Executive Summary

1. World Robotics 2014 Industrial Robots
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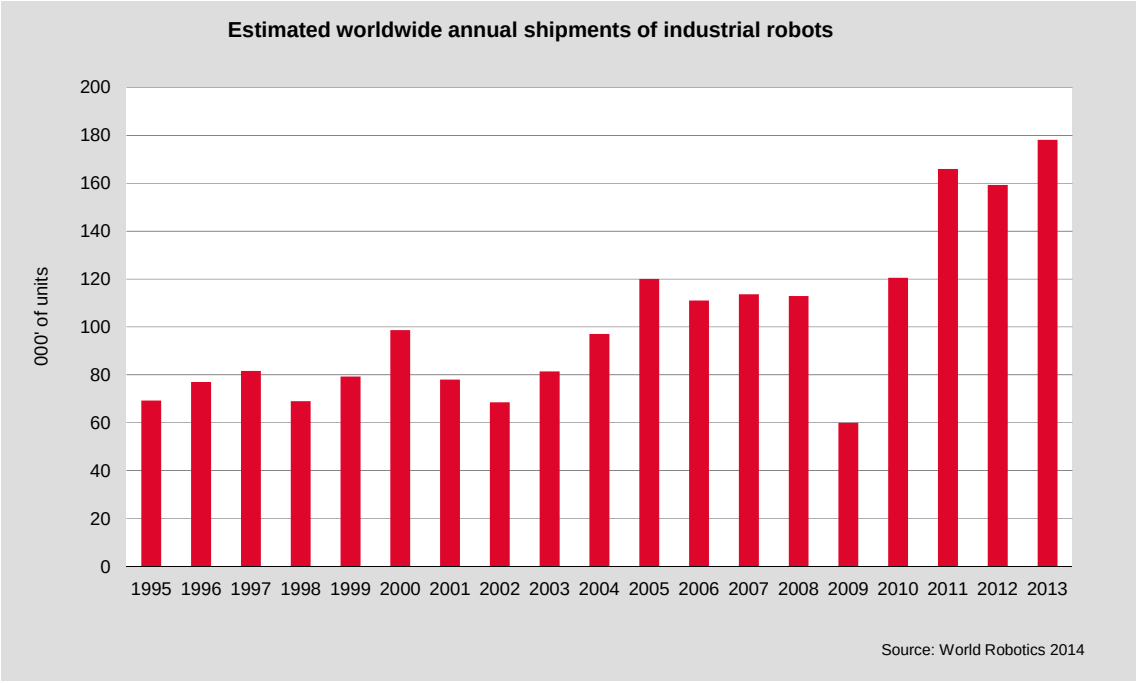
1. World Robotics 2014 Industrial Robots

2013: The highest number of industrial robots ever sold

In 2013, robot sales increased by 12% to 178,132 units, by far the highest level ever recorded for one year. Sales of industrial robots to the automotive, the chemical, and the rubber and plastics industries, as well as to the food industry continued to increase in 2013. The electrical/electronic industry also increased the number of robot installations in 2013 after the reduction of investments in 2012. China became the biggest robot market with a share of 20% of the total supply in 2013. About 70% of the total robot sales in 2013 were in Japan, China, the United States, Korea and Germany. Between 2008 and 2013 the average robot sales increase was at 9.5% per year (CAGR).



In 2013, about 30,300 industrial robots were shipped to the Americas, 8% more than in 2012, reaching again a new peak level like in 2011 and 2012. Drivers of this growth were the general industry and the automotive parts suppliers, while the motor vehicle industry reduced robot investments in 2013 compared to 2012. Since 2010, the modernization of the North American factories and the increase of production capacities in North America and in Brazil, especially by the automotive industry, accelerated the pace of robot installations substantially in the Americas. **Between 2008**

and 2013, the compound annual growth rate (CAGR) of robot supplies to the Americas was about 12% on average.

Robot installations in the **United States** continued to increase, by 6% to the peak of almost 23,700 units. Since 2010, the necessary modernization of the domestic production facilities has been boosting robot shipments to the United States. Between 2010 and 2013, annual sales in the United States increased by 18% on average per year (CAGR). In **Canada,** robot sales increased by 29% to 2,250 units in 2013. Despite the increasing trend of robot installations since 2010, the volume is still below the peak levels of 2005 and 2007, when about 3,000 robots were installed in each year. Robot sales to **Mexico** increased by 30% to a new peak level of 2,739 units in 2013. Robot sales to **Brazil** decreased from the peak level of 1,645 units to 1,398 units in 2013, 15% less than in 2012.

Asia (including Australia and New Zealand) was by far the biggest region with 98,807 industrial robots sold, 17% higher than in 2012. This was by far the highest level ever recorded. Almost all industries increased robot investment in 2013. After the strong increase of 132% in 2010, sales of industrial robots again rose, by 27%, to a new peak of about 88,700 units in 2011 and decreased in 2012 to 84,645 units. **Between 2008 and 2013, the compound annual growth rate (CAGR) of robot supplies to Asia/Australia was about 8% on average. With Japan excluded, the CAGR was about 22%.**

