



INTERNATIONAL
TRADE
ADMINISTRATION

2016 Top Markets Report **Industrial Automation**

A Market Assessment Tool for U.S. Exporters

April 2016



Industry & Analysis' (I&A) staff of industry, trade and economic analysts devise and implement international trade, investment, and export promotion strategies that strengthen the global competitiveness of U.S. industries. These initiatives unlock export, and investment opportunities for U.S. businesses by combining in-depth quantitative and qualitative analysis with ITA's industry relationships.

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Executive Summary

The United States is a major global producer of industrial automation equipment, broadly defined as the hardware and components used to automate systems in manufacturing or industrial settings. With nearly \$10.5 billion worth of exported equipment in 2015, the United States remains a competitive top-tier supplier to global markets.

Despite a slight decrease overall from 2014 to 2015, the next two years will likely see increases in U.S. industrial automation exports. This is largely a result of the growing global market for automation equipment, for which the United States is a top-tier supplier. The industrial automation market is driven by the need to reduce operational costs and improve productivity. While the recession of 2008 has largely passed, the deep impression left by the global credit crunch will continue to drive companies to streamline processes and automate production. This in turn will drive demand for industrial automation products in the short term.

In the medium to long-term, demand for automation equipment will only continue to grow as companies derive more and more value from cost-cutting and labor-reduction. As sensor technologies improve and the ability to harness and analyze big data becomes more viable in real time, the limits of operational efficiency in manufacturing, processing, material handling and logistics industries will continue to be pushed.

U.S. exports will continue to increase largely because of sales to NAFTA partner Mexico. Sales to Canada will continue to be high in volume, but they will likely face headwinds on the account of several factors. In the European market, Germany and the United Kingdom will remain key partners, with growth opportunities coming from the Netherlands and the smaller economies of Ireland and Poland. China will remain a major destination for U.S. equipment in Asia, though to a lesser extent owing to the onset of an economic slowdown. Growth opportunities will be present in Japan and Singapore and the smaller economies of Thailand and Malaysia. In South America, Brazil is the largest market for automation equipment, but recent economic and political challenges may hamper growth in the short term.

This ITA *Top Markets* report attempts to provide guidance to companies and U.S. government trade agencies by assessing and ranking foreign markets based on export potential. Based on trade data and global industrial indices, along with market intelligence from U.S. Foreign Commercial Service Officers, our rankings represent the best current understanding of market opportunities. The report also provides exporters with detailed assessments of selected markets by providing five country case-studies: Brazil, Canada, Mexico, Germany and Singapore.

Figure 1: Projected Top Markets for 2016-2017

1	Mexico	8	South Korea	15	Thailand	22	Peru	29	Venezuela
2	Canada	9	Netherlands	16	Ireland	23	Australia	30	Chile
3	Germany	10	Vietnam	17	Colombia	24	France	31	UAE
4	China	11	United Kingdom	18	Norway	25	Switzerland	32	Israel
5	Poland	12	Brazil	19	India	26	Belgium	33	South Africa
6	Japan	13	Saudi Arabia	20	Italy	27	Argentina	34	Malaysia
7	Singapore	14	Taiwan	21	Russia	28	Spain	35	Hong Kong

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Overview & Key Findings

Introduction

The United States is a major global producer of industrial automation equipment. In 2015, U.S. companies exported nearly \$10.5 billion worth of products to foreign markets. This was down from nearly \$10.7 billion in 2014, representing the first decrease in annual exports since the 2008 recession. Most of these sales went to highly developed markets with deeply embedded industrial bases and robust public infrastructure. As will be illustrated, however, demand for automation equipment is also growing in developing markets, which are more geared toward commodity production and lesser-valued outputs.

2015 has seen a number of high level developments that have broadly affected global markets. In the currency markets, the rising strength of the American Dollar created headwinds for many U.S. manufacturers by reducing prices of imported products into the domestic market. At the same time, the strong dollar raised prices of U.S. exports, particularly in the Eurozone and emerging markets like Brazil. In China, the 2nd largest global economy suffered significant slides in the stock market, attributed to signs of slowing growth. The exceedingly low cost of oil also affected many exporting countries across the world. By the end of 2015, however, for the first time since the 2008 recession, the Federal Reserve raised key interest rates as a general show of confidence in the strengthening U.S. economy. The December 2015 unemployment rate declined to 5.0 percent, the lowest in nearly a decade. Going into 2016, the U.S. economy appears poised for growth, even as much of the world struggles.

As global markets face uncertainty, developing an export strategy has become more important than ever for U.S. companies. Businesses looking to increase sales and profit, reduce dependence on the domestic market, and stabilize seasonal fluctuations should consider selling abroad. Nearly 96 percent of consumers live outside the United States, and two-

thirds of the world's purchasing power is located in foreign countries.

Key Findings: Top Markets and Methodology

This ITA *Top Markets* report attempts to assess the global market for automation equipment by analyzing U.S. exports in this sector: what products they are, where they are going, and the dollar value attached to each sale. To establish a priority of foreign markets that offer the best prospects for U.S. producers of industrial automation equipment, four criteria were used:

- total volume of U.S. industrial automation exports in 2015, as measured by U.S. Census Bureau Foreign Trade Division;
- compound annual growth rate (CAGR) of U.S. industrial automation exports between 2009 and 2015, as measured by U.S. Census Bureau Foreign Trade Division;
- most up-to-date ranking (2012) of market by United Nations Industrial Development Organization (UNIDO) "Competitive Industrial Performance Index"; and
- level of growth in industrialization as measured by rate of improvement in 2009 through 2012 UNIDO "Competitive Industrial Performance Index" rankings.

U.S. exports are defined as products originating in the United States, which is an important distinction to make in an increasingly globalized economy. Products that do not meet the minimum threshold of content made in the United States are not taken into account.

In ranking markets, ITA placed the most emphasis on the total volume of exports in 2015. It is presumed that markets with historically high U.S. exports will continue to have high volumes in the future for a variety of reasons. Historic export trends indirectly take into account factors specific to the United States, such as geography, Free Trade Agreements (FTA) and size of market opportunity.

Some may contend that size of the market is the most important factor in global rankings. In other words, the largest markets will present the greatest market opportunities. While valid to an extent, this logic does not take into account the variety of economic, historic and political factors that shape global trade. For example, top-ranked Mexico is not objectively the “largest” global market for industrial automation equipment, a position held definitively by China. Mexico, nonetheless, continues to present unparalleled opportunities for U.S. exporters because of its shared border and lack of tariffs. China, on the other hand, may be the largest importer of industrial automation products in the world, but U.S. exporters must contend more with regional competitors, such as Japan, Korea and Taiwan, which will affect pricing and market entry. Size also does not take into account market access barriers, such as tariffs, or policy prescriptions, such as export controls, which may apply to U.S. exporters. As a result, while the information provided in this report may be of general use to companies across all of industry, its utility is truly intended for U.S. exporters of industrial automation products.

Based on aggregated trade data and global industrial indices, this report ranks global markets based on their export potential. These rankings represent the best current understanding of market opportunities. Paired with on-the-ground market intelligence from U.S. Foreign Commercial Service officers, this report aims to assist exporters in better determining global sales opportunities in their industry.

This *Top Markets Report* will focus on the export forecast for products falling broadly into five categories:

- **Sensors and Instruments** for monitoring and controlling process variables, including temperature, pressure, viscosity, voltage current and more
- **Electric Motors and Actuators** including alternating and direct current motors, servos, electrical, hydraulic, and pneumatic actuators, and more
- **Electrical Relays and Industrial Control** equipment, including electro-mechanical relays, solid state relays, motor control relays, as well

as motor control centers, programmable logic controllers (PLC) and more

- **Material Handling** equipment, specifically conveying and elevating equipment
- **Industrial Robots**, including those used in spot welding, sorting, palletizing, painting and more

This report does not take into consideration exports of services, such as those provided by systems integrators. Nor does it account for software solutions related to automation, such as Product Lifecycle Management (PLM), Enterprise Resource Management (ERM) or others. Trade data derived from services is not readily available or consistent across markets, and therefore, statistics used for automation equipment could be used as a proxy indicator for services exports. If a country is a major recipient of U.S. equipment exports, it will likely have associated trade in related services.

For most of the products in these sectors, their utility lies not in stand-alone application but in integration. A vulcanized rubber conveyor belt on its own may be a commodity, but combined with a servo motor and motion control within a distribution warehouse, it becomes much more. Similarly, a PLC may physically be an inert piece of IT hardware, but after being connected to sensor inputs and control outputs, however, it becomes the central nervous system of a factory floor or food processing plant. It becomes the lynchpin for an automated system, and its success or failure can be extremely consequential.

Top Markets

The top 35 markets ranked in this report are geographically and economically diverse. They account for over 90 percent of all U.S. exports in the industry, with a minimum threshold of \$40 million in annual exports to each market in 2015. While the traditional markets of Western Europe figure prominently, growth in Asia and Latin America has been more widespread and has been strongly taking root. For U.S. exporters, the greatest export opportunities are not only in the largest markets. Many other considerations may be taken into account, including geographic and cultural proximity, ease of doing business, tariffs and market access, technical barriers to trade, and more. By ranking

markets based on aggregate trade flows, this report helps to account for these considerations while offering further detailed information in the five country case studies.

The five country case studies selected for further reference are chosen to illustrate a variety of points. Robust sales to Canada and Mexico, for example, are highly dependent on geographic proximity and ease of market access through the North American Free Trade Agreement (NAFTA), which is now in its 21st year of existence. Across the Pacific, Singapore is one of the most highly developed industrial economies in the world and is a major consumer of U.S. automation equipment. As a free-trade partner, market access is wide open, and sales are expected through the future. In Brazil, a number of headwinds that include tariffs and a slowing economy will challenge export growth in the short term. Finally Germany, the largest European market and top-ranked by United Nations industrial indices, is seen as one of the most regulated but rewarding destinations to do business. Entering the German market is often seen as key to entering Europe as a whole. With automation and connectivity at the core of the Industrie 4.0 initiative to improve manufacturing productivity, Germany is an important market for U.S. exporters. While these five countries are specifically highlighted, the U.S. Foreign Commercial Service maintains a presence in all of the top markets ranked in this report.ⁱ

Policymakers should appreciate the different competitiveness issues and market characteristics that impact exporters in each sector. For more country-specific information on local business practices and the economic and political environments, the U.S. Commercial Service also provides in-depth Country Commercial Guides that can be accessed online.ⁱⁱ

Industry Overview and Competitiveness

Broadly speaking, automation is the act of reducing manual labor inputs into products or processes. There are many reasons for automating processes. One is the need to reduce the amount of direct labor and decrease costs. Some tasks are truly “mindless” and may be undesirable to even low-skilled workers. By using automation to reduce the number of

monotonous tasks, businesses can better allocate resources to higher value propositions, such as research or business development. Other reasons for automation include the needs to improve product quality, to consistently meet exacting specifications, or to improve speed of output. In many industrial settings, certain tasks are also inherently dangerous or unsanitary for human workers. Automation of these tasks can improve occupational health and safety outcomes while reducing the number of worker compensation cases and costs for claims.

Today, according to a study by the McKinsey Global Institute, as much as 45 percent of activities individuals are paid to perform can be automated.ⁱⁱⁱ Many of the technologies that have underpinned the move toward automation have existed for decades. As the technologies have progressed, however, the level of automation across any number of industrial settings has reached unparalleled levels. In public transit, supervisory control and data acquisition (SCADA) systems are enabled by industrial automation products to ensure trains and traffic grids remain fluid and decongested. One look inside of a major postal distribution or logistics center reveals an almost staggering array of complexity that is made manageable by automation. Within the food and beverage industry, process controls are the key to ensuring that different batches of the same soft drink consistently look, smell and taste the same.

