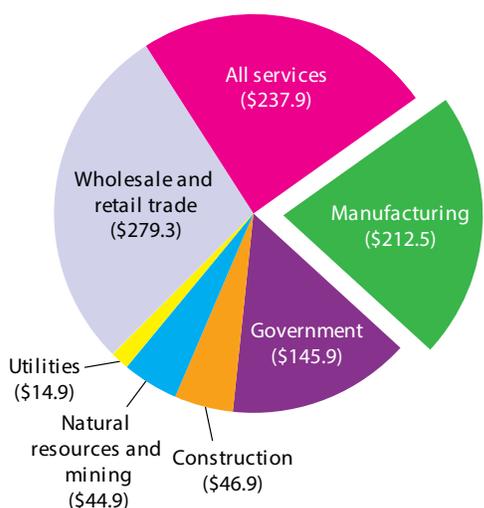
The manufacturing sector used \$212.5 billion of transportation services in 2012 (figure 5-3). In 2012 the sector used:

- primarily truck transportation services (e.g., used to haul raw materials like wood and cotton to manufacturing plants), which

accounted for 65.5 percent (\$139,114 million) of all transportation services used by the sector.

- slightly more for-hire truck transportation services (\$73,085 million) than in-house truck transportation operations (\$66,029 million).
- air, rail, and water transportation services (e.g., for hauling coal to steel forgeries) summing to 25.0 percent (\$53,074 million) of all the transportation services used by the sector. Nearly all air, rail, and water transportation services used were for-hire (23.3 percent, or \$49,427 million).

Figure 5-3 Use of Transportation by the Manufacturing Sector, 2012 (current dollars, billions)



NOTE: In-house transportation consists of transportation services (air, rail, truck, and water) provided by nontransportation industries for their own use. For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee-basis. Airlines, railroads, transit agencies, common carrier trucking companies, and pipelines are examples of for-hire transportation industries. "Other" for-hire transportation includes: transit and passenger ground transportation (excluding State and local government passenger transit); pipeline; sightseeing transportation and transportation support; parcel delivery, courier, and messenger services (excluding U.S. Postal Service); warehousing and storage; and other transportation and support activities.

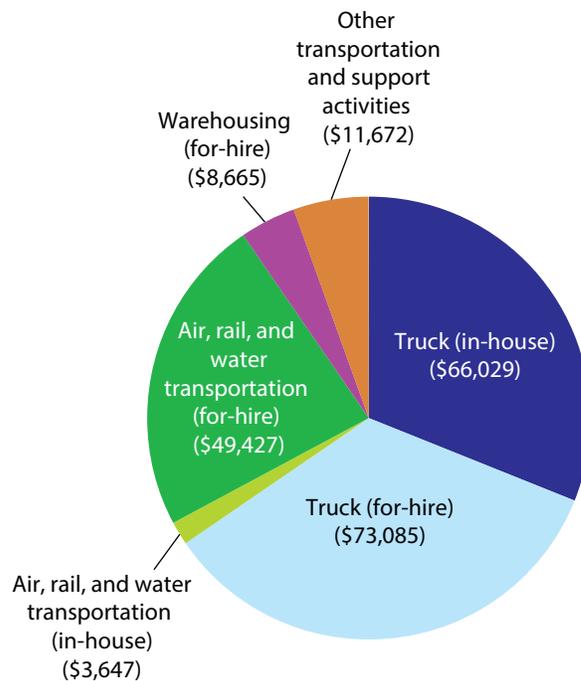
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at <http://www.bts.gov> as of March 2016.

- other transportation (pipeline transportation, passenger and ground transportation, and transportation support activities such as freight loading) totaling 5.5 percent (\$11,672) of all transportation services used by the sector (figure 5-4).

The manufacturing sector required marginally more transportation services in producing output than the average sector, albeit substantially less transportation services than the sector depending the most on transportation in 2012.

In 2012 the manufacturing sector required 3.7¢ worth of transportation services to produce one dollar of output, while the most dependent sector (wholesale and retail trade) required 10.2¢ worth of transportation services to produce one dollar of output. The manufacturing sector relied more on for-hire transportation services than in-house transportation operations, requiring 2.5¢ worth of for-hire transportation services to produce one dollar of output and 1.2¢ worth of in-house transportation operations to produce one dollar of output (figure 5-5).