The **People's Republic of China** became the biggest robot market in 2013 regarding annual sales. For the first time ever, the sales figures of Chinese robot suppliers are included in the IFR statistical survey. 36,560 industrial robots were sold in 2013 in China. Thereof, Chinese robot suppliers installed about 9,000 units according to the information from the China Robot Industry Alliance (CRIA). Their sales volume was almost three times higher than in 2012. Foreign robot suppliers increased their sales by 20% in China. **Between 2008 and 2013, total supply of industrial robots increased by about 36% per year on average in China.** In 2013, robot sales in **Japan** decreased by 12% to 25,110 units. The automotive industry, the electronics industry and the metal and machinery industry significantly reduced their robot investments in 2013. The business of the electrical/electronics industry was already weak in 2011 and 2012. The automotive industry however made considerable investments in robot installations during the same period (2011-2012). New production processes and new car models made it necessary to retool the assembly lines. It was also essential to rebuild factories which were destroyed by the tsunami in 2011. Furthermore, the Japanese automotive industry has had the lead in the development and production of electric cars. Robot sales in Japan have been following a decreasing trend since 2005 (which reached the peak at 44,000 robot units). Between 2008 – just before the global financial crisis – and 2013, robot sales in Japan were decreasing by 5% on average per year (CAGR). Robot supplies in the **Republic of Korea** increased by 10% to about 21,300 units in 2013 compared to 2012. In particular, the automotive parts suppliers increased their robot investments substantially while almost all other industries bought fewer robots in 2013. In 2013, robot sales surged by 62% to almost 5,500 units, a new peak level in **Taiwan** which became the fourth largest robots market in Asia. **Thailand** is one of the rapidly growing robot markets in Asia. In 2013, however, the supply of industrial robots declined from the peak level of about 4,000 units to about 3,200 units. Robot supplies to other South/Eastern Asian countries like **Indonesia**, **Malaysia, Singapore** and **Vietnam** increased in 2013. Robot installations in **India** reached a new peak of about 1,900 units.

In 2013, industrial robot sales in **Europe** reached almost the peak of 2011 (43,800). About 43,300 units were sold 5% more than in 2012. The drivers of the growth in 2013 were the car manufacturers which increased robot installations by 17% to almost

13,800 units, the highest number ever recorded. Robot sales to almost all other industries decreased. After substantial investments of the automotive industry in 2011 robot installations in this sector were somewhat reduced in 2012, while almost all the other industries continued purchasing robots. **Between 2008 and 2013 the compound annual growth rate (CAGR) of robot supplies to Europe was about 4.5%.**

In 2013, robot sales to **Germany** – by far the largest robot market in Europe - were 4% higher than in 2012 and reached about 18,300 units, which is the second highest number ever recorded for one year. The motor vehicle suppliers again were the drivers of the growth and increased robot investments while the automotive parts suppliers again reduced their robot installations. All other industries – the general industry - decreased investments in 2013 compared to 2012. Total sales to the general industry have lagged behind expectations since 2009. The robot supply to Germany increased between 2008 and 2013 by about 4% on average per year (CAGR) despite the already existing high robot density. Total sales of industrial robots were up by 7%, to 4,701 units in 2013, from about 4,400 units in 2012 in **Italy.** The car manufacturers, the metal products industry, and the pharmaceutical industry increased robot installations, while automotive parts suppliers ordered fewer robots. The robot supply in Italy recovered in 2010 and 2011, from 2,900 in 2009 to about 5,100 units in 2011. From 2007 to 2009, robot sales fell from about 5,800 units to 2,900 units. Robot supplies in Italy between 2008 and 2013 were stagnant (compound annual growth rate, CAGR). In 2013, sales of industrial robots in **Spain** surged by 38% to almost 2,800 units compared to 2012. This was the result of considerable investments of the car manufacturers as well as of almost all other industries, except the rubber and plastics industry. In 2009, Spain had the lowest shipment level since 1998 due to the worldwide economic and financial crisis. In 2010 and 2011, robot sales recovered to about 3,100 units in 2011. In 2012, the robot supply were again down to about 2,000 units. In 2013, sales of industrial robots in the **United Kingdom** decreased by 16% to 2,486 units, the second highest number of units ever recorded. In 2012, robot installations reached a peak of 2,943 units in the United Kingdom. Robot installations had already grown substantially in 2011. The automotive industry was the driver of the substantial increase in 2011 and 2012. Even though the robot investments of the car manufacturers decreased in 2013, they were still at the second highest level after 2012. The automotive parts suppliers and the general industry further increased robot orders in 2013. The car manufacturers have been investing in modernisation, increasing capacities, retooling, and new production sites. The continued but moderate recovery of robot sales in **France** since the economic and financial crisis in 2009 was interrupted in 2013. Robot sales dropped by 27% to about 2,200 units. The robot supply to the automotive industry – the largest user of industrial robots - and almost all other industries decreased considerably in 2013. Robot sales to **BENELUX** were following an increasing trend since 2010, reaching a new peak level of almost 1,900 units. Sales to **Sweden** increased to about 1,200 units. Robot sales in most of the **Central/Eastern European** countries were considerably up, especially in the **Czech Republic** and in **Slovakia**. Those in **Turkey** continued to increase in 2013 to about 1,100 units, a new peak level.

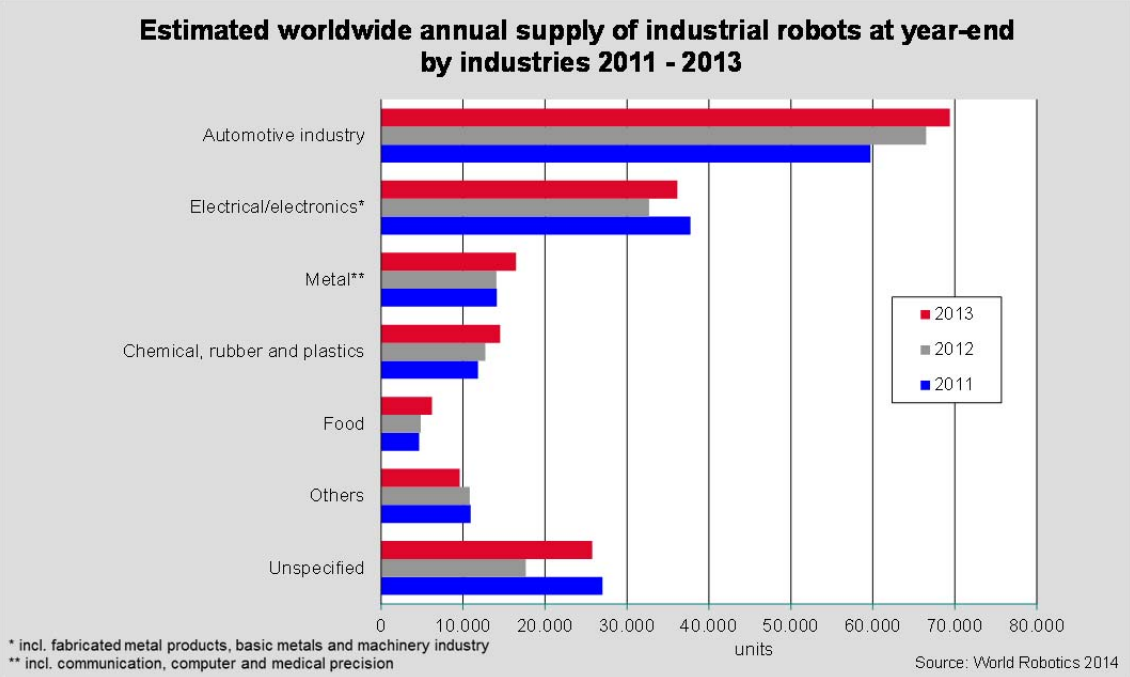
Continued increase of robot sales to the automotive industry

