

2016 Top Markets Report **Semiconductors and Semiconductor Manufacturing Equipment**

Overview and Key Findings

Introduction

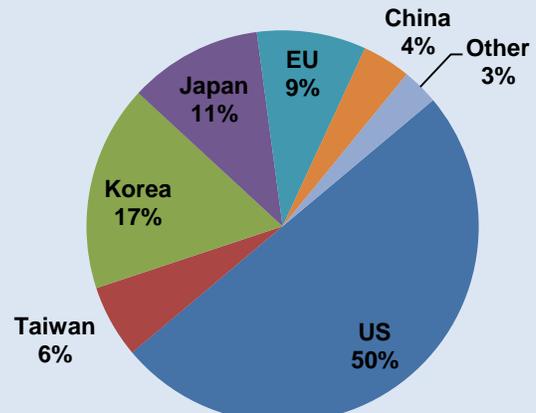
The U.S. semiconductor industry is the leading provider of semiconductors to the world with a majority of global market share. U.S. companies also lead in the semiconductor manufacturing equipment sector, accounting for 47 percent share of the world market. Over 80 percent of U.S. semiconductor sales do not take place in the U.S., and 84 percent of U.S. semiconductor manufacturing equipment sales take place outside of the United States. In order to compete in this industry most semiconductor and semiconductor manufacturing equipment companies must export.

Industry Overview and Competitiveness

After increasing 9.9 percent in 2014 to a record \$335.8 billion, global semiconductor sales fell slightly in 2015 to \$335.2 billion.¹ Much of the dip in the value of sales was due to exchange rate factors. According to IC Insights, sales by the top 20 semiconductor companies for 2015 would have risen 4 percent instead of remaining flat if exchange rates had remained constant.² World Semiconductor Trade Statistics (WSTS) predicts growth for 2016 at 1.4 percent and 2017 at 3.1 percent.³ Five of the top ten and eight of the top 20 semiconductor companies (including foundries) are U.S. firms.⁴

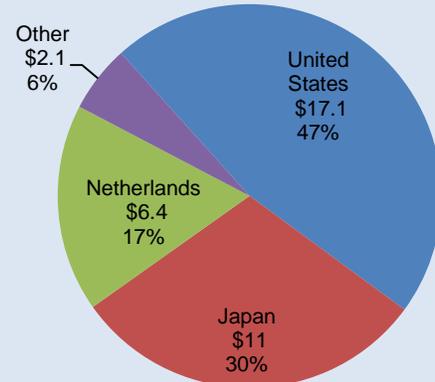
The U.S. is the leader in the semiconductor manufacturing equipment industry, with 47 percent of the world market. Along with Japan and the Netherlands, these top three countries control over 90 percent of the \$37 billion global market. Although there was a slight downturn in the industry in 2015 when the market is calculated in dollars, if

Figure 1: Global Market Share of Semiconductor Production, 2015



Source: SIA/World Semiconductor Trade Statistics (WSTS)/IHS/PwC/IC Insights
Share based on headquarters of seller: Foundry output not included, fables included.

Figure 2: Global Market Share of Semiconductor Manufacturing Equipment Production, 2015, Billions



Source: SEMI, SEAJ, Netherlands: ASML, ASMI Press Releases

exchange rates had remained constant, sales would have risen, and sales did rise on a unit basis. In 2016, the market is expected to enter a cyclical upturn that will continue into 2017. The U.S. market is only approximately 15 percent of semiconductor manufacturing equipment sales; thus U.S. companies need to export. Over 90 percent of global semiconductor manufacturing equipment sales outside the United States take place in five markets: China, Taiwan, Japan, Korea (South) and the EU, creating a very concentrated market.

Key Findings: Top Markets and Methodology

The Department of Commerce’s International Trade Administration (ITA) has identified five markets as top markets for both semiconductor and semiconductor manufacturing equipment. These markets are subjects of in-depth country case studies: China, the European Union (EU), Japan, Korea and Taiwan. These markets, plus the U.S. domestic market, represent nearly 70 percent of the world semiconductor market⁵ and over 90 percent of the world semiconductor manufacturing equipment market.⁶ In 2016, ITA’s analysis expands beyond Germany and identifies the entire European Union (EU) as a top market as there are opportunities in other European countries.

Moving beyond these top five markets, information on key Southeast Asian countries and other markets of note are included in the sector snapshots on the semiconductor and semiconductor manufacturing equipment subsectors, respectively. Country rankings by industry subsector are located in Appendix 2.