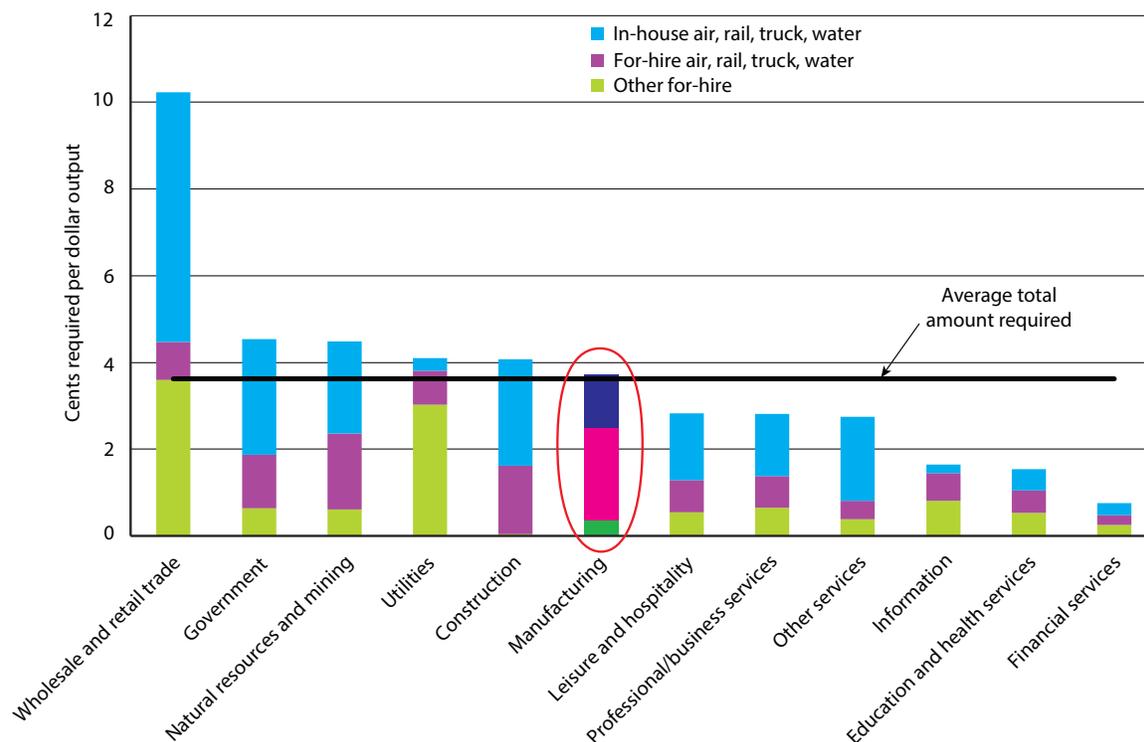
Figure 5-4 Manufacturing Sector's Use of Transportation by Mode, 2012 (current dollars, millions)



NOTE: In-house transportation consists of transportation services (air, rail, truck, and water) provided by nontransportation industries for their own use. For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee-basis. Airlines, railroads, transit agencies, common carrier trucking companies, and pipelines are examples of for-hire transportation industries. "Other" for-hire transportation includes: transit and passenger ground transportation (excluding State and local government transit); pipeline; sightseeing transportation and transportation support; parcel delivery, courier, and messenger services (excluding U.S. Postal Service); and other transportation and support activities.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at <http://www.bts.gov> as of March 2016.

Figure 5-5 Transportation Required Per Dollar of Output by the Manufacturing Sector, 2012



NOTE: In-house transportation consists of transportation services (air, rail, truck, and water) provided by nontransportation industries for their own use. For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee-basis. Airlines, railroads, transit agencies, common carrier trucking companies, and pipelines are examples of for-hire transportation industries. "Other" for-hire transportation includes: transit and passenger ground transportation (excluding State and local government transit); pipeline; sightseeing transportation and transportation support; parcel delivery, courier, and messenger services (excluding U.S. Postal Service); warehousing and storage; and other transportation and support activities.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at <http://www.bts.gov> as of March 2016.