Since 2010, the **automotive industry** – the most important customer of industrial robots – has considerably increased investments in industrial robots worldwide. About 69,400 new robots, 4% more than in 2012, were installed in this industry in 2013, establishing again a new peak. The share of the total supply was about 39%. Between 2009 – when robot installations hit rock bottom – and 2012, robot sales to the automotive industry surged from 19,300 units to 66,500 units. With regard to Australia, China, India, Thailand, Taiwan and other Asian countries, the data concerning the distribution of robots according to various industries is not complete. But considering that most of these countries are emerging markets with regard to the automotive

industry, the real share of robot supplies to the automotive industry is probably even higher.

The **electrical/electronics industry** (including computers and equipment, radio, TV and communication devices and equipment and medical, precision and optical instruments) increased robot orders by 11% to 36,200 units in 2013. This was the second highest level after 2011 (37,750 units). The share of the total supply in 2013 was about 20%. In 2010, the worldwide shipments of industrial robots almost tripled to about 31,500 units, up from 10,900 units in 2009. Although sales decreased in 2012, the rising demand for electronic products and new products, as well as the need to automate production (particularly in low wage countries), were the driving factors for a higher number of industrial robots in 2013.

The **rubber and plastics industry** has continuously increased the number of robot installations since 2009 from about 5,800 units to 12,200 units in 2013. However, this is still far below the peak of almost 15,000 units in 2006 and 2007. Share of the total supply in 2013 was about 7%. Robot sales to the **pharmaceutical and cosmetics industry** surged by 69% to almost 2,000 units (a new peak). Despite the high degree of automation in this industry, the number of industrial robot installations has remained relatively low for many years. Between 2010 and 2012, sales decreased from almost 1,500 units to almost 1,200 units. The **food and beverage industry** increased robot orders by 28% to almost 6,200 units, accounting for a share of 4% of the total supply. Sales have been continuously increasing, except in 2009.



In 2013, sales to the **metal and machinery industry** reached a new peak level of almost 16,500 units, accounting for a share of 9% of the total supply. In 2009, sales dropped to about 5,300 units. In 2010, sales started to recover considerably, and gained further momentum in 2011. In 2012, the supply more or less stagnated.

Sales to **all industries, except for automotive and electrical/electronics,** increased by 10% in 2013. The robot suppliers have been reporting a considerable increase in

the number of customers in the past years. However, the number of units ordered by these customers is often very small. **Worldwide operational stock of industrial robots increased again considerably in 2012**

Total accumulated sales, measured since the introduction of industrial robots at the end of the 1960s, amounted to about **2,650,000 units** by the **end of 2013.** These units include the dedicated industrial robots installed in Japan up to and including 2000 (see the tables in annex A). Most of the early robots, however, have by now been taken out of service. Based on the assumptions made in chapter 1, the IFR estimates:

the total worldwide stock of operational industrial robots at the end of 2013 was in the range of 1,332,000 and 1,600,000 units.

The minimum figure above is based, as was discussed in chapter 1, on the assumption that the average length of **service life is 12 years**. A UNECE/IFR pilot study has indicated that the average service life of an industrial robot might in fact be as long as **15 years**, which would then result in a **worldwide stock of 1,600,000 units**.

In 2013, the minimum stock considerably increased by 8%. Due to the tremendous decrease of robot installations in 2009, for the first time the minimum stock of 1,021,000 units in 2009 was about 1% lower than the stock of the year before. In 2010, the stock increased by 1% to the level of 2008. Since then, the stock has been increasing considerably.

Value of the market was up to US$9.5 billion

In 2013, the sales value increased by 12% to US$9.5 million to a new peak. Unit sales also increased by 12%. It should be noted that the figures cited above generally do not include the cost of software, peripherals and systems engineering. Including the mentioned costs might result in the actual robotic systems market value to be about three times as high. The worldwide market value for *robot systems* in 20133is therefore estimated to be $29 billion.

High potential for robot installations in many countries

When comparing the distribution of multipurpose industrial robots in various countries, the robot stock, expressed in the total number of units, can sometimes be a misleading measure. In order to take into account the differences in the size of the manufacturing industry in various countries, it is preferable to use a measure of robot density. One such measure of robot density is the number of multipurpose industrial robots per 10,000 persons employed in manufacturing industry or in the automotive industry or in the "general industry" (which is all industries excluding the automotive industry).