Semiconductors

Top markets for U.S. semiconductor sales include China, the EU, Japan and Korea. All of these markets exhibit vast amounts of electronics production. China has been called the “factory of the world” in terms of electronics, and its population has an increasing appetite for smartphones and consumer electronics. Japan has plenty of consumer electronics production as well as a very large automobile manufacturing sector. The EU is strong in automotive, instrumentation and communications equipment production. Korea is a powerhouse in consumer electronics manufacturing and has a vibrant automobile manufacturing industry. According to WSTS statistics, China was the only region that experienced sales growth in semiconductors (as measured in U.S. dollars) for 2015 (partially due to exchange rate issues).⁷

Semiconductor Manufacturing Equipment

According to Semiconductor Equipment and Materials International (SEMI), five regional markets account for 84 percent of worldwide sales of semiconductor manufacturing equipment: Taiwan, Korea, China, Japan and the United States. This creates a very concentrated market. Europe and the Middle East represent another 9 percent, and other markets (primarily in Southeast Asia) account for the remaining 7 percent of the world market.⁸

Methodology

The purpose of this methodology is to calculate the ranking of export markets for U.S. semiconductors and semiconductor manufacturing equipment for

Figure 3: Top Exports Markets for 2016

Semiconductors		Semiconductor Manufacturing Equipment	
Rank	Country	Rank	Country
1	China	1	Taiwan
2	European Union	2	Korea
3	Japan	3	China
4	Korea	4	European Union
5	Singapore	5	Japan
6	Taiwan	6	Singapore
7	Malaysia	7	Malaysia
8	Mexico	8	Israel
9	Thailand	9	Mexico
10	Vietnam	10	Philippines

Figure 5: Methodology for Ranking Markets Semiconductors



Semiconductor Manufacturing Equipment



2016 and to project exports in the future. This is relatively straightforward for semiconductor manufacturing equipment. It was difficult in the case of semiconductors, however, due to overseas packaging and final assembly of semiconductors and transshipments skewing the import and export data.

Last year, the most quoted source of regional market data for semiconductors, World Semiconductor Trade Statistics (WSTS), published data for the Chinese market, in addition to its country data for Japan. This has improved the methodology for semiconductors, as the WSTS data is used in this year’s calculation. To project the size of each country’s potential export market for U.S. companies, ITA used the formulas described in Figures 5.

Global Competitive Landscape

China

China, over the last 10 years, has been one of the largest and fastest growing country markets for U.S. semiconductors and semiconductor manufacturing equipment and will continue in the near-term. Headwinds brought on by slowing global demand for ICT products, slowing transitions to smaller integrated circuit production nodes and a strong dollar will be complicated further by China’s opaque policies and unprecedented, massive, state-led investment to develop an indigenous semiconductor industry. China’s policies cause medium and long-term uncertainties for U.S. industry prospects in the Chinese market.

European Union

The case study for Germany is replaced this year with an EU case study, as it makes sense to look at the entire market when selling into the EU. The EU is the second largest market for semiconductors, and the EU is expected to be the fastest growing market for semiconductor manufacturing equipment in 2016. As a participant in the World Trade Organization Information Technology Agreement (WTO ITA), most types of semiconductors and semiconductor manufacturing equipment enter EU Member States duty-free, and wider product coverage came with the WTO ITA expansion that was agreed upon in December 2015.

Japan

Japan is both an important market and competitor for U.S. semiconductor and semiconductor manufacturing equipment companies. Japan is a participant in the WTO ITA, and will eliminate tariffs on all products under the WTO ITA expansion on the implementation date – July 1, 2016. Japan hosts the very successful trade show for semiconductor manufacturing equipment and materials – and increasingly semiconductor-related electronics – SEMICON Japan, which will be a U.S. Department of Commerce certified trade show for the third year in a row.

Korea

Korea is the fourth largest export market for semiconductors and the second largest export market for semiconductor manufacturing equipment. Korea is a participant in the WTO ITA; thus, most types of semiconductors and

semiconductor manufacturing equipment enter the country duty-free, and any remaining types are covered under the U.S.-Korea Free Trade Agreement and the WTO ITA expansion.

Taiwan

Taiwan is the top market for semiconductor manufacturing equipment, and the sixth largest U.S. export market for semiconductors. Taiwanese companies are major manufacturers of electronic equipment. While final product assembly often takes place across the straits in Mainland China and U.S. semiconductor export sales are mainly attributed to that market, both design and buying decisions for the semiconductors in electronic equipment often take place in Taiwan. As a participant in the WTO ITA and the WTO ITA expansion, Taiwan has no significant tariff or non-tariff barriers to U.S. exports. Taiwan's leading position in the semiconductor foundry sector necessitates purchase of state-of-the-art semiconductor manufacturing equipment.

Challenges and Barriers

Although the U.S. leads in these sectors, there are competitors, primarily from China, the EU, Japan, Korea and Taiwan, for semiconductors, and Japan and the Netherlands for semiconductor manufacturing equipment.