The United States is a top tier global supplier of industrial automation equipment and is home to a robust domestic industry. On one side of the spectrum, hundreds of small to medium-sized enterprises (SMEs) typically offer products to compete in highly specialized equipment and component markets. Many of these pure-play companies are family owned and tend to focus on particular products for specific industries or applications. These make up the majority of automation equipment companies.

The greatest proportion of equipment sales, however, is generated by automation divisions of Fortune 500 industrial conglomerates. U.S. headquartered companies include GE (NYSE: GE), Johnson Controls (NYSE: JCI), Emerson Electric (NYSE: EMR), Rockwell Automation (NYSE: ROK), and others such as Danaher Corporation (NYSE: DHR) and

Honeywell International (NYSE: HON). These companies are often structured to provide products and services that are tailored to the unique settings of end-use industries. With employee counts ranging in the tens of thousands, these companies often enjoy robust presence in major markets throughout the globe.

The United States is also home to a large number of automation systems integrators. These companies are service-providers, with engineering and production expertise, that install or integrate automation products into existing machinery, factory lines, warehouses and more. They typically are certified by original equipment manufacturers (OEMs) to work directly with end-users, and they specialize in certain industries or applications. Integrators tend to be SMEs that provide in-depth expertise of local business needs and conditions, a business model that tends to be domestically oriented and less export-driven.

Market Drivers: End-Use Industries

The industrial automation market is tied to the performance of end-use industries, particularly those that rely heavily on high-volume output and process repeatability. These include automotive, food and beverage, metals and materials, oil and gas, packaging, pharmaceuticals, and more.

The automotive industry is one of the largest end-use industries for automation equipment. A single automobile can have as many as 15,000 precision parts with a premium placed on interchangeability.^{iv} In 2013, 86.9 million motor vehicles were produced around the globe with almost 76 million units produced outside of the United States.^v As a high-volume industry focused on mass-production, the automotive industry relies on multiple tiers of suppliers to provide components and subcomponents for each vehicle. From the bearings and parts in a seatbelt locking mechanism to the body of the car, most vehicle parts are currently produced using highly automated machinery.

Motor vehicle assembly is also highly automated. According to the International Federation of Robotics (IFR), the automotive sector is the largest end-user of industrial robotics, accounting for almost

98,900 installations in 2014.^{vi} Most carmakers today rely on articulated robotic arms with heavy payloads and multiple axes of rotation to do spot-welding, arc-welding, material handling, surface coating and inspection. In each case, robots allow for greater precision at a greater speed of production. The downstream benefits in quality have made industrial robotics a near prerequisite to any automotive assembly operation.

In consumer goods, the food manufacturing industry is also a major end-user of industrial automation equipment. The market for food manufacturing is estimated at over \$750 billion in the United States alone,^{vii} and McKinsey estimates the global food and agribusiness industry at \$5 trillion.^{viii} Subsectors, such as animal feed production, sugar processing, confections, condiments and dairy, make up an essential industry for a growing global population. For major manufacturers of globally branded products, most new plants are automated in their entirety. While large manufacturers may have the funds to automate entire operations, many SME processors with limited means also recognize the value in targeting specific processes in the product lifecycle for automation.

The same can be said for the beverage industry. Revenue from soft drinks, breweries, wineries and distilleries was estimated at \$500 billion in 2014 in the United States alone.^{ix} From ingredient delivery, mixing, bottling and secondary packaging to distribution, the beverage industry relies on numerous processes and steps before reaching the consumer. As with food manufacturing, beverage producers are often highly regulated for safety and sanitation. In most markets, quality control is an absolute requirement, and thus, finding solutions to eliminate human error is a major driver in improving operations.

There are many other end-use sectors to consider, but the point to underscore is that virtually any foreign manufacturer in a process-intensive industry is a potential customer for U.S. automation equipment. While many of these are mature industries, what is new is the increasing degree of scalability and drive to increase interoperability between machinery, sensors, controllers, drives and other equipment. As any enterprise grows to

accommodate increasing productivity demands, be it a manufacturer or utility provider, the need for hardware and control capabilities increases as well. As with information and communications technology (ICT) hardware in general, the rapid pace of improvement in speed and data processing in industrial ICT hardware has been a major enabler of progress across the globe. ITA expects this trend to continue to drive sales through the short and long-term.

Global Competitive Landscape

Relying on global trade data collected by the United Nations Statistics Division, ITA projects that competition will continue to come from suppliers in Asia, Western Europe and Mexico. According to U.N. data, in 2014, the United States was the third largest exporter of automation equipment in the world, behind China and Germany.^x

Since 2007, China has been the largest exporter of equipment. It has also been the fastest growing in terms of global export market share, increasing from 11.4 percent in 2004 to 20.2 percent in 2014. The United States, on the other hand, has seen the largest decline over the same period, falling from 15.1 percent to 9.8 percent. Japan was the fourth largest exporter in 2014, but it also saw a decline in market share.

Asia

In Asia, the major competing markets are China, Japan and South Korea. China has been the largest producer of automation equipment for nearly a decade. Much of this has been due to offshore assembling for major multinational firms by contract manufacturing companies. For example, Taiwan-headquartered Foxconn traditionally assembles ICT products for export into western markets. Growth, however, is also being propelled by an increase in domestic consumption and a drive to improve manufacturing productivity in-country. Some sources estimate that output within China from Chinese-owned firms will surpass that of foreign-owned firms by 2020.^{xi}

In Japan, emphasis on product quality and lean manufacturing has made the country a leading

developer and supplier of automation equipment. Japan is well-known for revolutionizing computer-numerical control (CNC) technology, becoming a global powerhouse in manufacturing controls for the machine tool industry. Japan is also well-known for industrial robotics. While China has recently eclipsed Japan as the leading global producer, according to the IFR, Japan is estimated to have the largest operational stock of industrial robots in the world.^{xii} Some of the country's major industrial conglomerates, such as OMRON, Fanuc, Yaskawa and Mitsubishi, are diversified across robotics and other automation products.

Korea has emerged as one of the prominent "Asian Tigers" and is one of the top 10 producers of automation equipment. The IFR notes that Korea had the highest robot density in the world,^{xiii} a point analysts attribute largely to government actions and initiatives.^{xiv}

Europe

Western European companies continue to compete tightly with U.S. companies in global markets. In 2014, the largest European exporters were Germany, Italy, France and the United Kingdom.

In Europe, Germany is considered the leading voice in smart manufacturing and productivity. Germany is Europe's largest exporter of automation equipment by far and surpasses the United States as the second largest in the world. Germany is home to the Industrie 4.0 initiative, which aims to "utilize the enormous potential of digitization... to strengthen Germany's manufacturing base."^{xv} The world's largest automation trade show, the Hannover Messe, draws roughly 225,000 participants each year. Germany is home to thousands of SMEs and a number of leading multinational corporations, including Siemens AG and Bosch Rexroth.

Across Europe, countries, such as Italy, France and Switzerland, are home to a number of prominent automation companies. Companies like Schneider Electric of France and ABB of Switzerland are leading providers of industrial control systems. At the time of writing this *Top Markets Report*, ABB is also one of the largest industrial robotics companies to manufacture in the United States. Italy's Comau

Group, a subsidiary of automotive giant Fiat-Chrysler, has also produced advanced automation systems for years.

Mexico

Mexico, like China, has traditionally been a large market for assembling and manufacturing by major multinational firms. Much of this trend has been driven by the North American Free Trade Agreement (NAFTA), Mexico's oldest and most consequential free trade agreement. As a result of lower labor costs and close geographic proximity, many U.S. multinational firms have acquired manufacturing operations in Mexico for the purpose of eventual resale in the U.S. market. Mexico, however, has also entered into over 40 free trade agreements with Japan, the European Union and others, providing further incentive for larger multinational companies to expand growth into the Americas.^{xvi}

Challenges and Barriers

The International Trade Administration (ITA) regularly engages with foreign governments to improve outcomes for U.S. exporters.

Market Access

In the automation sector, tariffs affect many products in a number of countries. Opening market access through tariff reduction remains a critical strategy for many countries, including Brazil, China, India and more. By increasing the price of the product for the consumer, tariffs affect the cost-competitiveness of imported items and have distortionary effects on the market. While tariffs have traditionally provided a source of revenue, they can also be used to protect politically-sensitive domestic industries by prohibitively raising the cost for outside competition. The United States continues to push for open access to markets through expansion of free trade agreements (FTA), such as the Trans-Pacific Partnership (TPP) or the Transatlantic Trade & Investment Partnership (T-TIP). The United States also continues to push for market access through established multi-lateral fora, such as the World Trade Organization (WTO), and bilateral fora with trade partners like China and India through the U.S.-China Strategic & Economic

Dialogue and the U.S.-India Strategic & Commercial Dialogue.

Content Localization

ITA also seeks to engage foreign governments on issues of content localization. Content localization requirements are typically set forth by governments as a means of ensuring that a certain percentage of inputs into a product are sourced from domestic manufacturers. In return, the local manufacturer may receive preferential treatment in taxation and/or subsidies, among other incentives. For example, Brazil gives tax reductions on and exemptions to many industrial ICT equipment and goods that are produced locally and qualify under the Basic Production Process (Processo Produtivo Básico, or PPB).^{xvii} The PPB offers incentives for the creation and development of products with a certain minimum amount of local content, creating barriers for U.S. exporters.

While calls by foreign governments to increase local content production are not in themselves barriers to trade, they can raise concerns if they lead to actual requirements. Similarly, in 2015, the Chinese Ministry of Industry and Information Technology unveiled "Made in China 2025," an industrial policy that intends to upgrade Chinese manufacturing through technology and skilled labor. The plan also calls for Chinese companies in targeted sectors to raise domestic content to 70 percent. These priority sectors include advanced ICT equipment, automated machine tools, industrial robotics and power equipment, among others.^{xviii} While these calls are not necessarily detrimental to trade, ITA monitors them closely for their potential to affect U.S. exports. Through bilateral fora, such as the U.S.-Brazil Commercial Dialogue and the U.S.-China Joint Commission on Commerce and Trade, as well as with our FTA partners, ITA continues to advocate for the same preferential treatment to be given to U.S. exports in these sectors.

Technical Barriers to Trade

ITA closely monitors technical regulations issued by governments and the development of standards, which include voluntary product specifications set forth by hundreds of regional and industry-specific

standards-developing organizations (SDOs). Oftentimes, governments will incorporate voluntary standards set by SDOs into their regulatory regimes, making them mandatory for their respective markets. When regulations become overly burdensome or have the effect of limiting imports from otherwise qualified vendors, they can become trade irritants and, in some cases, be classified as technical barriers to trade (TBT).

Since 1995, the EU has mandated that all machinery used within the 28 EU members be built to comply with the “Machinery Directive” on safety; European Economic Area countries (EEA, which includes Iceland, Liechtenstein and Norway) also follow this directive. Machinery manufacturers indicate their compliance with this directive by placing a “CE” marking (short for the French *Conformité Européene*) on their products. The easiest means for demonstrating compliance with the EU Directive is to show conformity with the recognized European Standard associated with it. Thus, to use the “CE” marking, many manufacturers demonstrate conformity to the appropriate standard or standards. For U.S. producers that manufacture to standards developed by U.S.-domiciled SDO’s, this can require expensive changes to the product. Apart from the direct costs of retooling and reconfiguring models for the European market, there is opportunity cost from the lost sales of U.S. products that are not modified for export. As a result, companies interested in doing business in Europe should be well versed in the “Machinery Directive” and its requirements.^{xxix}

While CE marking has become an understood cost of doing business in Europe, an area long of concern to the U.S. Government and ITA has been the EU practice of spreading its standards regime to other countries through the EU Neighborhood Policy (ENP) and through European Free Trade Agreements (FTA). The ENP consists of 16 markets in Eastern Europe, Africa and the Middle East^{xxx} and is designed to promote closer economic and political integration with markets where the EU has strong trade ties but that are unlikely to become EU members. As part of the ENP or as a signatory to an FTA, countries are often provided with aid and technical assistance to develop their markets and, in exchange, are often conditioned to adopt EU standards and directives.