In 2013, the **Republic of Korea again reached the highest robot density in the world**. Per 10,000 employees, 437 industrial robots were in operation. The reason is the continued large volume of robot installations in the recent years. The robot density in Japan decreased to 323 units, and in Germany it continued to increase to 282 units. It is followed by **Sweden**, which in 2013 had a density of 174 robots per 10,000 employees in the manufacturing industry. The rate has been continuously increasing in the past years. It is followed by **Belgium** and **Denmark** with a robot density of 169 and 166 units respectively. The rates increased considerably compared to 2012. The robot density continuously rose in the **United States** to 152 units in 2013. **Taiwan** had a

density of 142 units at the end of 2013, up from 124 in 2012. There was a substantial increase of robot installations in 2013. The rate of density in **Spain** continued to increase to 141 units. **France** follows with 125 industrial robots in operation per 10,000 employees in the manufacturing industry, **Finland** with 122 units, **Austria** with 118 and **Canada** with 116 units. In the **Netherlands**, **Slovenia**, **Slovakia**, **Switzerland, Australia,** the **Czech Republic and the United Kingdom,** densities ranged between 93 and 66 units. The robot density **ranked below the average robot density worldwide (62 units in 2013) in all other surveyed countries.** Many of these countries are emerging robot markets. **In 2013, the average robot density in the following regions was: 82 in Europe, 73 in the Americas, and 51 in Asia.**

The considerable high rate of automation of the automotive industry compared to all other sectors is demonstrated in the evaluation of the number of industrial robots in operation per 10,000 employees in automotive industry and in all other industries. In 2013, like in previous years, **Japan** had by far the highest robot density in the automotive industry. 1,520 industrial robots were installed per 10,000 employees in the automotive industry versus 214 robots in all the other industries. In **Germany** 1,140 robots per 10,000 employees were installed in the automotive industry in 2013. The robot density, the employment rate in the German automotive sector, as well as the operational stock, continuously increased between 2010 and 2013. Furthermore, in all other German industries the robot density continued to increase to 154 units, which is significant compared to the other countries.

Regarding the robot density in the automotive industry, **the United States** ranked third with a robot density of 1,111 units. It increased only moderately between 2010 and 2013 while the operational stock rose considerably. The reason is the **remarkable increase of employment in the automotive industry** in the same period. The employment rate in the automotive industry increased by 21% in 2013 compared to 2010. Only 82 units of robots, per 10,000 employees, were installed in all the other sectors.

In **China**, the huge amount of robot investments in the recent years resulted in a substantial increase in the robot density of the automotive industry. Between 2006 and 2013, the number of installations steadily increased from 51 to 281 robots per 10,000 employees. All other sectors also increased the number of robot installations, but the robot density rate was only about 14 robots per 10,000 employees in 2013. The potential for robot installations in this market is still tremendous.

The overall conclusion indicates that in almost all the surveyed countries, the potential for robot installations in the non-automotive industries is still tremendous, but it is also considerably high in the automotive industry among the emerging markets and in some traditional markets as well. This is mostly due to the necessary modernization and retooling that is needed in these markets.

Double-digit growth between 2014 and 2017

The result of the first two quarters in 2014 of the IFR Quarterly Statistics showed a continued high double-digit growth. A decreasing dynamic of the increase of shipments in the second half of 2014 due to the unsure development of the global economy is likely. **Global robot installations are estimated to increase at least by about 15% to 205,000 units in 2014. An even higher increase is possible if the global economic situation improves.** The main customer, the automotive industry, is continuing to invest heavily in robot installations. However, robot supply may slow down in certain markets. The electrical/electronics industry is increasing robot investments in production automation as well as in retooling for new production processes. A further increase of robot orders from other industries is also likely,

particularly from the rubber and plastics industry, pharmaceutical industry, the food and beverage industry, and the metal and machinery industry. Major growth is expected in Asia, particularly China and Taiwan, Korea and most of the other Southeast Asian markets, and in North America. Robot sales to Europe are expected to increase in 2014 even in the highly automated market of Germany. Robot sales will either stagnate or slightly increase in Italy, France, Spain and the United Kingdom. The supply in the Central and Eastern European countries will further increase. **Robot supplies in the Americas will increase by 11% and in Asia/Australia by 21%, while robot sales in Europe will rise by 6%.**

From 2015 to 2017, robot installations are estimated to increase by 12% on average per year (CAGR): about 6% in the Americas as well as in Europe, and about 16% in Asia/Australia. The trend towards automation continues to increase the volume of robot installations. Industry 4.0, linking the real-life factory with virtual reality, will play an increasingly important role in global manufacturing. The robotics industry is looking into a bright future. Consider the following facts:

- Global competition requires modernisation of production facilities.
- Energy-efficiency and new materials, e.g. carbon-composites, require retooling of production.
- Human-machine collaboration will open up new applications and attract new customers.
- Growing consumer markets require expansion of production capacities.
- Decline in products' life-cycle and increase in the variety of products require flexible automation.
- Technical improvements of industrial robots will increase the use of robots in the general industry and in small and medium sized companies, e.g. user-friendly robots, uncomplicated, and low priced robots for simple applications.
- Improved quality requires sophisticated high tech robot systems.
- Robots improve the quality of work by taking over dangerous, tedious and dirty jobs that are not possible or safe for humans to perform.

Impetus will mainly come from Asia, particularly from China, and from North America. The automotive industry will continue to be the innovator for new technology. The growing global demand for electronic products, new products, and new production technologies are boosting investments in retooling of existing production processes and expanding production capacities of the electrical/electronics industry particularly in Asia. More details are provided in Table 4.1 and Figure 4.1.

Based on the analysis of the robot density in various countries (see chapter 2.5), we can conclude that the potential for robot installations in the non-automotive industries is still tremendous, but it is also considerably high in the automotive industry among the emerging markets and in some traditional markets as well. This is mostly due to the necessary modernization and retooling that is needed in these markets.

Certain risks are involved with regard to this forecast (2015-2017):

Risks in the euro zone are still pointing downwards. Geopolitical risks such as the conflict between Russia and Ukraine, the resulting tensions between Russia and the Western world, as well as the developments in the emerging countries and on the global financial markets may affect the economy even more adversely than currently expected. Downward risks also include insufficient implementation of structural reforms in the euro zone countries.

However, investments in automation are necessary and are deemed to continue, perhaps at a later point.

