

EXECUTIVE SUMMARY

2007 World Robot Market

World total: 114,365 units, up 3% on 2006

World total stock of operational industrial robots:

- **995,000 units, 5% greater than 2006**

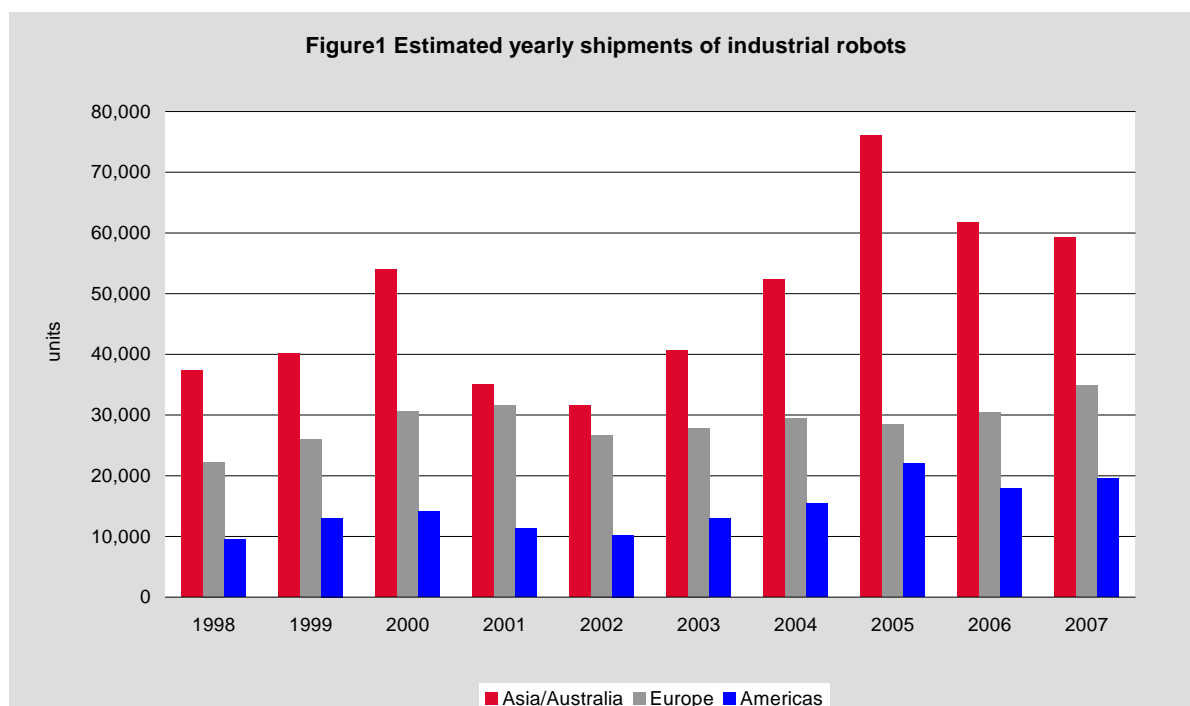
The world market increased by 3% in 2007.....

After the peak in 2005, the world market fell by 12% in 2006, to 111,052 newly supplied industrial robots. In 2007, an increase of 3% to 114,365 units was realized. As in recent years, the results in the major regions were quite different: decline in Asia, recovery in the Americas, continuing growth in Europe.

In 2007, world-wide shipments to the **automotive industry** increased by 2% compared to 2006.

Across the total **electrical/electronics industry** (including office and computing machinery and equipment, radio, TV and communication devices and equipment, and medical, precision and optical instruments), installations surged in 2005. This was the second year in a row that has seen huge increases in robot installations in these industries. Thus it is not surprising that in 2006, investment slowed down. In 2007, the slowdown continued.

Shipments to the **chemical industry** stagnated, whereas the **food and beverage industry's upward trend continued**, with a further increase in supply of 20%. Sales to the **metal products industry** also increased by a further 6% and to the **machinery industry** by 9%.



In 2007, about 59,300 robots were supplied to **Asian** countries (including Australia and New Zealand), about 4% fewer than in 2006. The main markets, Japan and the Republic of Korea, saw a continuing decline in robot investments, as did Taiwan. On the other hand, the emerging markets, such as China, the Southeast Asian countries and India, all achieved significant increases in supply. The

electrical/electronics industry, which invested very heavily in 2005, cut robot purchases by half in 2006 and continued to cut back in 2007 throughout Asia and Australia. Supplies to the automotive industry also decreased further. Supplies to all other industries only decreased slightly.

I In Japan, the largest market in Asia and the world, supplies fell by 3%, to about 36,100 units. After the substantial investments within the automotive and electrical/electronics industry in 2005, purchases in both sectors were down in 2006 and 2007. The fall was somewhat compensated by increased sales to the chemical/rubber and plastics industry and the medical devices industry.