The effect is market access barriers in many instances for U.S. companies. Policymakers should be aware of EU agreements with other markets that obligate countries to withdraw from conflicting standards.

Export Controls

The United States Government restricts the sale of certain products and technologies to foreign countries or persons through a broad, interagency Export Control policy. The purpose of this policy is to safeguard U.S. national security interests and foreign policy objectives by limiting the sale of sensitive equipment, software and technology. While most U.S. products shipped to foreign markets are innocuous and used strictly for commercial purposes, other products may possess a “dual-use” capability; that is, they can be used for legitimate commercial applications but can also be used for military or proliferation activities. As a result, the United States Government maintains regulations in tandem with international agreements such as the Wassenaar Arrangement and Missile Technology Control Regime, which lay out rules and restrictions for exporting or releasing products to foreign countries or persons.^{xxxi}

For industrial automation equipment, many of the applicable licensing requirements are located in the Commerce Control List (CCL) of the Export Administration Regulations (EAR), which enumerates specific items regulated by the U.S. Department of Commerce, Bureau of Industry and Security (BIS).^{xxxi}

While the CCL enumerates specific items that require export licenses, the EAR also contains additional requirements applicable to most other items, which may require licensing based on the receiving entity (end-user) and/or the end-use of the product. For example, further regulatory requirements will likely apply to equipment sold for use in creating weapons or munitions, even if the equipment is not covered by an entry in the CCL. Also, some exports to certain countries may require further licensing, including both embargoed destinations and other countries such as China, India or Russia. BIS also maintains a *List of Parties of Concern*, which enumerates individuals and entities that may be subject to licensing requirements or

whose export privileges are denied outright. Finally, some items are not controlled by BIS but are instead subject to regulation by another agency, which may maintain separate licensing requirements.

While not all manufacturing technology products will require licensing, exporters will save valuable lead-time by familiarizing themselves in advance with the relevant Export Control regulations and utilizing the numerous compliance trainings that are regularly scheduled by the Bureau of Industry and Security.^{xxiii} More importantly, export control violations may carry significant repercussions, including substantial criminal, civil and administrative penalties. Exporters may also find local assistance through the Department of Commerce's network of 108 U.S. Export Assistance Centers.^{xxiv}

Opportunities

The global market for automation is growing. Going into 2016, the demand for integrated and scalable products is at an all-time high in order to meet the growing expectations of consumers. This is not only the case in highly-industrialized economies but also in developing nations as many companies simply

bypass old technologies and leap-frog straight into the trends of today. As traditional IT principles continue to merge with manufacturing, companies that are able to harness concepts of "digital factory" will be at a distinct competitive advantage in their respective industries.

U.S. automation companies are keenly aware of this reality. Around the globe and across all industries, the paradigm of production is shifting towards digitization. Factories can no longer afford to run at the "surface level." They need data collected by sensors in order to measure throughput, systems to provide analysis in real-time, and controls to optimize performance.

U.S. companies are well-positioned to play a leading role in driving technical change in the global value chain. While the United States will continue to be a leading innovator and market for automation technologies, ITA is dedicated to partnering with U.S. companies that are looking to sell overseas. With a robust network in over 100 U.S. cities and 80 countries worldwide, ITA is a ready and able partner in unlocking the potential of exporting.

Country Case Studies

The following pages include country case studies that summarize U.S. industrial automation export opportunities in selected markets. The overviews outline ITA's analysis of the U.S. export potential in each market and offer recommendations to exporters that can improve their competitiveness. The markets represent a range of countries to illustrate a variety of points – and not the top markets overall.

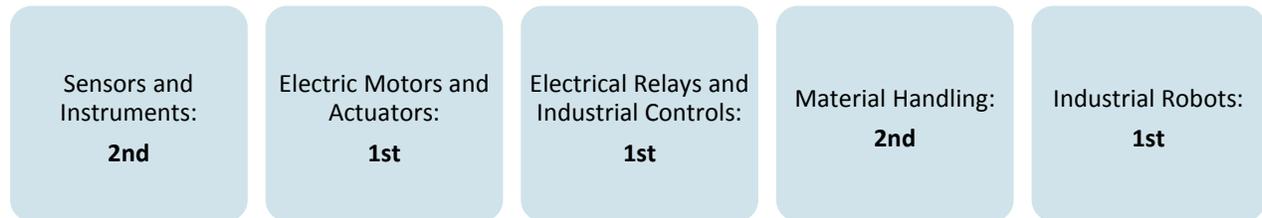
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Mexico

Mexico ranks first in this Industrial Automation Top Markets Report. With a highly developed industrial base and virtually zero market access barriers, Mexico surpassed Canada in 2015 as the largest purchaser of U.S. automation exports. With strong growth projected through the near and long-term, Mexico will continue to be a strategic market for U.S. manufacturers.



Subsector Rankings



ITA expects U.S. industrial automation exports to Mexico will continue to increase through 2017. Between 2009 and 2015, exports to Mexico grew at an average annual rate (CAGR) of 10.8 percent. Exports to Mexico have grown every year since 2009. ITA projects that this trend will continue as Mexican companies continue to adopt more productive and efficient manufacturing techniques in response to increased global demand for consumable and durable goods.

Country Overview

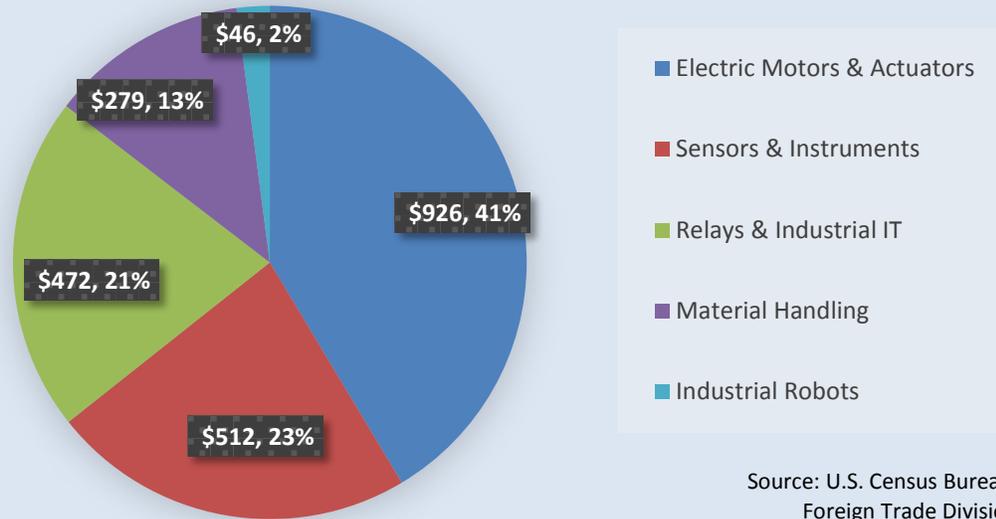
Mexico is a strategic market for U.S. industrial automation exporters. Over the past 21 years since entering into the North American Free Trade Agreement (NAFTA), Mexico's economy has increasingly oriented itself away from agriculture and more towards an export-driven manufacturing economy. Between 2002 and 2012, Mexican

automotive exports increased by 152 percent from \$27.9 billion to \$70.3 billion, and electronics increased by 73 percent from \$43.3 billion to \$74.9 billion.^{xxv}

Mexico's major industrial hubs are the metropolitan areas surrounding Mexico City, Guadalajara, and Monterrey. Mexico's 1,900-mile shared border with the United States has also seen an outgrowth of industrial activity, especially as multinational corporations aim to create vertical supply chains made possible by NAFTA.

As a signatory of NAFTA, Mexico has virtually zero market access barriers for U.S. exports. Mexico is a net importer of automation products, and the United States is Mexico's largest import partner. According to latest available U.N. data, in 2014, U.S. products accounted for 43.7 percent of all imported automation equipment into Mexico, followed by China with 21.2 percent and Germany at 6.2 percent.

Figure 2: U.S. Industrial Automation Exports to Mexico, 2015
(in USD Dollars)



Export Overview

Mexico is the largest export market for three of the Industrial Automation product categories. To begin, Mexico is by far the largest destination for U.S.-made electric motors and actuators. In 2015, Mexico accounted for over one-fifth of all U.S. exports in the subsector, which totaled \$926 million. This was down slightly from the \$928 million total in 2014, but average annual growth (CAGR) has been just under 7 percent between 2009 and 2015. ITA projects that sales in this subsector will continue to grow.

Mexico was also the largest purchaser of U.S.-made electrical relays and industrial controls. Not only did Mexico receive the largest volume, totaling \$472 million in 2015, but the subsector was also the fastest growing in the Mexico market, growing at an average annual rate (CAGR) of 21.6 percent. Growth has been substantial in programmable controllers (under 1,000 Volts), which totaled \$197 million in 2015. This was up nearly eight times the value of shipments in 2009. In relays of less than 60 Volts, sales in 2015 were \$84 million, up more than four times the amount in 2009.

Industrial Robots accounted for the smallest proportion of sales to Mexico out of the five subsectors. In 2015, however, Mexico received the greatest volume of all U.S.-exported robots and end-of-arm tooling, totaling \$46 million. Sales were driven especially by parts and tooling, which typically make up more than half of U.S. exports in the subsector. Given Mexico’s free trade agreements with powerhouses like Japan, home of FANUC, Yaskawa and others, competition against U.S. producers is particularly strong in the country. Much of this is driven by the Mexican automotive and consumer electronics industries, which draw heavily from mass-produced components.

Mexico is the second largest U.S. export market for sensors and instruments. Sales of process control instruments and other regulating apparatuses in this product category were \$512 million in 2015. ITA predicts that purchases from Mexico will continue to increase through 2017, likely surpassing Canada as the leading destination for U.S.-made products in this category.

Sales of material handling equipment used for automation were \$279 million in 2015, making Mexico the second largest purchaser of U.S.

Figure 3: Annual U.S. Industrial Automation Exports to Mexico, by Subsector (In USD Millions)



products in this subsector. Purchases of conveyors and elevating equipment have grown significantly between 2009 and 2015, increasing by an average of 12.9 percent per year (CAGR).

Challenges and Barriers

Mexico is a NAFTA signatory and has eliminated virtually all tariffs on U.S. industrial automation products. U.S. companies may provide a Certificate of Origin to claim preferential tariff treatment for exports under NAFTA.

The United States and Mexico continue to engage regularly on technical barriers to trade through the NAFTA Committee on Standards-Related Measures. In the past they have also cooperated through the U.S.-Mexico High Level Regulatory Cooperation Council,^{xxvi} as well as the USAID-ANSI Standards Alliance.^{xxvii} Mexico provides official standards called *Norma Oficial Mexicana* (or NOMs) as well as voluntary standards (NMX) through the Mexican Standards Catalog.^{xxviii} The U.S. Department of Commerce maintains one of four Standards Attachés worldwide in Mexico City, and most U.S. standards developing organizations (SDOs) are engaged with Mexican counterparts.