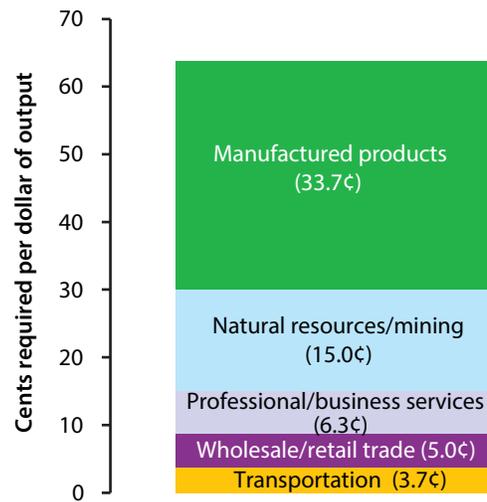
The overall transportation requirement for the manufacturing sector (3.7¢) is relatively modest compared to other inputs. In 2012, transportation services were the fifth most important input, while manufactured products (e.g., nails, screws, etc.) were the most important input. The manufacturing sector requiring 33.7¢ worth of manufactured products to produce one dollar of output (figure 5-6).

In 2014 the manufacturing sector employed nearly one million transportation and material

moving workers, accounting for 8.0 percent of its entire work force. The sector employed more material moving workers (730,530) than transportation workers (about 236,550)² (figure 5-7). Transportation workers include motor vehicle operators, ship engineers, aircraft pilots and flight engineers, etc. Material moving workers support transportation activities and include occupations such as cleaners of vehicles and ship loaders.

² Total for transportation occupations includes supervisors of material moving workers, which could not be separated from supervisors of transportation workers.

Figure 5-6 Top 5 Most Required Inputs by the Manufacturing Sector to Produce a Dollar of Output, 2012



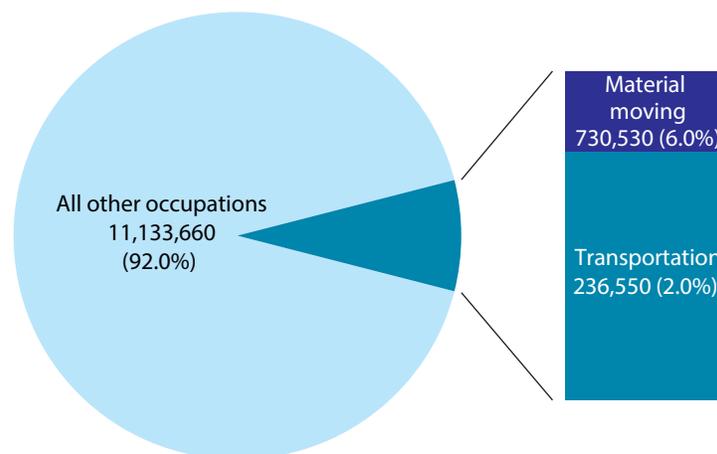
Production inputs (top 5 most required)

NOTE: Transportation includes in-house and for-hire transportation.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at <http://www.bts.gov> as of March 2016.

Figure 5-7 Number of Workers Employed in the Manufacturing Sector by Occupation, 2014

Manufacturing occupations
Total work force = 12,100,740



NOTE: Total for transportation occupations includes supervisors of material moving workers, which could not be separated from supervisors of transportation workers.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment and Wages, available at <http://www.bls.gov/oes> as of Nov. 23, 2015.

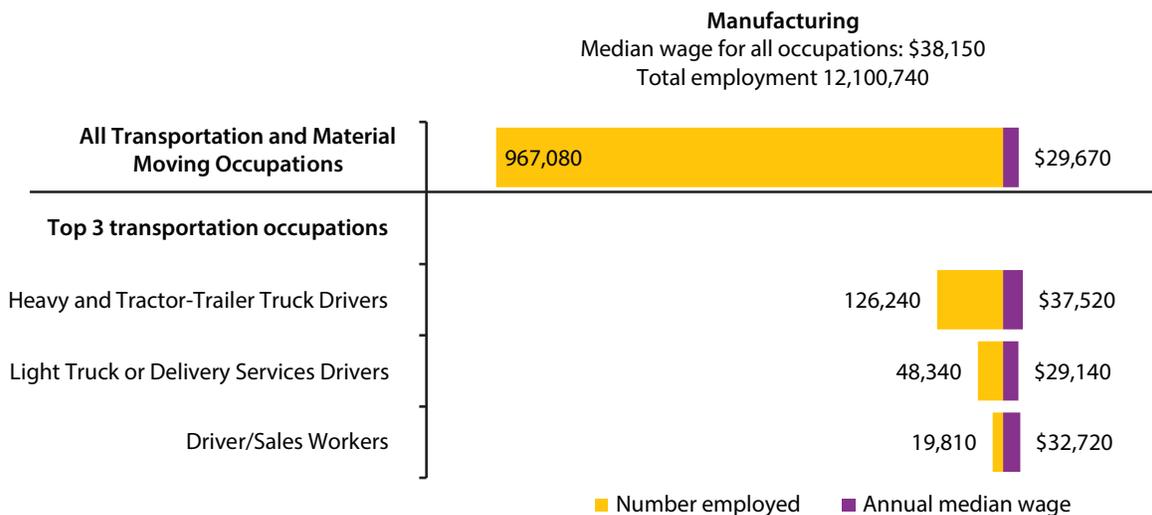
Transportation and material moving workers in the manufacturing sector earned a median wage of \$29,670 in 2014, while workers of all occupations in the manufacturing sector earned a higher median wage (\$38,150) (figure 5-8).