Robot supplies fell by 6% in the **Republic of Korea** (the second largest Asian robot market) in 2007, to about 10,100 units. A slump in orders from nearly all industries – especially motor vehicle suppliers - was partly offset by stronger investment in the electronics industry and the automotive parts industry.

Robot investment is still booming in **China**, the third largest Asian robot market, with 6,600 units supplied in 2007, an increase of 14% on the previous year. Here, demand is increasing in all industries, including the automotive sector. The supply of industrial robots was up by 11% in **India**. Robot sales to Taiwan (Province of China) declined by 44%.

Total supplies in all other Asian markets, including Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam, surged by 25%. In Australia, sales increased, but only by 2%.

About 19,600 industrial robots were supplied to the **Americas** in 2007, 9% more than in 2006. Strong demand from the motor vehicle industry in the highly competitive U.S. and Canadian markets was the main reason for this solid result. Sales and production volumes of cars have stagnated or even declined over the last few years, which have also witnessed changes in the respective market shares of the individual manufacturers. The car market in the United States and Canada declined once again in 2007. The “Detroit 3” – GM, Ford and Chrysler – had to cut production while Japanese and Korean companies gained market share and continued to increase their capacities. As such, the increase in robot shipments to the automotive industry was mainly the result of investment by foreign firms. ‘General industry’ i.e. all other industries – reduced robot purchases by 4%. .

Robot supplies to **Mexico** were expected to increase in 2007, but in fact they were down. It seems that investments that had been announced were in fact postponed until 2008. Strongly increasing demand for industrial robots has been registered in **Argentina and Brazil**. Deliveries to these countries almost doubled.

Sales of industrial robots in **Europe** were up by 15% to about 34,900 units, the highest number of robots ever recorded in one year. This was the result of surging investments in the non-automotive sector as well as in the motor vehicle industry.

Germany – the largest market for industrial robots in Europe – was the engine of growth in Europe. Supplies of industrial robots surged by 30% to about 14,900 units, the highest number of robots ever recorded in one year for the country. This was due to significantly increased demand from almost all industries, especially the motor vehicle industry, the metal and engineering industry, the glass industry, the electrical/electronics industry and the food and beverage industry.

Italy – the second largest market - grew by 14%, to 5,800 units. This was the result of strong demand from the automotive industry and a remarkable increase in supply in almost all other industries.

The yearly supply of industrial robots in **France** decreased by 11% to about 2,700 units. As in 2006, supplies to the automotive industry plummeted. The chemical industry also purchased fewer robots than in 2006. The beginnings of a recovery in robot sales to the machinery industry, a significant increase in robot supplies to the metal industry, and a remarkable increase in robot supplies to the food industry all helped to counterbalance these decreases to a certain degree.

Sales to **Spain** and the **United Kingdom** were down.

Robot sales to **Central/Eastern European** countries surged by 61%. In particular, the **Czech Republic, Poland** and **Russia** all saw significant increases in robot supplies.

Table 1

Shipments and operational stock of multipurpose industrial robots Number of units

Country	Yearly installations				Operational stock at year-end		
	2006	2007	2008	2011	2007	2008	2011
America	17,910	19,582	19,700	21,700	165,328	176,500	204,200
North America (Canada, Mexico, USA)	17,417	18,722	18,500	19,000	160,632	170,700	192,300
Central and South America	493	860	1,200	2,700	4,696	5,800	11,900
Asia/Australia	61,748	59,254	62,000	73,000	498,786	512,600	589,900
China	5,770	6,581	7,500	9,500	23,908	31,400	57,900
India	836	928	1,500	4,500	2,833	4,300	14,900
Japan	37,393	36,091	36,000	40,000	356,240	353,300	355,200
Republic of Korea	10,756	10,078	10,900	11,600	72,972	77,300	101,700
Taiwan, Province of China	4,307	2,399			20,973		
Thailand	1,102	1,252			4,826		
Other Asia	812	1,138			10,907		
Australia/New Zealand	772	787			6,127		
Europe	30,385	34,882	36,900	40,000	328,568	345,200	389,300
Benelux	1,459	1,310			10,648		
France	3,071	2,736	2,800	3,000	33,462	34,500	36,200
Germany	11,425	14,902	15,500	14,500	140,161	145,200	158,100
Italy	5,108	5,811	6,200	6,500	61,589	64,500	70,100
Spain	2,709	2,409			27,367		
Sweden	865	1,046			8,830		
United Kingdom	1,220	1,050	1,050	1,100	15,340	15,300	13,800
Central/Eastern European countries	1,324	2,138			7,796		
other Europe	3,204	3,480			23,375		
Africa	426	263	300	400	1,323	1,600	2,800
Total	111,052	114,365	118,900	134,100	994,005	1,035,900	1,185,900