Know Your Buyer

Due to its close geographical and cultural proximity to the United States, the Mexican market is quite

similar to the U.S. market in many respects. Direct sales and sales agents are widely used by companies because of close proximity and low shipping costs. Owing to the country's geographic size, it may behoove exporters to work with distributors in multiple hub cities like Mexico City, Guadalajara or Monterrey, as well as population centers along the 1,900-mile stretch of border with the United States.

Government procurement is decentralized, and Mexican government agencies buy through their own purchasing offices. As a result, government tenders vary between agencies. Public tenders are published in the *Diario Oficial* and are published through an online system.^{xxix}

National and Regional Trade Shows

[MC]² Conference
April 19-21, 2016—Dallas, TX, USA
<http://mc2conference.com/>

Fabtech Mexico
May 4-6, 2016—Mexico City, Mexico
<http://mexico.fabtechexpo.com/>

Expo Pack Mexico
May 17-20—Mexico City, Mexico
<http://www.expopack.com.mx/2016/en/expopack>

IMTS 2016

September 12-17, 2016–Chicago, IL, USA

<http://www.imts.com/>

The Assembly Show 2016

October 25-27, 2016–Rosemont, IL, USA

<http://www.theassemblyshow.com/index.php>

Pack Expo International

November 6-9, 2016–Chicago, IL, USA

<http://www.packexpointernational.com/>

Fabtech 2016

November 16-18, 2016–Las Vegas, NV

<http://www.fabtechexpo.com/fabtech-2016/>

TECMA

March 7-10, 2017–Expo Bancomer Santa Fé, Mexico

City, Mexico

<http://www.tecma.org.mx/>

Promat 2017

April 3-6, 2017–Chicago, IL, USA

<http://www.promatshow.com/>

FEIMAFE

June 5-10, 2017–Anhembi, São Paulo, Brazil

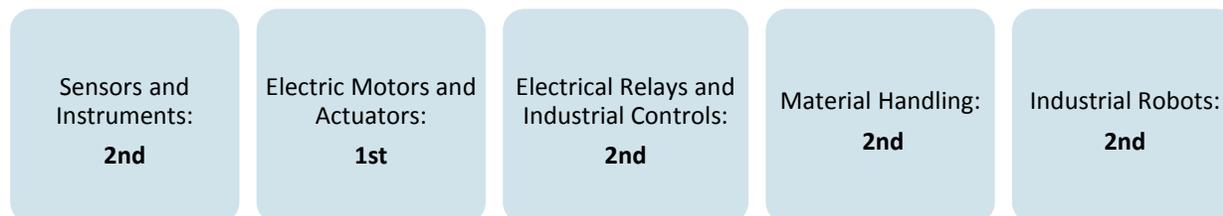
<http://www.feimafe.com.br/en/>

Canada

Canada ranks second overall in this year's Industrial Automation Top Markets Report. Despite headwinds due to currency exchange rates and falling oil prices, Canada has consistently received the highest or second-highest volume of U.S. automation exports. With its close proximity and shared language with the United States, Canada will continue to be a major destination for U.S. equipment exports.



Subsector Rankings



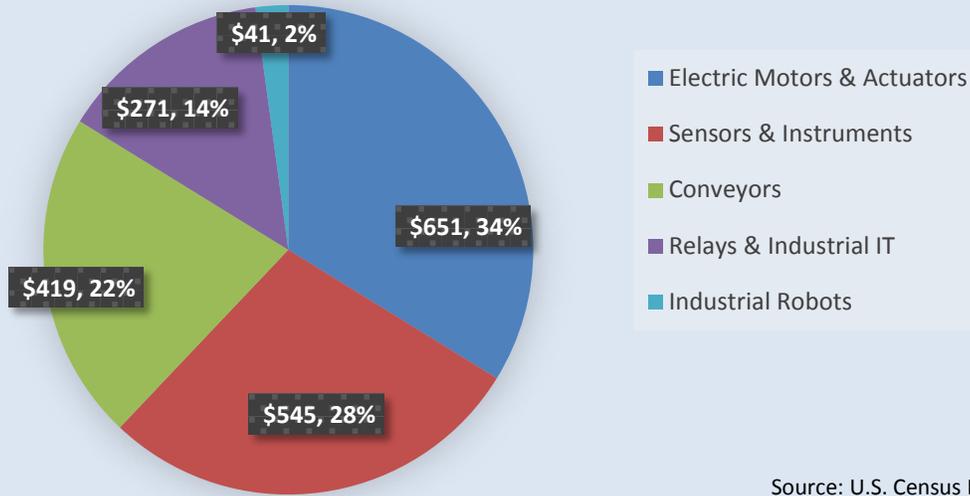
ITA expects that U.S. industrial automation exports to Canada will decline through 2017. In 2015, U.S. automation exports to Canada were over \$1.9 billion. Exports to Canada decreased by 13.3 percent between 2014 and 2015, and since 2012, they have declined by roughly 7.1 percent annually (CAGR). ITA attributes this primarily to the strengthening U.S. Dollar against the Canadian Dollar. In 2012, both currencies traded at near parity. By the end of 2015, 1USD traded for 1.38CAD, presenting significant headwinds for U.S. exporters.

ITA also notes increased output from Mexico, with whom Canada partners in NAFTA. Since 2009, Mexico's share of the Canadian import market has increased by almost three percentage points. Increased output from Mexico is largely a result of deepening vertical supply chains through the NAFTA corridor and the relative stability of exchange rate between Canadian Dollars and Mexican Pesos. Coupled with the U.S. currency appreciation, ITA projects that U.S. exports to Canada will continue to face headwinds through 2017.

Country Overview

Canada is a strategic market for U.S. automation exporters. The country is a member of the Group of Seven (G7) and has one of the largest and most highly advanced manufacturing economies in the world, which houses robust automobile, metal fabrication, consumer goods and plastics manufacturing industries. Canada is also one of the five largest energy producers in the world and is the principal source of U.S. energy imports.^{xxx} Canada's proximity to the United States and status as a NAFTA trading partner are reflected in the level of trade already existing between the two countries. Canada is a net importer of industrial machinery and equipment.^{xxxi} According to latest available U.N. data, in 2014, U.S. automation equipment accounted for 50.5 percent of the Canadian import market, the largest percentage of all of Canada's trade partners. This was followed by China with 12.7 percent and

**Figure 4: U.S. Industrial Automation Exports to Canada by Subsector, 2015
(in USD Millions)**



Source: U.S. Census Bureau
Foreign Trade Division

Mexico with 10 percent, both of which remain two principal competitors.

Canada shares over 5,500 miles of border with the United States (including Alaska). Approximately 90 percent of the country’s 35 million residents live within 100 miles of the U.S. border. Manufacturing is concentrated in Ontario and Quebec, which account for roughly two-thirds of all manufacturing sales in the country, followed by Alberta and British Columbia.^{xxxii}

Export Overview

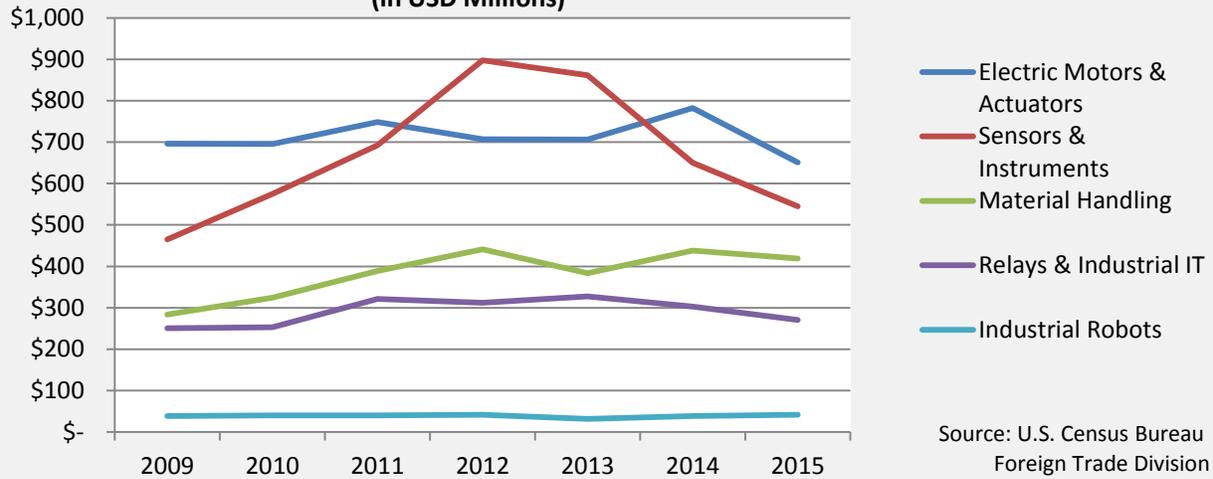
Canada remains an important destination for U.S. exports. In 2015, sales to Canada accounted for nearly 18 percent of all industrial automation exports. Since 2012, however, U.S. exports to the country have declined by over 20 percent. In 2015, Mexico surpassed Canada for the first time to become the largest U.S. export market for automation products. Currency exchange rates are largely the cause of this trend, which have made it more expensive for Canadian consumers to import U.S. products. The record-low price of oil has also created significant challenges for the Canadian economy, with direct implications for automation

equipment exporters. Other factors include the move of several automotive assembly lines and engine manufacturing units out of Canada, most notably General Motors.^{xxxiii}

Canada is the largest export market for U.S.-made electric motors and actuators. In 2015, this category accounted for 34.5 percent of all industrial automation exports to Canada. However, from 2014 to 2015, exports in this product category, including parts, declined by 16.7 percent, which was the greatest decline among all of the product categories.

Canada remains the second largest U.S. export market for sensors and instruments, totaling \$545 million in 2015. Sales in this category experienced a similar drop between 2014 and 2015, falling over 16 percent. Recent developments that have contributed to the decrease in Canadian demand include the practical-completion of the national Smart Grid program, which has dropped demand for metering equipment to mainly maintenance and replacement parts. Sales of sensors and instruments also have been hard hit by Canada’s sagging oil and gas industry. Downstream oil refinement relies heavily upon process control apparatuses, and the low cost of oil has shrunk demand significantly in this area.

**Figure 5: Annual Performance, U.S. Industrial Automation Exports to Canada
(in USD Millions)**



Conveyors and assorted material handling equipment sales were \$419 million in 2015, accounting for approximately 22.2 percent of U.S. automation exports to Canada. From 2009 to 2015, sales in this product category increased at an average annual rate (CAGR) of 6.7 percent, the largest growth rate in all of the product categories. Conveyors also experienced the smallest decline in sales between 2014 and 2015, dropping 4.5 percent. Unlike the previous categories described, material handling products have been affected far less by dropping oil prices.

In 2015, electric relays and industrial IT equipment exports equaled \$270 million, down 10.5 percent from 2014. Controllers and other control-room products have been affected by low oil prices, particularly due to their wide use in Supervisory Control and Data Acquisition (SCADA) systems across midstream and downstream operations.

Canada was the second largest export destination for U.S.-made industrial robots, including parts and end-of-arm tooling. In 2015, Canada received \$41 million of U.S. exports, up 6.4 percent from 2014. Robots are primarily concentrated in the Canadian automotive industry, which declined slightly from 2013 to 2014.^{xxxiv} Globally, Canada is still a relatively small market for industrial robots, adding only 2,300 units in 2014.^{xxxv} It still remains an important market for U.S. suppliers.

Challenges and Barriers

As a long-time free trade partner, Canada has zero tariffs on U.S. products. Under NAFTA, U.S. goods exports can claim preferential treatment through a Certificate of Origin.