The manufacturing sector employed the largest number of transportation workers as heavy and tractor-trailer truck drivers (126,240), followed by light truck or delivery services drivers (48,340) and driver/sales workers (19,810). Heavy and tractor-trailer truck drivers earned the highest median wage (\$37,520) among these three types of motor

vehicle operators but earned slightly less than the sector median wage. Driver/sales workers earned a median wage of \$32,720, while light truck or delivery services drivers earned a lower median wage (\$29,140) (figure 5-8).

The 2002 Vehicle Inventory and Use Survey (VIUS) is the most recent survey of vehicle ownership and use by industry. According to the 2002 VIUS, the manufacturing industry operated, at 0.8 million, fewer trucks than most other industries and accumulated fewer miles (15.4 billion) (figure 5-9).

Figure 5-8 Median Annual Wage and Employment for Most Common Transportation Occupations (top 3) in Manufacturing Sector, 2014



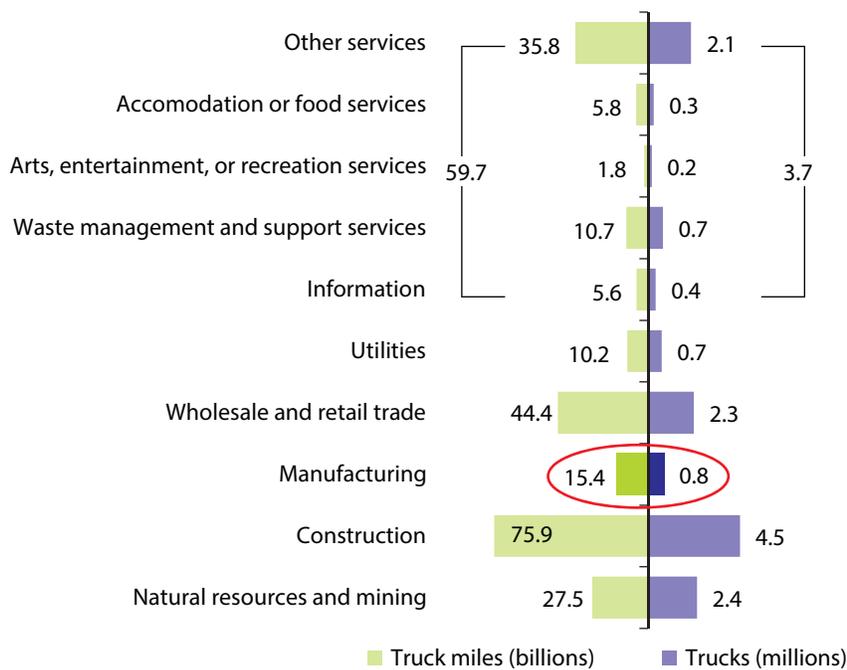
NOTE: Top three transportation occupations are the transportation occupations employing the largest number of workers and are selected from detailed occupation group in Bureau of Labor Statistics Occupational Employment and Wages table. The top three transportation occupations in the manufacturing sector are: heavy and tractor-trailer truck drivers; light truck or delivery services drivers; and driver/sales workers.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment and Wages, available at <http://www.bls.gov/oes> as of Nov. 23, 2015.

The 2012 Commodity Flow Survey shows that the manufacturing industry shipped 4.2 trillion tons of raw materials and finished goods domestically, valued at \$5.7 trillion, and accounting for 1.3 trillion ton-miles. Trucking was the dominant mode. Trucks carried 67.5 percent of the tonnage shipped by the manufacturing industry, 66.9

percent of the value, and accounted for 54.2 percent of ton-miles. The manufacturing industry, however, tended to use modes other than truck to ship goods long distances. The average shipment distance was shorter by truck (399 miles per shipment) than by all other modes, and longest by air (1,276 miles per shipment) (figure 5-10).