Table 1

Estimated yearly shipments of multipurpose industrial robots in selected countries. Number of units

Country	2012	2013	2014*	2017*
America	**28,137**	**30,317**	**33,700**	**40,000**
Brazil	1,645	1,398	2,000	3,500
North America (Canada, Mexico, USA)	26,269	28,668	31,500	36,000
Other America	223	251	200	500
Asia/Australia	**84,645**	**98,807**	**120,000**	**186,000**
China	22,987	36,560	50,000	100,000
India	1,508	1,917	2,500	5,000
Japan	28,680	25,110	28,000	32,000
Republic of Korea	19,424	21,307	23,500	26,000
Taiwan	3,368	5,457	6,000	9,000
Thailand	4,028	3,221	4,200	7,000
other Asia/Australia	4,650	5,235	5,800	7,000
Europe	**41,218**	**43,284**	**46,000**	**55,000**
Czech Rep.	1,040	1,337	1,800	2,600
France	2,956	2,161	2,300	2,800
Germany	17,528	18,297	19,500	21,000
Italy	4,402	4,701	4,800	5,500
Spain	2,005	2,764	3,000	3,800
United Kingdom	2,943	2,486	2,500	3,500
other Europe	10,344	11,538	12,100	15,800
Africa	**393**	**733**	**800**	**1,000**
not specified by countries**	4,953	4,991	4,500	6,000
Total	**159,346**	**178,132**	**205,000**	**288,000**

Sources: IFR, national robot associations.

*forecast

** reported and estimated sales which could not be specified by countries

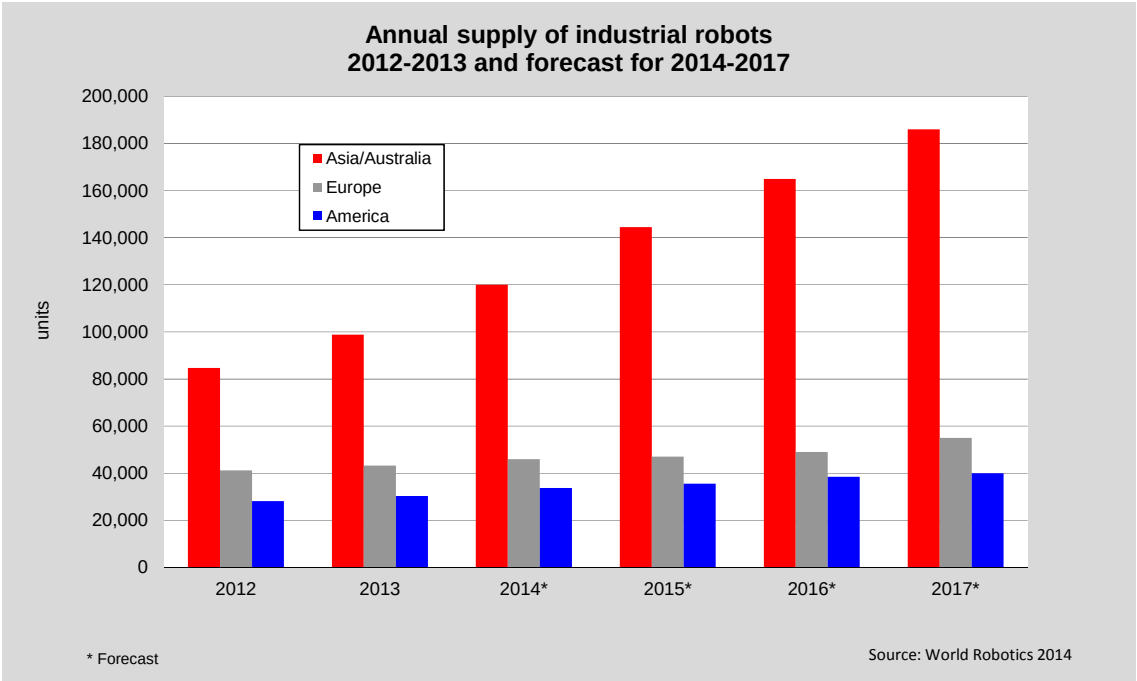


Table 2

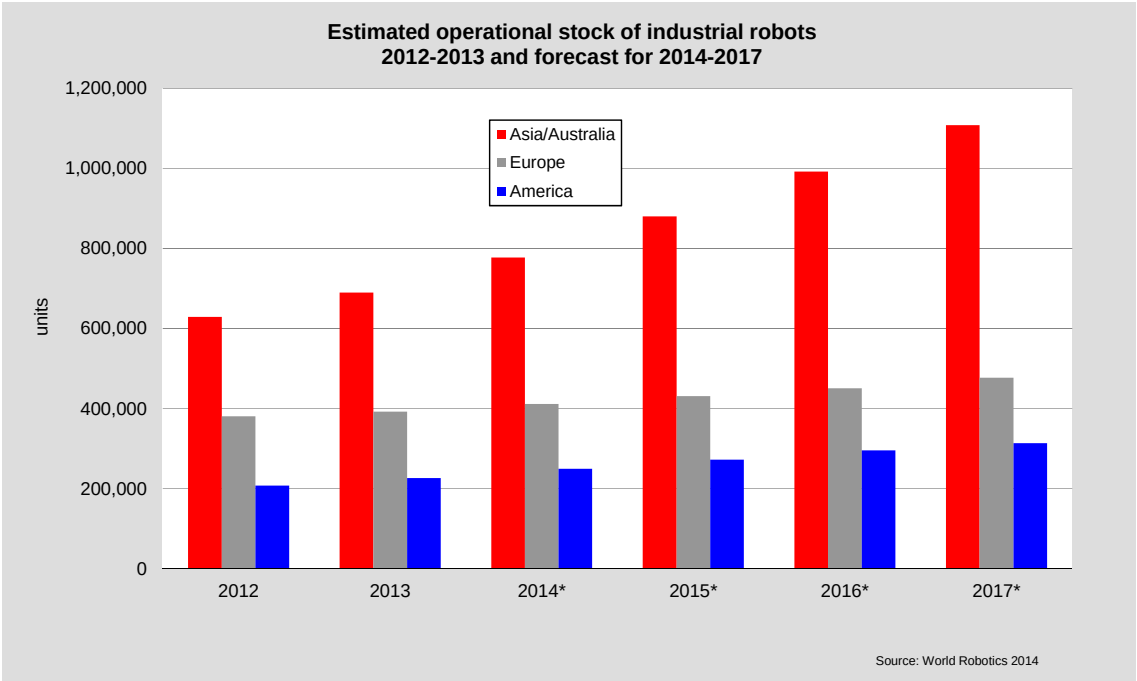
Estimated operational stock of multipurpose industrial robots at year-end in selected countries. Number of units