Technical barriers to trade are few, and Canadian standards development is closely aligned with that of the United States. Given their close integration, there has been emphasis by Canadian and U.S. standards-developing organizations to collaborate even further to promote shared interests in international fora.

Exporters who also provide after-market services are advised to be well-versed in the relevant Work Permit regulations. After-market service represents an important revenue stream for automation companies, and many companies are unaware of regulations that specifically provide exceptions for after-sales working activities. For more information, exporters are encouraged to visit their local USEAC or contact relevant U.S. Foreign Commercial Service offices located in Canada.

Know Your Buyer

Sales channels in Canada vary based on the subsector. Heavier or specialized equipment typically go through short marketing channels, and direct producer-to-user distribution is common. Equipment of considerable size and value is typically purchased

directly by the user, though also through distributors and manufacturers' agents. The Canadian Government licenses customs brokers for importers, and it is typically the importer's responsibility to arrange customs clearance. Many U.S. exporters are unaware of the Non-Resident Importer Program, which allows U.S. companies to register to export in Canada without necessitating a physical presence.^{xxxvi}

Information about government procurement practices is available from Public Works and Government Services Canada.^{xxxvii} Companies wishing to compete for government tenders can create an account in the Supplier Registration Information (SRI) system.^{xxxviii}

National and Regional Trade Shows

Process & Automation Shows, Canada
<http://www.cpecn.com/index.cfm?id=2>

Automation Expo & Conference
April 20-21, 2016 – Edmonton, Canada
<http://aecalberta.ca/>

[MC]² Conference
April 19-21, 2016 – Dallas, TX, USA
<http://mc2conference.com/>

Montreal Manufacturing Technology Show
May 16-18, 2016 – Montreal, Canada
<http://mmts.ca/>

ATX- Automation Technology Canada
May 16-18, 2016 – Toronto, Canada
<http://www.imts.com/>

IMTS 2016
September 12-17, 2016 – Chicago, IL
<http://www.imts.com/>

The Assembly Show 2016
October 25-27, 2016 – Rosemont, IL, USA
<http://www.theassemblyshow.com/index.php>

Pack Expo International
November 6-9, 2016- Chicago, IL, USA
<http://www.packexpointernational.com/>

Fabtech 2016
November 16-18, 2016 – Las Vegas, NV
<http://www.fabtechexpo.com/fabtech-2016/>

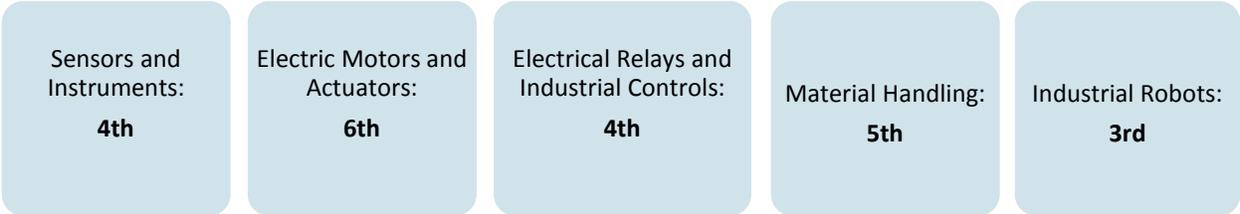
Promat 2017
April 3-6, 2017 – Chicago, IL, USA
<http://www.promatshow.com/>

Germany

Germany ranks third overall in this year’s Industrial Automation Top Markets Report. Germany is Europe’s largest economy and a top global manufacturing market. Germany benefits from a highly skilled labor force and is a staunch proponent of advanced manufacturing. Germany is also a leading supplier of machinery, motor vehicles, household appliances and other manufacturing sectors.



Subsector Rankings

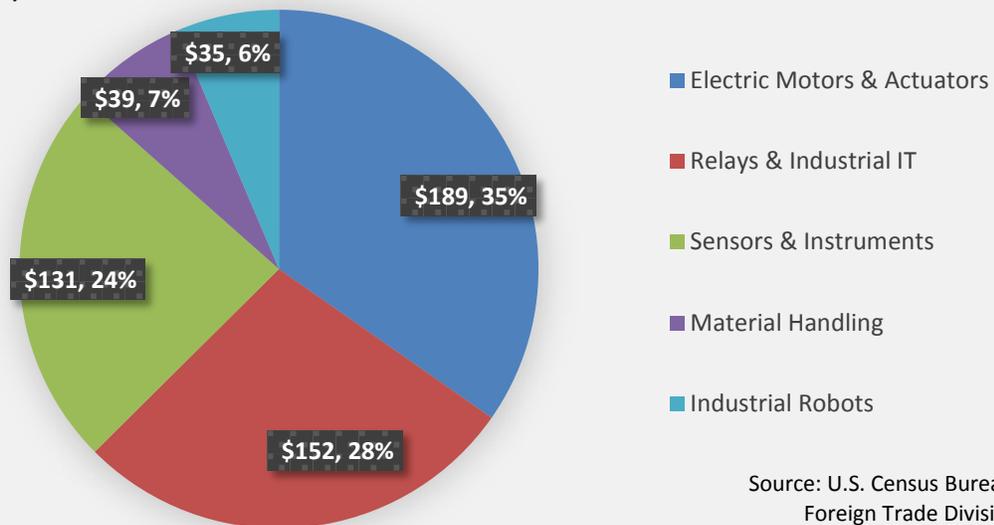


ITA expects that U.S. industrial automation exports to Germany will grow through 2017. In 2015, U.S. exports in the sector were valued at \$545 million. Germany is the United States’ largest trading partner in Europe, and exports to Germany in the sector grew greatly by 20.8 percent between 2014 and 2015. Germany is a leading proponent of harnessing automation technologies to improve manufacturing productivity, a fact most visible in the Federal Industrie 4.0 initiative, which aims to provide funding and resources towards “smart” factories. Between 2009 and 2015, exports grew at an average annual rate (CAGR) of 8.4 percent. Despite headwinds related to currency exchange rates, sound continued growth is expected for U.S. automation exports to Germany.

Country Overview

Germany is the economic powerhouse of Europe. It is the most populous European country with roughly 81 million residents, and it is the fourth largest global economy by GDP. Germany is a major consumer and net exporter of motor vehicles, manufacturing machinery, electrical equipment, rubber and plastics products, among more. The country’s emphasis on advanced vocational apprenticeship programs has helped to make “German engineering” synonymous with advanced precision manufacturing.

**Figure 6: U.S. Industrial Automation Exports to Germany by Subsector, 2015
(in USD Millions)**



According to latest available U.N. trade data, the United States captured 5.7 percent of the German import market in 2014. The United States was Germany’s seventh largest automation equipment supplier, behind China, Hungary, Czech Republic, Switzerland, Poland, and France. Despite being one of the largest competing suppliers of automation equipment, Germany remains a growing consumer of U.S. automation exports, particularly for highly specialized items. For many companies, entering the German market is an important element of any comprehensive export strategy to Europe.

Export Overview

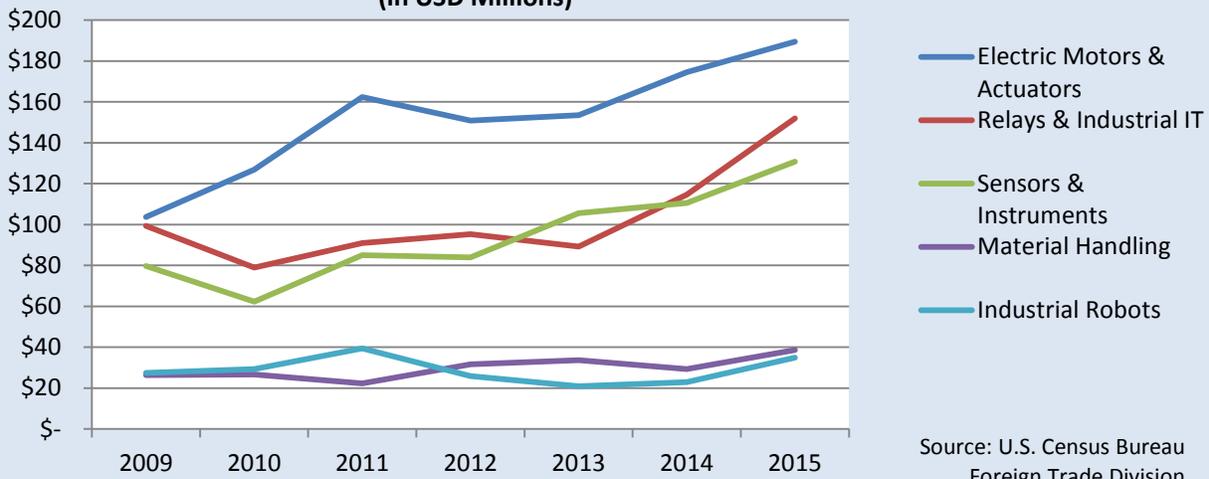
According to the VDMA (German Engineering Federation), Germany’s largest mechanical engineering trade association, excitement around the “Industrie 4.0” initiative is already beginning to translate to increased customer expectations. In the broadest sense, “Industrie 4.0” is the German-government term for developing “Smart Factory” capabilities throughout German industry by developing cyber-physical systems. According to VDMA, the broad publicity of this government-led policy has already led to an increasing demand for networked and automated solutions.^{xxxix}

This increased demand for automation equipment has been evident in U.S. export performance. In

2015, Germany was the third largest recipient of U.S. industrial robots and end-of-arm tooling, accounting for just under \$35 million in sales. Competition for industrial robots is quite high in Germany, which is home to KUKA, as well as subsidiaries of Swiss-owned ABB Robotics, Austrian-owned Stäubli, and others. According to the International Federation of Robotics, Germany had the fourth largest number of installed industrial robots in 2014, and was the largest in Europe. Despite Germany being the third largest destination for the subsector, sales of industrial robots made up the smallest proportion of U.S. automation exports to the country in 2015.

Germany is a major consumer of electrical relays and industrial IT equipment. As the fourth largest buyer in this subsector, Germany accounted for almost \$152 million in sales in 2015. Much of this growth has come from sales of programmable controllers for industrial settings (less than 1,000 Volts), which drew over \$92 million in sales in 2015. Germany is home to a number of competitor companies, for example Siemens and Robert Bosch as well as smaller multinationals such as Beckhoff Automation. Purchases of U.S.-made controllers in Germany have grown at an exceptionally rapid rate of 30.1 percent per year (CAGR) since 2009. ITA expects that exports in this subsector will continue to increase through 2017.

Figure 7: Annual U.S. Industrial Automation Exports to Germany, by Subsector (in USD Millions)



Sensors and instruments are another growth subsector. In 2015, sales were \$130 million, making it the fourth largest purchaser of U.S.-made products in the category. Between 2009 and 2015, sales of these products grew by 8.6 percent annually (CAGR). Major competitors include SICK AG, Siemens Sensor Systems, Bosch Sensortec and more. ITA expects further growth opportunity particularly through 2017. In 2015, Germany was the fifth largest recipient of U.S. material handling products, including conveyors and elevating apparatuses. Sales in this subsector were nearly \$39 million. Material handling made up a comparatively small proportion of U.S. exports. Average annual growth (CAGR) between 2009 and 2015 was 6.6 percent, and ITA projects that sales will continue to grow in this product category.

Germany was the sixth largest destination for U.S. electric motor and actuator exporters in 2015. Sales of the product category totaled \$189 million 2015, making it proportionally the largest U.S. category in Germany. Between 2009 and 2015, sales of motors and actuators had the highest combined annual growth rate of all subsectors (10.6 percent), led particularly by growth in electrical and electro-hydraulic actuators. Major competitors include Siemens, Bosch Rexroth AG, SEW Eurodrive and others.