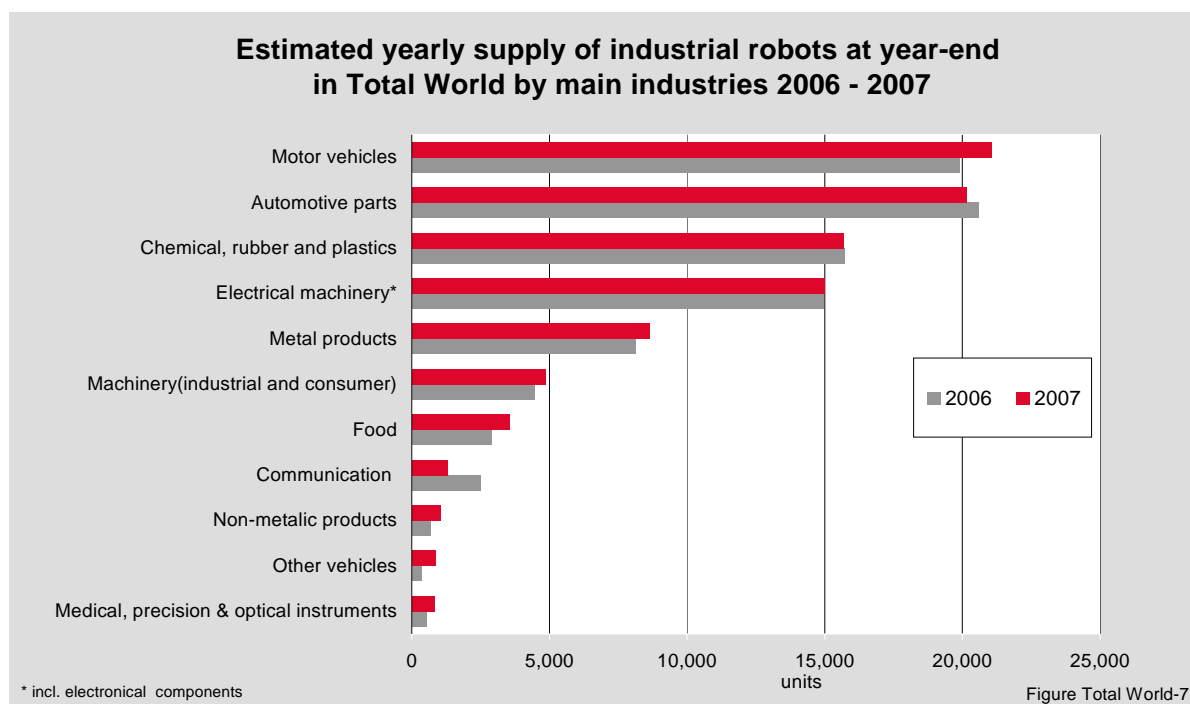
Source: IFR, national robot associations and UNECE (up to 2004)

Total accumulated yearly sales, measured since industrial robots started to be introduced in industry at the end of the 1960s, amounted to more than **1,860,000 units** at the **end of 2007, including, as mentioned before, the dedicated industrial robots installed in Japan up to and including 2000** (see the tables in annex A). Many of the early robots, however, have by now been taken out of service. The stock of industrial robots in actual operation is therefore lower. Based on the assumptions made in chapter I, UNECE and IFR estimate the

**total worldwide stock of operational industrial robots
at the end of 2007 between a minimum of 994,000 units
and a possible maximum of 1,200,000 units**

The minimum figure above is based, as was discussed in chapter I, 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 might in fact be as long as **15 years**, which would result in a **worldwide stock of 1,200,000 units**.

When the minimum 2007 stock of 994,000 units is compared with the 950,000 units at the end of 2006, it represents an increase of 5%.



Forecasts for 2008-2011

The world market for industrial robots is projected to increase by 4% from 114,365 units in 2007 to 118,900 in 2008. From 2009, it will rise by a yearly average of 4.1% to 134,100 in 2011.

In 2008, **Europe** will be up by 6% to a new peak level. North America will be down slightly by 1%, while Brazil will continue to grow. Total **Americas** will stagnate at a high level. Demand in China, India, ASEAN, Central/Eastern Europe and South America will again increase at an above-trend rate. Robot supplies will stagnate in Japan, while in the Republic of Korea growth of about 8% can be expected. **Asia/Australia** will grow by 6%.