Country	2012	2013	2014*	2017*
America	**207,017**	**226,071**	**249,500**	**313,200**
Brazil	7,576	8,564	10,300	18,300
North America (Canada, Mexico, USA)	197,962	215,817	237,400	291,900
Other America	1,479	1,690	1,800	3,000
Asia/Australia	**628,889**	**689,349**	**777,100**	**1,107,600**
China	96,924	132,784	182,300	427,900
India	7,840	9,677	12,100	23,300
Japan	310,508	304,001	306,700	287,000
Republic of Korea	138,883	156,110	175,600	227,500
Taiwan	32,455	37,252	42,600	56,300
Thailand	17,116	20,337	24,400	40,100
other Asia/Australia	25,163	29,188	33,400	45,500
Europe	**380,546**	**392,227**	**411,500**	**476,800**
Czech Rep.	6,830	8,097	9,800	15,500
France	33,624	32,301	31,600	30,200
Germany	161,988	167,579	175,200	199,200
Italy	60,750	59,078	58,400	57,800
Spain	28,911	28,091	28,700	32,000
United Kingdom	15,046	15,591	17,300	23,800
other Europe	73,397	81,490	90,500	118,300
Africa	**2,858**	**3,501**	**4,200**	**6,600**
not specified by countries**	16,079	21,070	25,600	41,800
Total	**1,235,389**	**1,332,218**	**1,467,900**	**1,946,000**

Sources: IFR, national robot associations.

*forecast

** reported and estimated sales which could not be specified by countries



2. World Robotics 2014 Service Robots

The total number of professional service robots sold in 2013 rose by a relatively low 4% compared to 2012 to 21,000 units up from 20,200 in 2012. The sales value slightly decreased by 1.9% to US$3.57 billion. Since 1998, a total of about 150,000 service robots for professional use have been counted in these statistics. It is not possible to estimate how many of these robots are still in operation due to the diversity of these products resulting in varying utilization times. Some robots (e.g. underwater robots) might be more than 10 years in operation (compared to an average of 12 years in industrial robotics). Others like defence robots may only serve for a short time.

It is interesting to note that up to 2008 about 63,500 service robots for professional use were sold during a period of more than 12 years. However, during the past five years some 100,000, service robots for professional use were sold according to the results of these statistics. This demonstrates the accelerating rate of increase in sales. Still, few main application areas make up most of the volume.

With about 9,500 units, service robots in defence applications accounted for almost 45% of the total number of service robots for professional use sold in 2013. Thereof, unmanned aerial vehicles seem to be the most important application but their sales decreased by 12% to 8,500 units. A number of 750 unmanned ground based vehicles which include e.g. bomb fighting robots were sold, 80% more than in 2012. Up to 2010, bomb fighting robots had been counted in the category “Rescue and security applications”. Therefore, the data of the previous years were revised.

The number of demining robots was 300 units in 2013, compared to some 300 units in 2012. The value of defence robots can only roughly be estimated. It was about US$792 million, 3% lesser than in 2012. This accounts to about 22% of the total sales of professional service robots. However, the true number of these robots as well as the value might be significantly higher.

Almost 5,100 milking robots were sold in 2013 compared to 4,750 units in 2012, representing a 6% increase. 760 units of other robots for livestock farming such as mobile barn cleaners or robotic fencers for automated grazing control were sold in 2013, resulting in an increase of 46%. The total number of field robots sold in 2013 was about 5,900 units, accounting for a share of 28% of the total unit supply of professional service robots. The sales value of field robots increased by 4% to US$ 883 million, accounting for about 25% of the total value of professional service robot sales. Other robots used for livestock farming as well as agricultural robots are getting grounded in the market also. Automation of farming and livestock breeding is increasing. 73% of the total unit sales of professional service robots in 2012 were defence or field robots.

Sales of medical robots decreased by 2% compared to 2012 to almost 1,300 units in 2013, accounting for a share of 6% of the total unit sales of professional service robots. The most important applications are robot assisted surgery and therapy with more than 1,000 units sold in 2013, 2% less than in 2012. The total value of sales of medical robots increased to US$1,450 million, accounting for 41% of the total sales value of the professional service robots. Medical robots are the most valuable service robots with an average unit price of about US$1.5 million, including accessories and services. Therefore, suppliers of medical robots also provide leasing contracts for their robots.

About 1,900 logistic systems were installed in 2013, 37% more than in 2012, accounting for 9% of the total sales of professional service robots. About 1,300 automated guided vehicles in manufacturing environments and about 450 in non-manufacturing environments are building up an increase of 32% compared to automated guided vehicles sales numbers in 2012. Despite the improvement of the data base, it is assumed that the actual number of newly deployed systems is far higher. The value of sales of logistic systems is estimated at about US$216 million.

Medical robots as well as logistic systems are well established service robots with a considerable growth potential.

About 650 construction and demolition systems were supplied in 2013, however more units were estimated to be sold (no more reliable information could be retrieved). 320 robots for professional cleaning were sold, mainly professional pool cleaners. About 280 inspection and maintenance systems and 130 underwater systems were supplied.

Underwater systems are among the most valuable professional service robots with an average unit price of about US$1.1 million. The total value of sales was about US$103 million, accounting for a share of 3% of the total sales value of professional service robots in 2013. 105 rescue and security robots were installed in 2013. In the survey, a number of 733 mobile robot platforms for general use were reported. This number might also be considerably higher.

In 2013, about 4 million service robots for personal and domestic use were sold, 28% more than in 2012. The value of sales increased to US$1.7 billion.

Service robots for personal and domestic use are recorded separately, as their unit value is generally only a fraction of that of many types of service robots for professional use. They are also produced for a mass market with completely different pricing and marketing channels.

So far, service robots for personal and domestic use are mainly in the areas of domestic (household) robots, which include vacuum and floor cleaning, lawn-mowing robots, and entertainment and leisure robots, including toy robots, hobby systems, education and research.