Challenges & Barriers

Germany maintains a highly open and transparent business environment, and there are few formal market access barriers. Navigating the complex German regulatory landscape, however, can present challenges. Regulations are heavily enforced and applied consistently to both domestic and foreign suppliers.

Probably the greatest challenge to entering the German market is overcoming German electro-technical standards and conformity assessment procedures, which differ markedly from those in the United States. For most electrical components such as plugs and cables, U.S. and European standards are nonaligned. In practice, this means that for most U.S. machinery makers, the additional labor required to assemble machinery for the German market will affect pricing, inflating the price paid by the customer while decreasing the cost competitiveness compared with domestic and other European-made machines. This is also true for German manufacturers in the U.S. market, however. To date, standards remain a controversial topic between the U.S. Government and the European Commission, particularly in the context of ongoing Transatlantic Trade & Investment Partnership (T-TIP) negotiations. To overcome this obstacle, U.S. companies are advised to be well-versed in the relevant standards in place for the German market.^{x1}

As part of the European Commission's "Machinery Directive," machinery sold throughout the EU is required to obtain a CE marking whenever the product is covered by specific product legislation. CE stands for "Conformité Européenne," and it is intended to demonstrate compliance with European safety and environmental standards.

In many regards, the intense competitive nature of the German market cannot be overlooked as a challenge. According to a joint study by McKinsey and VDMA, the largest German trade associations for mechanical engineering industries, less than one percent of German companies operate in the low-price segment. The remainders operate in the medium or premium-price segment, with 64 percent identified as operating in only the premium.^{xii} As a result, the competitive landscape for U.S. firms is quite stiff, and success is highly dependent on superior quality product offerings and robust localized customer service.

Know Your Buyer

In Germany, arguably more so than any other country, the trade fair is critical to facilitating commerce, especially among larger items like capital goods. Germany is home to the world's largest industrial trade show, the Hannover Messe, as well as many of the largest vertical international trade events in the world, such as METAV and AMB. All told, trade fairs provide near unmatched exposure in the German market.

Germany fosters a free market system, and there are no regulations to bind U.S. exporters to a particular sales channel. Direct sales or indirect sales through distributors, agents, commercial representatives and more are the norm, and the country's transparent business climate make conducting due diligence more efficient.

National and Regional Trade Shows

HANNOVER MESSE

April 25-29, 2016 — Hannover Exhibition Grounds, Hannover, Germany

<http://www.hannovermesse.de/home>

Sensor + Test, Nuremberg

May 10-12, 2016 – Nuremberg, Germany

<http://www.sensor-test.de/welcome-to-the-measurement-fair-sensor-test-2016/>

CeMAT – Intralogistics + Supply Chain

May 31-June 3, 2016 – Hannover, Germany

<http://www.cemat.de/>

Automatica – Robotics and Mechatronics

June 21-24, 2016 – Munich, Germany

www.automatica-munich.com

AMB Stuttgart

September 13-17, 2016

<http://www.messe-stuttgart.de/amb/>

K – Trade Fair for Plastics and Rubber

October 19-26, 2016 – Düsseldorf, Germany

<http://www.k-online.com/>

VISION – Machine Vision

November 8-10, 2016 – Stuttgart, Germany

www.messe-stuttgart.de/en/vision/

SPS IPC Drives

November 22-24, 2016 – Nuremberg, Germany

https://www.mesago.de/en/sps/for_visitors/welco me/index.htm

METAV

February 20-24, 2018 – Düsseldorf, Germany

www.metav.com

Singapore

Singapore ranks seventh overall in this year's Industrial Automation Top Markets Report. Singapore is a highly industrialized Southeast Asian economy and Free Trade partner with the United States. While Singapore's growth has slowed in the past year due to low oil and gas prices, the government continues to invest in initiatives to improve productivity and advanced manufacturing, making it a target market for U.S. industrial automation exporters.

Overall Rank

7

2015 U.S. Exports:
10th

2009-2015 Export
Growth:
14th

2012 UNIDO Industrial
Competitiveness
Ranking:
2nd

UNIDO Industrial
Competitiveness
Growth Ranking:
9th

Subsector Rankings

Sensors and
Instruments:
5th

Electric Motors and
Actuators:
9th

Electrical Relays and
Industrial Controls:
7th

Material Handling:
15th

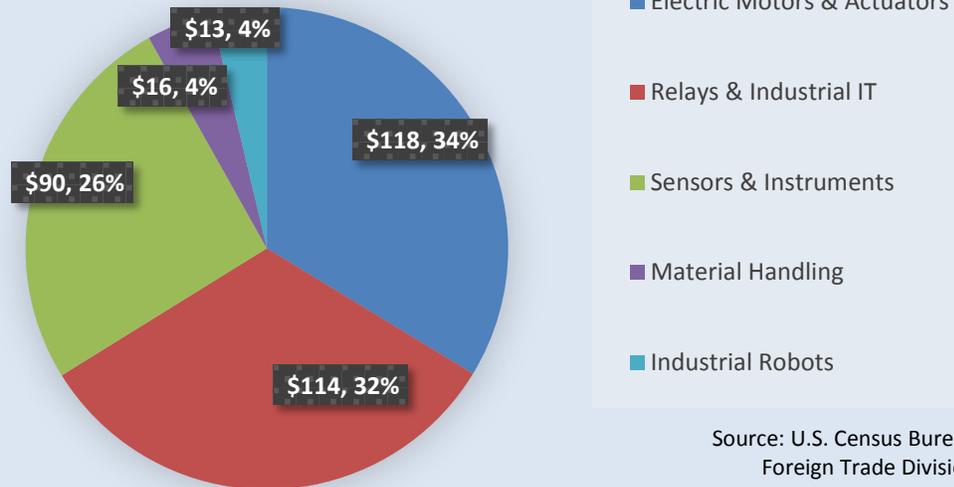
Industrial Robots:
8th

ITA expects that U.S. Industrial Automation exports to Singapore will grow moderately through 2017. In 2015, U.S. exports in the sector were valued at \$351 million. This was down a slight 2.6 percent from 2014's total of \$360 million, which was the first annual decline since the global recession in 2008. This is largely tied to Singapore's slowing economy, which has been hampered by low prices of oil and diminished Chinese demand for Singaporean exports.^{xliii} Between 2009 and 2015, however, U.S. exports grew at an average annual rate (CAGR) of 11 percent. As a result, ITA expects that opportunities will continue to grow moderately for U.S. exports to the Singaporean market.

Country Overview

With a population of more than 5 million and half the landmass of greater London, Singapore is among the leading commercial and financial services hubs in the world. It is a developed free-market economy with one of the highest GDP per capita rates in the world, and it is a major exporter of electronics, machinery, pharmaceuticals, refined petroleum and more. In 2004, the United States-Singapore Free Trade Agreement entered into force, eliminating virtually all tariffs on U.S. exports. The country's emphasis on advanced technical education at the secondary and postsecondary levels has helped to attract strong investment by multinational corporations, and policies to improve production output, such as the National Additive Manufacturing Innovation Cluster (NAMIC), continue to reinforce Singapore's status as a destination for innovation and advanced manufacturing.^{xliiii xliiv}

Figure 8: U.S. Industrial Automation Exports to Singapore, 2015
(in USD Millions)



According to latest available U.N. trade data, the United States held 19.1 percent of Singapore’s import market share for automation equipment in 2014, making it the largest partner that year. This was ahead of China at 19 percent, Malaysia at 10.2 percent, and Japan at 8 percent. 2014 was the first year since 2010 in which Singaporean automation imports from the United States were larger than those from China, and U.S. market share has risen nearly 5 percentage points between 2009 and 2014.

Export Overview

In 2015, Singapore was the fifth largest recipient of U.S.-made sensors and instruments, which totaled \$90 million in exports. Purchases have grown at a rapid rate, growing year-on-year and averaging 17.1 percent in annual growth (CAGR) between 2009 and 2015. Process control instruments, including those for maintaining flow and liquid levels, experienced the greatest growth within this product category. ITA expects that sales opportunities will continue to be strong in this subsector through 2017.

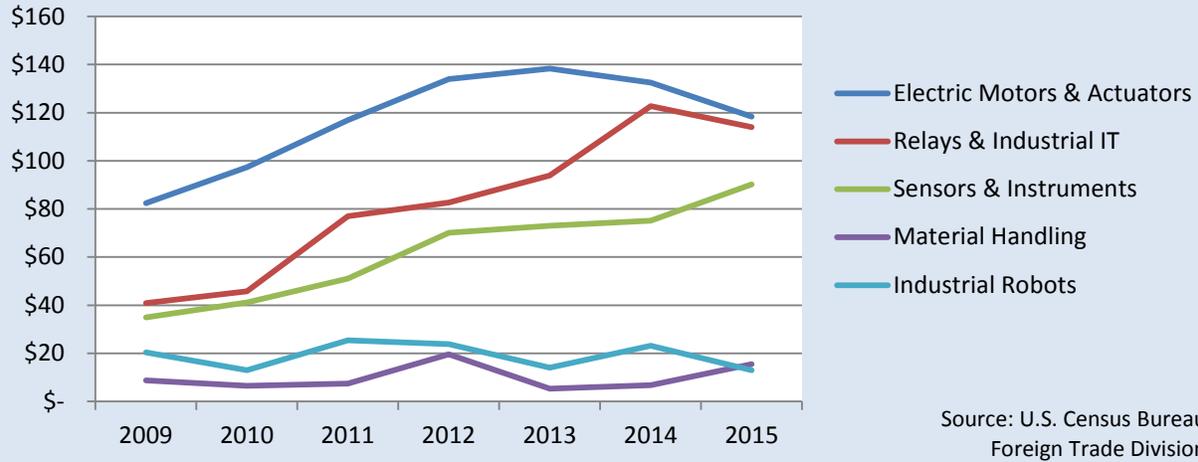
Electrical relays and industrial IT product purchases totaled \$114 million in 2015, making Singapore the seventh largest market for U.S. exports in this subsector. Sales, however, decreased by 7.2 percent in this product category between 2014 and 2015, marking the first instance of decline since 2009. Nonetheless, ITA projects that growth in this subsector will continue through 2017, particularly as

key infrastructure and transportation developments begin to take place.^{xiv}

Despite making up a relatively small proportion of U.S. exports to Singapore, sales of industrial robots in 2015 totaled \$13 million, making it the eighth largest U.S. export market for the product category. Purchases in this category typically have fallen under replacement parts and end-of-arm tooling, owing largely to the significant market presence of Asian robot OEMs, such as FANUC, Yaskawa and Mitsubishi, and more. U.S. exports of industrial robots were the only industrial automation product category to experience negative average annual growth between 2009 and 2015. ITA projects headwinds in this subsector through 2017 due to competing Asian brands.

Exports of electric motors and actuators to Singapore totaled \$118 million in 2015. Proportionally this was the largest subsector of U.S. automation exports to Singapore. Singapore was the ninth largest purchaser of U.S. exports in this product category. Sales in this category were driven largely by electric and pneumatic actuators, which are commonly used with valves and taps in chemical processing and downstream oil refinement. Sales in this product category have declined every year since 2013, which was further indicative of the slumping oil economy. Besides industrial robots, electric motor and actuator sales were also the slowest growing subsector for Singapore, averaging 6.2

Figure 9: Annual U.S. Industrial Automation Exports to Singapore, by Subsector (in USD Millions)



percent annually (CAGR). ITA projects that sales in this subsector will continue to face headwinds through 2017.