An average growth in robot shipments world-wide of about 4% per year can be expected between 2009 and 2011. Stagnating or only slowly growing investments by motor vehicle suppliers world-wide will be compensated – to a certain degree - by more vigorous demand across all other industries. In **Europe** and in the **Americas**, average growth will be about 3% per year, and in **Asia/Australia** 5% per year.

In terms of units, it is estimated that the worldwide stock of operational industrial robots will increase from about 995,000 units at the end of 2007 to 1,186,000 at the end of 2011, representing an average annual growth rate of 4.6%.

Measurements of robot density based on the total number of persons employed

In 2001-2006, employment slightly decreased in most of the countries surveyed, while the stock of robots continued to increase. In Japan, the stock of operating robots as well as employment within the sector fell in the period 2001 to 2006. In 2007, employment in the manufacturing industry and robot stock increased in most of the countries.

In **Japan** and in the **Republic of Korea**, which collect data on all types of industrial robots and are therefore not comparable with other countries, have a quite high density of robot installations. In 2007, in Japan 310 industrial robots and in the Republic of Korea 185 industrial robots, were in operation per 10,000 persons employed in the manufacturing industry.

Germany had a density of 234 robots per 10,000 employed in the manufacturing industry in 2007. Germany is the most automated country in Europe. **Italy** and the **United States** had 116, each, and **Sweden** 115 robots per 10,000 employed in manufacturing industry. They are followed by **Finland** with 96, **France** with 82 and **Spain** with 77 robots per 10,000 employed in manufacturing industry. The densities in **Denmark, Austria, the Benelux, Switzerland, Australia** and the **United Kingdom** ranged between 50 and 76. In **Norway**, the density was 32 and in **Portugal** 20. Countries in Central and Eastern Europe, with the exception of the **Czech Republic**, have even lower densities.

Robot densities – 2 robots per 10 workers in the motor vehicle industry

Japan and Italy are in the lead with 2,100 robots and 1,772, respectively per 10,000 workers, but, bearing in mind that Japan includes all types of robots (up to and including 2000), it is not comparable with the densities of other countries. Thereafter follows Germany with a density of 1,439, United States 997, France 929, United Kingdom 794, Spain 763 and Sweden 600. The technological level with respect to robotics is thus rather homogeneous in the motor vehicle industry in most of the above-mentioned countries.

Installations of advanced multipurpose industrial robots by types

In 2007, **articulated robots** were riding on a wave of success. Supply increased by 12% to a share of **66%** of all robots installed, up from 60% in 2006. **Linear/cartesian/gantry robots** decreased by 7% to a share of 20%, down from 22% in 2006. **Cylindrical robots**, were down in the second year in a row by 20% to a share of 3% of the total, down from 12% in 2005. **SCARA robots** were down by 17% to a share of 11% of the total installations, down from 13% in 2006.

Distribution of service robots

Service robots for professional use: 49,000 units installed up to the end of 2007

With 12,008 units the service robots in **defense, rescue and security applications**, accounted for 25% of the total number of service robots for professional use installed up to the end of 2007 (see table VII.1 and figure VII.1a). Thereafter follow field robots (mainly **milking robots**) with 20%, **cleaning robots** and **underwater systems** with 12%, each. **Construction and demolition robots** (9%), **medical robots** (9%) and **mobile robot platforms for general use** (7.4%) come in the next ranges. Minor installation numbers were counted for logistic systems (2,019 units), inspection systems (1,079 units) and public relation robots (about 130 units).

Service robots for personal and private use: about 3.4 million units for domestic use and about 2.0million units for entertainment and leisure sold up to end 2007

Service robots for personal and domestic use are recorded separately, as their unit value generally is 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 cleaning and lawn-mowing robots, and **entertainment and leisure robots**, including toy robots, hobby systems and education and training robots.

The market for **robots for handicap assistance** is still small, but is expected to double in the next four years. Robots for **personal transportation** and **home security and surveillance robots** will also increase in importance in the future.

Up to the end of 2007, accumulated sales of **vacuum cleaning robots** resulted in 3.3 million units. At the end of 2007, the stock of **lawn mowing robots** amounted to 111,000 units.

Projections for the period 2008-2011: 54,000 new service robots for professional use to be installed

Turning to the projections for the period 2008-2011, the stock of service robots for professional use is forecast to increase to some 54,000 units. Application areas with strong growth are **defence, rescue and security applications, field robots, cleaning robots, medical robots** and **mobile robot platforms for multiple use**.

Projections for the period 2008-2011: about 12.1 million units of service robots for personal use to be sold

It is projected that sales of **all types of domestic robots** (vacuum cleaning, lawn-mowing, window cleaning and other types) in the period 2008-2011 could reach some **4.6 million units**.

The market for **entertainment and leisure robots**, which includes toy robots, is forecast at about **7.4 million units**, most of which, of course, are very low cost.