China's IC Industry Development Policies

The U.S. semiconductor industry and global semiconductor value-chain faces a challenge from the Chinese government's highly orchestrated and well-funded program to develop an independent domestic semiconductor industry supply chain. China's government is investing upwards of \$150 billion into the industry over the next decade through what is dubbed the "National IC Fund".⁹ These policies, as mentioned earlier, cause medium and long-term uncertainties for the U.S. industry prospects in the Chinese market. See the China Case Study for details.

Counterfeits

According to the Semiconductor Industry Association (SIA), counterfeit semiconductors cost the U.S. semiconductor industry an estimated \$7.5 billion per year, which translates into nearly 11,000 lost American jobs.¹⁰ Counterfeit semiconductors pose

serious risks to global supply chains, public health and safety, and civilian and military infrastructure. They are a growing problem for the United States and many other countries, despite gradual improvements in IPR enforcement around the world. Often harvested from electronic waste (e-waste), most counterfeit semiconductors are e-waste components re-marked to indicate that they are new or that they perform to a higher standard. These counterfeits are assembled inside supposedly new electronic equipment. Due to age, mishandling or unsuitability to the task, these counterfeits can prematurely fail or simply not function as expected. This is especially dangerous when they are assembled into navigational, detection, testing or monitoring electronics and similar products, as the buyer may not have any warning that the product is not functioning properly. Many of these counterfeit semiconductors originate from China. Protection and enforcement of IPR and trade secrets are priority issues for both the semiconductor and semiconductor manufacturing equipment industries.

Opportunities

WTO Information Technology Agreement Expansion

In December 2015, the United States and over 50 developed and developing country partners at the World Trade Organization announced a landmark expansion of the Information Technology Agreement, which will phase out hundreds of tariffs on U.S. information technology exports all over the world. The expanded agreement will eliminate tariffs on technologies developed since the initial Agreement was signed in the late 1990s as well as broader applications of information and communication technologies (ICT).

The expansion of the Agreement covers a list of 201 product categories, which the WTO estimates to be worth \$1.3 trillion in global exports per year (about 10 percent of total global trade). The United States exports \$180 billion in these products each year. The agreement includes semiconductors, semiconductor manufacturing equipment, and semiconductor related products. See Appendix 1 and country case studies for details.

Semiconductors

Current growth in electronics production is the main driver of the global semiconductor industry. Growing

demand for smartphones, tablets, digital televisions, wireless communications infrastructure, network hardware, computers and electro-medical devices is stimulating global demand of semiconductors, but the overall annual growth is expected to slow to 3.5 percent.¹¹ The Internet of Things (IoT) – aka, internet connected devices – is in its infancy but will contribute significantly to semiconductor demand over the long term, as will the development of smart grids and Smart Cities and automated smart manufacturing.

Semiconductor Manufacturing Equipment

Projections of sales of fab equipment show 13.2 percent growth in the world market from 2016 to 2017 (to an estimated \$42.8 billion), to be driven by equipment for foundries, and for memory (NAND and DRAM) and power semiconductor manufacturing.¹² China is expected to start or complete ten new semiconductor manufacturing facilities (fabs) in 2016 to 2017, outstripping planned facilities in the U.S., Taiwan and Southeast Asia, with two new fabs each; and Japan, Korea, and Europe and the Middle East, with one each. All of these facilities, should construction proceed, will need equipping in the late 2016 to 2018 time-period.¹³

¹ WSTS World Semiconductor Trade Statistics

² "Five Top-20 Companies Forecast to Show Double Digit Growth this year" [Research Bulletin IC Insights](#) 11/10/2015.

³ WSTS Semiconductor Market Forecast Autumn 2015 Press Release December 1, 2015.

⁴ "Five Top-20 Companies Forecast to Show Double-Digit Growth This Year" [IC Insights Research Bulletin](#) 11/10/2015.

⁵ WSTS data and analyst estimates.

⁶ SEMI Worldwide Semiconductor Equipment Statistics, 2/2015 (subscription) United States is North America

⁷ "Global Semiconductor Sales Top \$335 Billion in 2015" Feb 1, 2016, SIA Press Release.

⁸ SEMI Worldwide Semiconductor Equipment Statistics, 2/2015 (subscription) United States is North America

⁹ "From Catching Up to Forging Ahead" Dieter Ernst, East-West Center

¹⁰ Oral Testimony of SIA President Brian Toohey during the Senate Armed Services Committee Hearing on Counterfeit Electronic Parts in the Department of Defense's Supply Chain, November 8, 2011.

¹¹ "Global Semiconductor Market Slumps in 2015, IHS Says", [IHS.com](#) 4/4/2016.

¹² "Highlights of the February 2016 Edition of the Fab Databases", 3/16/2016.

¹³ "Equipment Spending Up: 19 New Fabs and Lines to Start Construction" [SEMI](#), 6/9/2016.