Singapore was the 15th largest export market in 2015 for U.S. material handling equipment, including conveyors and elevating apparatuses. Sales to Singapore totaled \$16 million in 2015, though year-to-year performance has been more volatile and prone to dramatic increases and decreases. Given Singapore's close proximity and trade relationship with low-cost suppliers like China and Malaysia, ITA projects that Singapore will remain a relatively small market for U.S. manufactured products in this category.

Challenges & Barriers

Singapore maintains a highly open and transparent business environment, and there are few formal market access barriers. In fact, Singapore is ranked first by the World Bank Group for ease of doing business.^{xlvi} Singapore is also ranked second in the world by the World Economic Forum's Global Competitiveness Report for its commitment to Intellectual Property protection.

In many regards, the intense competition present in the Singaporean market cannot be discounted as a challenge. As a destination for top foreign investors from all across the world, competition is not local but global.

Know Your Buyer

As the commercial hub for Southeast Asia, Singapore is home to many agents and distributors that cover regional and local sales. Competition is stiff, and representatives are typically aggressive in courting new opportunities. Given Singapore's size, exporters will typically find one agent or distributor to suffice for local coverage, and a second potentially for greater Southeast Asian operations.

National and Regional Trade Shows

Automex 2016
 May 25-28, 2016 – Kuala Lumpur, Malaysia
<http://www.automex.com.my/>

Industrial Automation Fiesta 2016
 June 8-10, 2016 – Binh Duong, Vietnam
<http://vietnamindustrialfiesta.com/about-iaf-2016/>

Singapore International Water Week
 July 10-14, 2016 – Singapore
<http://www.siww.com.sg/>

Asian Robotics Week 2016
 November 23-24, 2016 – Singapore
<Http://robots-expo.com/>

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Brazil

Brazil ranks 12th in this year's Industrial Automation Top Markets Report. Between 2009 and 2014, exports to Brazil grew at a significant rate. However, economic contractions and fiscal hardships are projected through the near term that will pose significant challenges to growth.

Overall Rank

12

2015 U.S. Exports:
7th

2009-2015 Export
Growth:
4th

2012 UNIDO Industrial
Competitiveness
Ranking:
23rd

UNIDO Industrial
Competitiveness
Growth Ranking:
14th

Subsector Rankings

Sensors and
Instruments:
9th

Electric Motors and
Actuators:
7th

Electrical Relays and
Industrial Controls:
9th

Material Handling:
4th

Industrial Robots:
10th

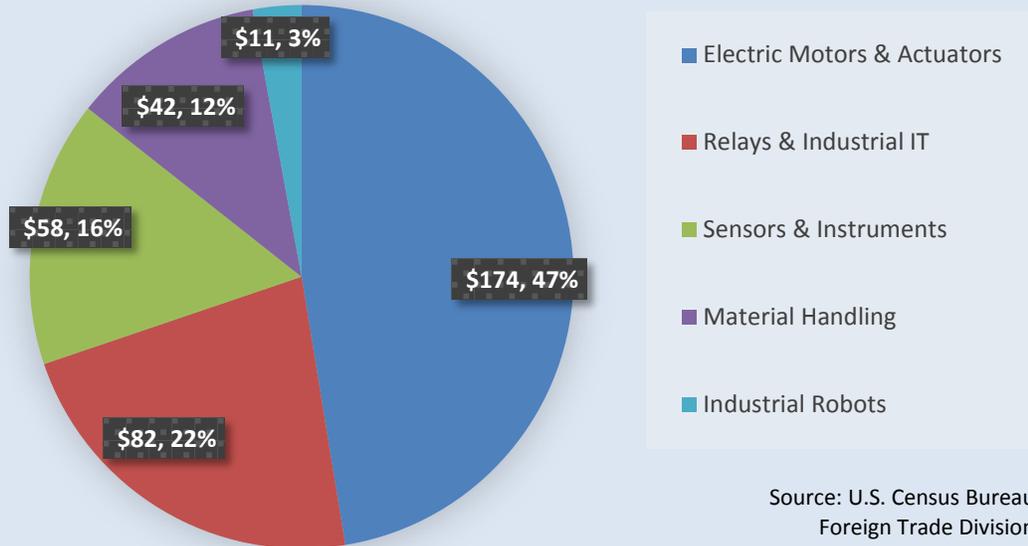
After experiencing a 6.8 percent decrease in 2015, ITA expects U.S. industrial automation exports to Brazil will continue to decrease through 2017. This is largely owing to Brazil's economic prospects, which analysts contend have "deteriorated significantly," and will require significant structural changes to be able to return to growth.^{xlvii} Tied to this assessment are currency exchange rates and the climbing value of the U.S. Dollar against the Brazilian Real, which rose over 60 percent between 2014 and the end of 2015. Despite growing efforts to increase productivity in Brazil, given the economic challenges of a recession, ITA projects that exports to Brazil will continue to face headwinds in the automation sector.

Country Overview

Brazil is the fifth largest nation in the world by area, the sixth largest by population, and the seventh largest economy. As the "B" in BRIC nations (Brazil, Russia, India, China), Brazil has experienced rapid economic growth in the immediate aftermath of the 2008 global recession. It is by far the largest South American market. Brazil is a leading member of the MERCOSUR southern common market, which also includes Argentina, Paraguay, Uruguay and Venezuela.

According to latest available U.N. trade data, the

Figure 10: U.S. Industrial Automation Exports to Brazil, 2015
(in USD Millions)



United States captured 18.1 percent of Brazil’s import market for automation equipment in 2014, behind China with 23.7 percent. U.S. share was higher than Germany (11.4 percent), Italy (6.4 percent), and Japan (4.5 percent). Brazil’s economy remains largely structured around commodity production: agricultural products like soybeans and coffee, textiles, chemicals, metals, and more. It is also a regional producer of motor vehicles, producing the sixth highest volume of autos in the world in 2013.^{xlviii} Brazil’s large supply of low-cost labor has worked as a competitive advantage in these industries. The country, however, has made strides toward greater manufacturing and processing productivity through automation. If it were not for the general economic malaise, the forecast for this Top Markets Study would remain quite positive.

Brazil’s economic conditions, however, are expected to worsen before getting better. According to the OECD, Brazil’s recession is forecast to continue through 2016, and the economy is to begin its slow recovery in 2017.^{xlix} While Brazil will continue to rely

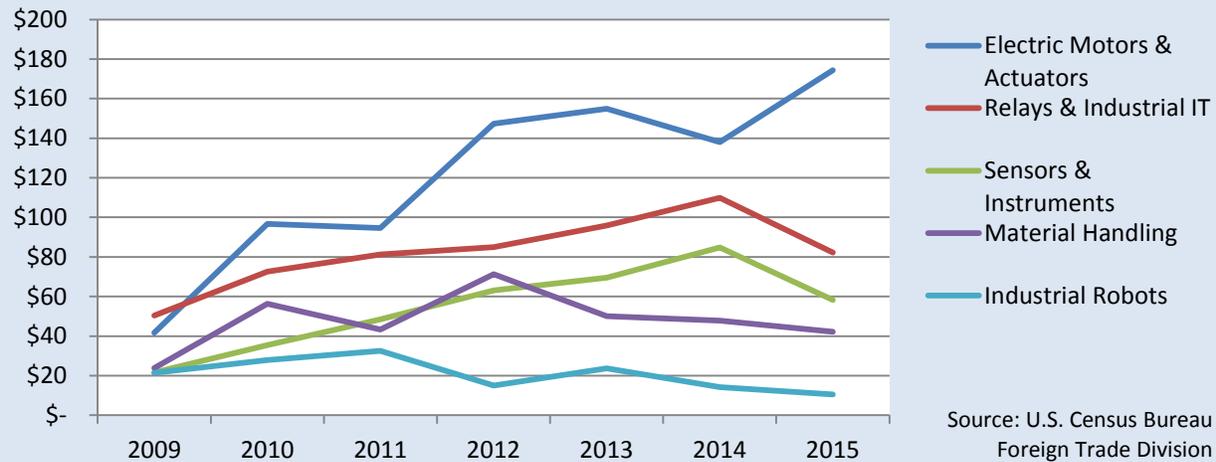
on U.S. machinery and automation imports, ITA projects negative growth in the short-term.

Export Overview

Brazil was the fourth largest U.S. export market for material handling products in 2015. Sales of conveyors and elevating equipment equaled \$42 million in 2015, which was down from a high of \$71 million in 2012. Sales have decreased every year since 2012 at an average rate (CAGR) of 16 percent. ITA projects that this trend will continue through 2017.

Electric motors and actuators made up the largest proportion by far of U.S. automation products sold to Brazil in 2015. Brazil was the seventh largest recipient of all U.S. products in this category, which totaled \$174 million in 2015. Electric motors and actuators were the only product category to experience growth in 2015, increasing by 26.3 percent from 2014 values. This growth is largely a result of oil pipeline investments, retrofitting automated valves and actuators across many pipelines.¹

Figure 11: Annual U.S. Industrial Automation Exports to Brazil, by Subsector (in USD Millions)



In 2015, Brazil was the ninth largest purchaser of two industrial automation product categories. First, electric relays and industrial IT hardware - the sales of which totaled \$82 million - was down from a peak value of \$109 million in 2014. Within this category, programmable controllers of less than 1,000 Volts made up the largest proportion of purchases and grew steadily in spite of the broader decline. The second, sensors and instruments, experienced the greatest sales drop of all product categories to Brazil from 2014 to 2015, declining 31.3 percent to a total of \$58 million. ITA expects sales of both product categories to decline through 2016. Industrial robots accounted for the smallest proportion of sales to Brazil out of the five subsectors. In 2015, Brazil received the 10th greatest volume of all U.S.-exported robots and end-of-arm tooling, totaling \$11 million. Sales were driven especially by parts and tooling, which made up over three-quarters of exports in the subsector.

Challenges and Barriers

Brazil maintains a number of protectionist policies that create market access barriers to U.S. exports. Tariffs are levied against many foreign-manufactured automation products. Similar to a sales tax for imported goods, tariffs are duties collected by the government and have the effect of raising prices on foreign goods. By raising prices, tariffs are intended to help domestic industry maintain cost-competitiveness against foreign producers. ITA

maintains that tariff barriers meant to protect local industry do so at the expense of local consumers, who ultimately pay the price through lower-quality products. ITA continues to call on the Brazilian government to lower tariff rates to benefit Brazilian consumers. Exporters can find applied tariff rates here.ⁱⁱ

Brazil also poses a number of technical barriers to trade. One outstanding challenge remains the dispute over the Brazilian National Telecommunications Agency's requirement to test certain ICT equipment (to include industrial IT equipment) in Brazil rather than by independent certification bodies.ⁱⁱⁱ The unnecessary duplication in testing and delayed time to market have been reported by numerous U.S. companies, and ITA continues to engage the Brazilian Government to seek resolution. The United States and Brazil continue to engage regularly on technical barriers to trade. Technical regulations generally are published in the *Diário Oficial da União* (the Official Gazette, equivalent of the U.S. Federal Register), and if the regulation is likely to affect trade, Brazil's National Institute of Metrology, Quality, and Technology (INMETRO) is responsible for notifying the WTO to allow parties to comment.

Of concern to U.S. companies is Brazil's generally weak record in intellectual property rights protection. Brazil is listed in the "Watch List" of the United States Trade Representative's "Special 301"

report for intellectual property rights (IPR) protection.^{liii} Brazil has fallen under the “Watch List” category since 2007, though much of these concerns remain over counterfeits of consumer goods and lack of transparency in pharmaceuticals and agro-chem products, and not necessarily in automation equipment. The U.S. Government will continue to press Brazil to resolve these practices.