Handicap assistance robots have taken off to the anticipated degree in the past few years. In 2013 a total of about 700 robots were sold, up from 160 in 2012 - an increase of 345%!

Numerous national research projects in many countries concentrate on this huge future market for service robots. In contrast to the household and entertainment robots, these robots are high-tech products.

The market of robots for personal transportation could not be surveyed sufficiently because the available information was poor. However, this market as well as home security and surveillance robots will gain importance in the future.

In 2013, it was estimated that 2.7 million domestic robots, including all types, were sold. The actual number might, however, be significantly higher, as the IFR survey is far from having full coverage in this domain. The value was about US$799 million, 15% higher than in 2012.

As for entertainment robots, about 1.2 million units were counted in 2013, 12% more than in 2012. Numerous companies, especially Asian ones, offer low-priced “toy robots”. But among those mass products, there are increasingly more sophisticated products for the home entertainment market. For many years now, the LEGO® Mindstorms® programme has belonged to the more high quality products offering software environments which reach well into high-tech robotics. The total value of the 2013 sales of entertainment robots amounted to US$911 million.

Projections for the period 2014-2017:

About 134,500 new service robots for professional use to be installed

Turning to the projections for the period 2014-2017, sales forecast indicate an increase to about 134,500 units with a value of US$ 18.9 billion.

Thereof, about 54,000 robots for defence applications will be sold in the period 2014-2017. They are followed by milking robots with about 28,200 units. This is probably a rather conservative estimate. These two service robot groups make up 61% of the total forecast of service robots at the current time.

A strongly growing sector will be mobile platforms in general use. Service robot suppliers estimate that about 16,000 mobile platforms as customizable multi-purpose platforms use will be sold in the period 2014-2017. Also, sales of logistic systems will increase considerably in this period. More than 10,200 units are estimated, thereof, about 9,200 automated guided vehicles. About 1,140 robots for rescue and security applications will be sold between 2014 and 2017, mainly surveillance and security robots. Robots for professional cleaning will increase to about 2,550 units in the same period, mainly systems for floor cleaning. About 7,130 medical robots will be sold plus 3,850 robots for inspection and maintenance.

In the period 2014-2017, sales of underwater systems are projected to amount to about 680 units. Another strong growing sector is public relation robots which will increase to more than 400 robots. These robots are increasingly used in supermarkets, at exhibitions, in museums etc. as guides or information providers. Another strong growing application group is construction and demolition. About 2,700 units are estimated to be sold in the period between 2014 and 2017. This is also a rather conservative forecast. Construction and demolition robots are increasingly used in areas which are dangerous or unhealthy for humans.

These forecasts are, as mentioned earlier, based mainly on individual sales projections by companies and professional organizations. It is the opinion of the IFR Statistical Department that the forecasts should be seen as trends concerning market direction rather than actual and precise sales forecasts.

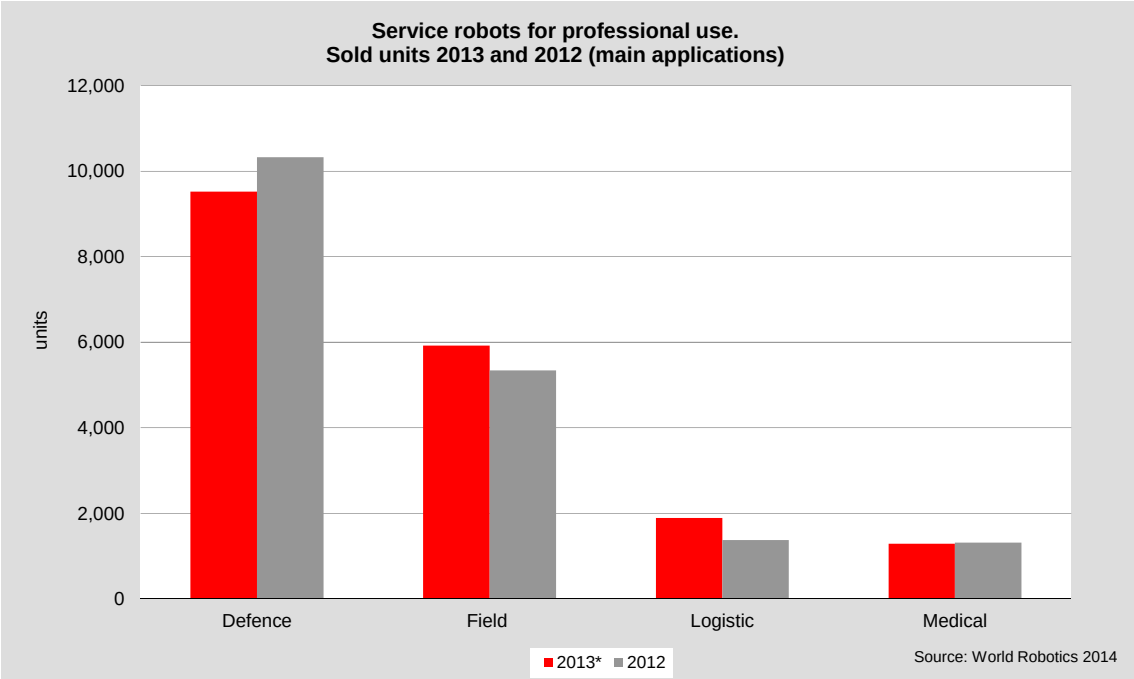
Projections for the period 2014-2017:

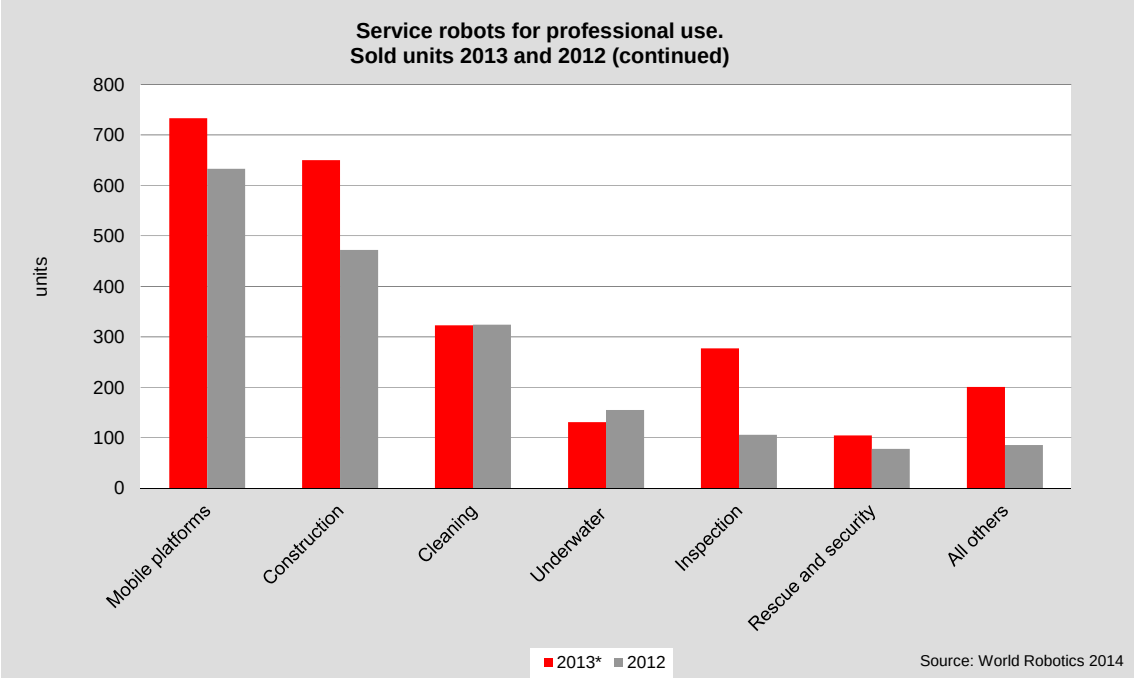
About 31 million units of service robots for personal use to be sold

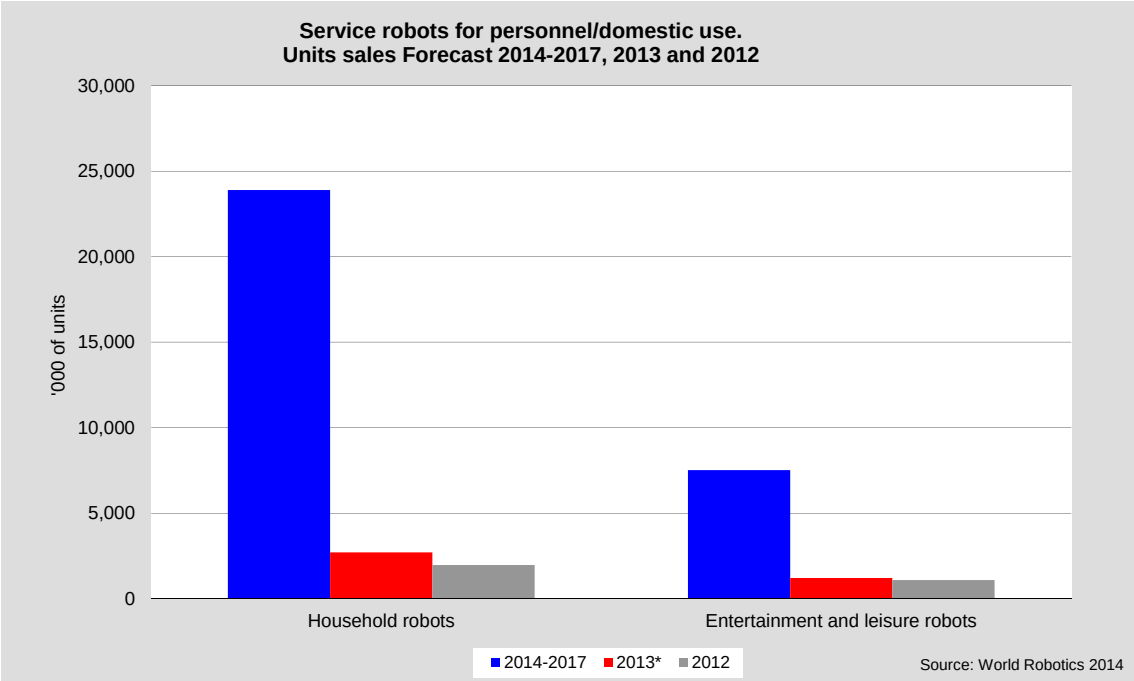
It is projected that sales of all types of robots for domestic tasks (vacuum cleaning, lawn-mowing, window cleaning and other types) could reach almost 23.9 million units in the period 2014-2017, with an estimated value of US$6.5 billion. The size of the market for toy robots and hobby systems is forecast at about 4.5 million units, most of which for obvious reasons are very low-priced. About 3 million robots for education and research are expected to be sold in the period 2014-2017.

Sales of all types of entertainment and leisure robots are projected at about 7.5 million units, with a value of about US$4.5 billion.

Sales of robots for elderly and handicap assistance will be about 12,400 units in the period of 2014-2017. This market is expected to increase substantially within the next 20 years.


Service robots for professional use.
Sold units 2013 and 2012 (main applications)
12,000
10,000
8,000
6,000
4,000
2,000
0
units
Defence
Field
Logistic
Medical
2013*
2012
Source: World Robotics 2014


Service robots for professional use.
Sold units 2013 and 2012 (continued)
800
700
600
500
400
300
200
100
0
units
Mobile platforms
Construction
Cleaning
Underwater
Inspection
Rescue and security
All others
2013*
2012
Source: World Robotics 2014


Service robots for personnel/domestic use.
Units sales Forecast 2014-2017, 2013 and 2012
'000 of units
30,000
25,000
20,000
15,000
10,000
5,000
0
Household robots
Entertainment and leisure robots
2014-2017
2013*
2012
Source: World Robotics 2014