Figure 5-9 Trucks Used and Truck Miles Accumulated for Business by the Manufacturing Industry, 2002

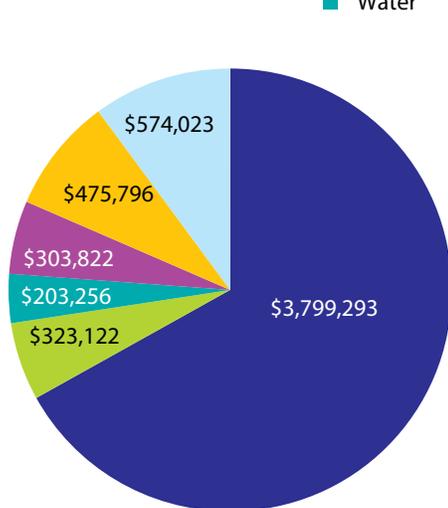


NOTE: Totals for trucks in use only.

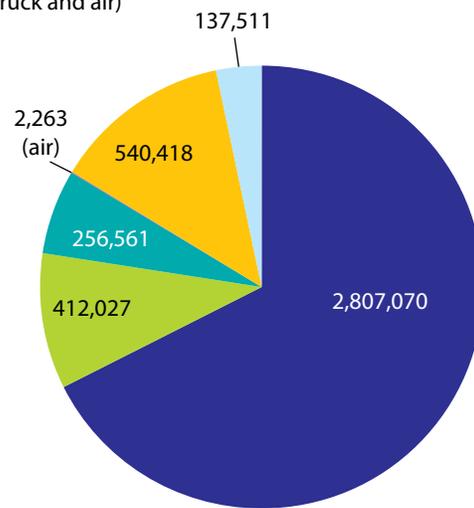
SOURCE: U.S. Census Bureau, 2002 Economic Census Vehicle Inventory and Use Survey, Table 2a, available at <https://www.census.gov/prod/ec02/ec02tv-us.pdf> as of August 2012.

Figure 5-10 Characteristics for Shipments Made by the Manufacturing Sector by Mode of Transportation, 2012

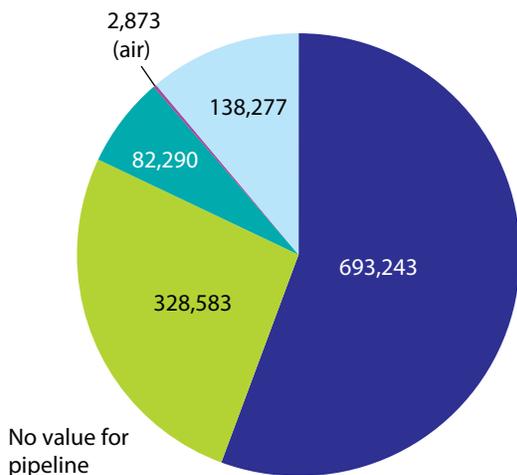
- Truck
- Pipeline
- Rail
- Multiple modes
- Water
- Air (incl truck and air)



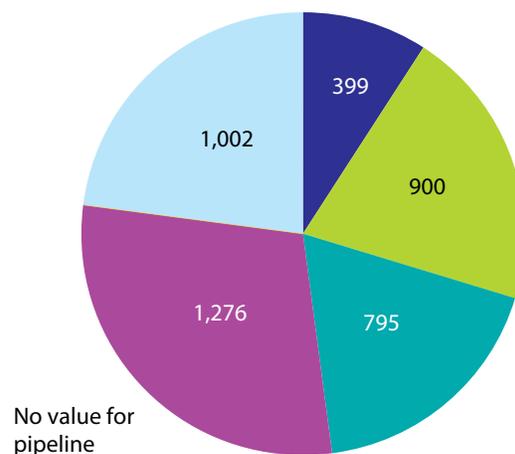
Value of shipments (millions of dollars)
total value of shipments = \$5.7 trillion



Tons (thousands)
total tons shipped = 4.2 billion



Ton-miles (millions)
total ton-miles = 1.3 trillion



Average miles per shipment
average miles per shipment = 713

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Commodity Flow Survey 2012, available at www.bts.gov as of October 2015