Know Your Buyer

Brazil is by far the largest South American market, one that dominates the surrounding regions both economically and commercially. Automation companies will typically partner with a local distributor, agent or integrator to complete sales. Companies are advised to do due diligence on local sales representation, paying particular attention to geographic coverage of major hubs like Brasilia, Sao Paulo, and Belo Horizonte. All importers must register with the Secretariat of Foreign Trade (SECEX) and comply with the computerized documentation system called the “Sistema Integrado de Comércio Exterior” (SISCOMEX).

Companies are advised to seek legal advice from local counsel before establishing sales channels within the country. For more information, exporters

are advised to review the Brazil *Country Commercial Guide* or speak with a member of the U.S. Foreign Commercial Service in Brazil.^{liiv}

National and Regional Trade Shows

FEIMEC

May 3-7, 2016 – São Paulo, Brazil
<http://www.feimec.com.br/Home/>

MECANICA

May 17-21, 2016 – São Paulo, Brazil
<http://www.mecanica.com.br/en/>

MEC Show

July 26-29, 2016 – Serra, Brazil
<http://www.mecshow.com.br/site/2016/pt/home>

EXPOMAC

September 21-24, 2016 – Curitiba, Brazil
<http://www.expomac.com.br/>

TeQ- Tecnologiaquimica

November 8-10, 2016 – Rio de Janeiro, Brazil
<http://tecnologiaquimica.com.br/en/>

Addendum: Resources for U.S. Exporters

The U.S. Government has numerous resources available to help U.S. exporters: from additional market research, to guides to export financing, to overseas trade missions, to staff around the country and the world. A few key resources are highlighted below. For additional information about services from the International Trade Administration (ITA), please visit www.export.gov.

Country Commercial Guides

<http://export.gov/ccg/>

Written by U.S. Embassy trade experts worldwide, the *Country Commercial Guides* provide an excellent starting point for what you need to know about exporting and doing business in a foreign market. The reports include sections addressing: market overview, challenges, opportunities, and entry strategies; political environment; selling U.S. products and services; trade regulations, customs, and standards; and much more.

Basic Guide to Exporting

<http://export.gov/basicguide/>

A Basic Guide to Exporting addresses virtually every issue a company looking to export might face. Numerous sections, charts, lists and definitions throughout the book's 19 chapters provide in-depth information and solid advice about the key activities and issues relevant to any prospective exporter.

Trade Finance Guide: A Quick Reference for U.S. Exporters

<http://www.export.gov/tradefinanceguide/index.asp>

Trade Finance Guide: A Quick Reference for U.S. Exporters is designed to help U.S. companies, especially small and medium-sized enterprises, learn the basics of trade finance so that they can turn their export opportunities into actual sales and achieve the ultimate goal of getting paid on time for those sales. Concise, two-page chapters offer the basics of numerous financing techniques, from open accounts to forfaiting and government assisted foreign-buyer financing.

Trade Missions

<http://www.export.gov/trademissions/>

Department of Commerce trade missions are overseas programs for U.S. firms that wish to explore and pursue export opportunities by meeting directly with potential clients in local markets.

Trade missions include, among other activities, one-on-one meetings with foreign industry executives and government officials that are pre-screened to match specific business objectives.

Certified Trade Fairs

http://www.export.gov/eac/show_short_trade_events.asp?CountryName=null&StateName=null&IndustryName=null&TypeName=International%20Trade%20Fair&StartDate=null&EndDate=null

The Department of Commerce's trade fair certification program endorses overseas trade shows that are reliable venues and good markets for U.S. firms to sell their products and services abroad. These shows serve as vital access vehicles for U.S. firms to enter and expand into foreign markets. The certified show/U.S. pavilion ensures a high-quality, multi-faceted opportunity for American companies to successfully market overseas. Among other benefits, certified trade fairs provide U.S. exhibitors with help facilitating contacts, market information, counseling and other services to enhance their marketing efforts.

International Buyer Program

<http://export.gov/ibp/>

The International Buyer Program (IBP) brings thousands of international buyers to the United States for business-to-business matchmaking with U.S. firms exhibiting at major industry trade shows. Every year, the International Buyer Program results in millions of dollars in new business for U.S. companies by bringing pre-screened international buyers, representatives and distributors to selected shows. U.S. country and industry experts are on site at IBP shows to provide hands-on export counseling, market analysis, and matchmaking services. Each IBP show also has an International Business Center where U.S. companies can meet privately with prospective international buyers, prospective sales

representatives, and business partners and obtain assistance from experienced ITA staff.

The Advocacy Center

<http://www.export.gov/advocacy/>

The Advocacy Center coordinates U.S. government interagency advocacy efforts on behalf of U.S. exporters that are bidding on public-sector contracts with overseas governments and government agencies. The Advocacy Center helps to ensure that sales of U.S. products and services have the best possible chance competing abroad. Advocacy assistance is wide and varied but often involves companies that want the U.S. Government to communicate a message to foreign governments or government-owned corporations on behalf of their commercial interest, typically in a competitive bid contest.

U.S. Commercial Service

<http://www.export.gov/usoffices/index.asp>

With offices throughout the United States and in U.S. Embassies and consulates in nearly 80 countries, the U.S. Commercial Service utilizes its global network of trade professionals to connect U.S. companies with international buyers worldwide. Whether looking to make their first export sale or expand to additional international markets, companies will find the expertise they need to tap into lucrative opportunities and increase their bottom line. This includes trade counseling, actionable market intelligence, business matchmaking, and commercial diplomacy.

Appendix 1: Methodology

To establish a priority of foreign markets that offer best prospects for U.S. producers of industrial automation equipment, this report identified four criteria that were weighted according to perceived relevance. These criteria were:

- total volume of U.S. industrial automation exports in 2015, as measured by U.S. Census Bureau Foreign Trade Division (50%);
- compound annual growth rate (CAGR) of U.S. industrial automation exports between 2009 and 2015, as measured by U.S. Census Bureau Foreign Trade Division (20%);
- most up-to-date ranking (2012) of market by United Nations Industrial Development Organization (UNIDO) “Competitive Industrial Performance Index” (15%); and
- level of growth in industrialization as measured by rate of improvement in 2009-2012 UNIDO “Competitive Industrial Performance Index” rankings (15%).

To determine total volume and annual growth of U.S. industrial automation exports, ITA identified 77 unique 10-digit Schedule B codes. “Schedule B” codes are those used by U.S. exporters to declare their products for export, and thus reflect the dollar value of items as reported to the U.S. Census Bureau Foreign Trade Division. Domestic exports are goods that are grown, produced or manufactured in the United States. They are also commodities of foreign origin that have been changed in the United States or in a U.S. Free Trade Zone, including changes that were made from the form in which they were imported, or that have been enhanced in value or improved in condition by further processing or manufacturing in the United States.

In ranking markets, ITA placed the most emphasis on total volume of exports in 2015. It is presumed that markets with historically high U.S. exports will continue to be so in the future for a variety of reasons. Historic export trends indirectly take into account factors specific to the United States, such as geography, Free Trade Agreements (FTA) and size of market opportunity.

As the subject of this report implies, use of industrial automation equipment is predicated on a level of industrialization in the target market. Industrialization is understood to cover a wide range of social and economic activities within a society. The United Nations Industrial Development Organization (UNIDO) “Competitive Industrial Performance” Index (CIP) is a composite index that consists of sub-indicators of industrial competitiveness. It is presumed that the greater the value of a country’s CIP ranking, the more likely that country will house a market for industrial automation products. Likewise, it is presumed that countries experiencing growth over time in their CIP ranking will represent growing demand for industrial automation products.

It should be noted that the 2015 Industrial Automation Top Markets Report focuses on *physical equipment* exports. It does not take into account exports of accompanying software solutions, such as product lifecycle management (PLM), enterprise resource management (ERM), Manufacturing Execution Systems (MES), product visualization or other software. It also does not take into account *services*, such as those provided by third party systems integrators, distributors or consultants. While services undoubtedly play an important role in this sector, precise export data on industrial automation software and accompanying services is neither readily available nor consistent across markets. It is presumed that a country that imports a high volume of equipment will likely have associated trade in related services; therefore, trade statistics for equipment can be used as a proxy indicator for services.

Market	2012 Industrial Performance	Industrial Performance Growth: 2009 to 2012	2015 Merchandise Exports	Merchandise Export Growth, 2009 to 2015	Total Score
<i>Weights:</i>	<i>0.15</i>	<i>0.15</i>	<i>0.5</i>	<i>0.2</i>	<i>1</i>
Mexico	31	50	100	19	66
Canada	38	42	86	4	56
Germany	100	43	22	14	35
China	62	69	28	6	35
Poland	29	50	2	100	33
Japan	88	54	12	12	30
Singapore	58	63	14	21	29
Korea	73	55	15	7	28
Netherlands	56	44	12	35	28
Vietnam	6	90	0	62	27
United Kingdom	48	43	17	12	25
Brazil	15	50	15	32	24
Saudi Arabia	15	94	5	4	20
Taiwan	52	57	3	7	19
Thailand	4	100	1	17	19
Ireland	52	26	2	28	19
Colombia	29	50	2	26	18
Norway	60	39	0	5	16
India	52	26	5	4	15
Italy	52	26	4	6	15
Russia	17	68	1	5	14
Peru	25	50	0	12	14
Australia	21	37	8	4	13
France	10	50	5	7	13
Switzerland	12	50	0	18	13
Belgium	52	26	1	1	12
Argentina	12	50	1	12	12
Spain	35	25	2	7	11
Venezuela	8	50	3	2	10
Chile	6	50	3	3	10
United Arab Emirates	8	25	4	13	9
Israel	21	25	1	8	9
South Africa	10	28	0	4	7
Malaysia	2	10	2	0	3
Hong Kong	0	0	3	3	2

Appendix 2: Notes and Citations

- ⁱ Note: Switzerland and Venezuela are “Partner Posts,” meaning export promotion and commercial responsibilities are delegated to the State Department in the Economic Section of the U.S. Embassies in Bern and Caracas, respectively.
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- ^v Alan K. Binder, ed. “Ward’s Automotive Yearbook 2014” *Ward’s Automotive Group* (Southfield, MI)
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- ^{ix} Gale Business Insights Global- dollar value calculated through aggregating revenues of industries falling under NAICS 3121, “Beverage Manufacturing”.
- ^x This data reflects global exports between countries and should not be taken to indicate total levels of output for export and internal consumption. For example, countries like Germany rely heavily upon exports, while less is consumed in the domestic markets. For countries like the United States that are significantly larger in size and population, most of production is consumed internally, with less reliance on exporting.
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<https://www.fas.org/sgp/crs/row/R40784.pdf>
- ^{xvii} United States Trade Representative “2015 National Trade Estimate Report on Foreign Trade Barriers” p. 43.
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- ^{xlvii} Kenneth Rapoza “Brazil’s Economy Hasn’t Been This Bad Since 1930” *Forbes*, 14 January, 2016
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- ^{xlviii} Alan K. Binder, ed. “Ward’s Automotive Yearbook 2014” *Ward’s Automotive Group* (Southfield, MI), pg. 6
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<http://www.bnamericas.com/en/news/electricpower/brazil-unveils-us53bn-energy-investment-plan1>
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- ⁱⁱⁱ United States Trade Representative “2015 National Trade Estimate Report on Foreign Trade Barriers: Brazil” pg. 39.
- ^{liii} United States Trade Representative “2015 Special 301 Report”, pg. 71
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