

EXECUTIVE SUMMARY of

1. World Robotics 2009 Industrial Robots

2. World Robotics 2009 Service Robots

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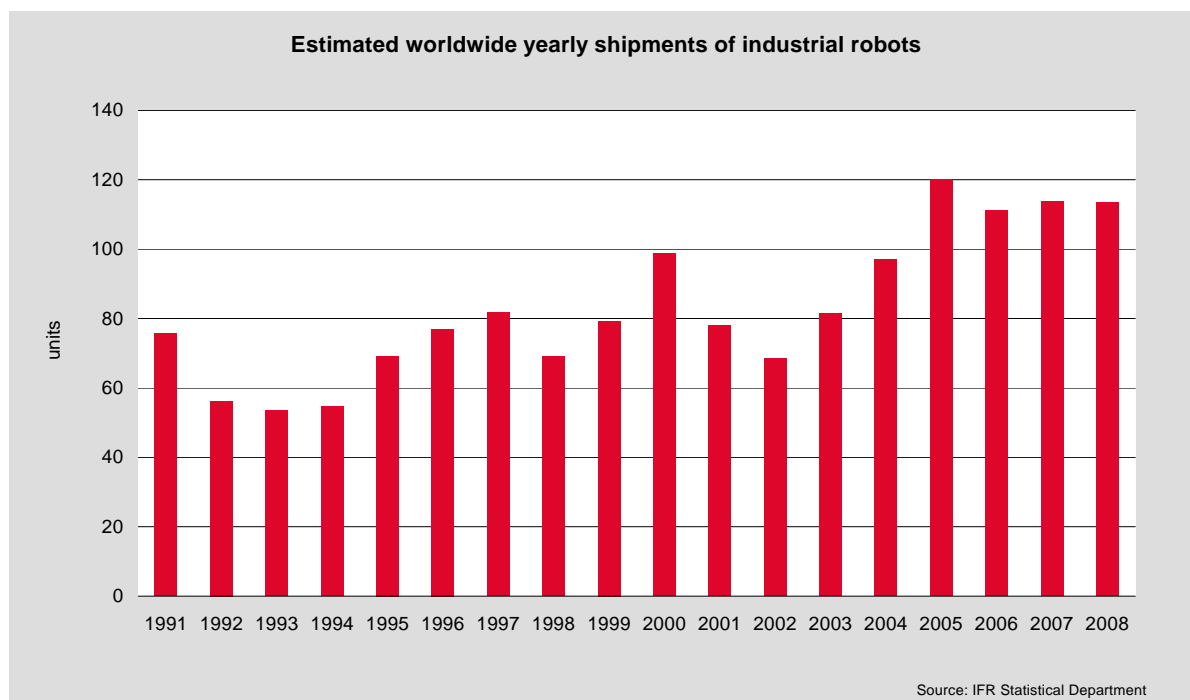
2008 World Robot Market – Already affected by the economical downturn

In 2008, the worldwide sales of industrial robots stagnated at about 113,300 units. Following a strong record in the first half of 2008, sales of robot installations were affected by the worldwide economic crisis. In many countries orders and sales were reduced dramatically in the last quarter of 2008.

It should be noted that during 2007 and 2008 demand was stagnating at a rather high level, only about 6% less than the peak level of 2005. This high level of annual sales of industrial robots since 2005 has two reasons:

- The automotive industry strengthened its investments in automation in order to increase production in emerging markets as well as to gain market shares in traditional markets.
- Many non-automotive sectors like the rubber and plastics industry, the metal and machinery industry, the food and beverage industry and the electronics industry made large investments to optimize their production processes.

The financial crisis of 2008, which was the leading cause of the global economic crisis, put a halt to this worldwide trend toward automation.



In recent years, various regions have concluded different outcomes: increase in Asia, decline in the Americas, stagnation in Europe:

In 2008, about 60,300 robots were supplied to **Asian** countries (including Australia and New Zealand), almost 4% more than in 2007. The main market, Japan, saw a continuing decline in robot

investments. But, the Republic of Korea and most of 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 robot installations in 2005, cut robot purchases substantially in 2006, and continued to cut back in 2007 throughout Asia and Australia. But in 2008, a slight increase of robot sales had been registered. After two years of decreasing supplies, sales to the automotive industry were up. Supplies to all other industries decreased.

In Japan, the largest market in Asia and the world, supplies fell by 8%, to about 33,100 units. Following the substantial investments within the automotive and electrical/electronics industry in 2005, purchases in both sectors were down in 2006 and 2007. In 2008, the orders of the automotive industry slightly increased, while all other sectors reduced their orders. The effects of the worldwide economic crisis were also felt in Japan in autumn 2008.

In 2008, - after two years of decreasing supply - 11,600 industrial robots were ordered for the Republic of Korea, up 28% from 2007. This was the result of large investments made by the motor vehicle and the electronics industry. Automotive parts suppliers and the metal products industry increased their robot orders as well. However, the rubber and plastics industry purchased fewer robots than in 2007.

Robot investment is still booming in **China**, the third largest Asian robot market, with 7,900 units supplied in 2008, an increase of 20% above the previous year. Here, demand was especially increasing in the automotive sector. The supply of industrial robots was down by 5% in **India**. Robot sales to **Taiwan** surged by 40%. Total supplies in all other Asian markets, including **Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam**, rose by 10%. In Australia, sales increased by 6%.

About 17,200 industrial robots were supplied to the **Americas** in 2008, 12% less than in 2007. The automotive industry in the **United States** – by far the largest robot market in the Americas - and in **Canada** was strongly affected by the cyclical recession which began at the end of 2007 and the collapse of the financial markets which followed in the autumn of 2008. Almost all industries were affected by the economic crisis, but the automotive industry was hit the hardest. In the recent years only the domestic car suppliers were faced with decreasing car sales in North America. But, in 2008, the foreign producers had to register a strong decrease as well. Overcapacities, shrinking demand, the wrong model policy of the domestic suppliers and the financial crisis affected the automotive industry substantially in North America. Production capacities have been cut or relocated. Investments from foreign companies have been stopped or restrained.

Sales of industrial robots in **Europe** stagnated at about 35,100 units, the second highest number of robots ever recorded in one year. This was due to a large increase of robot sales to: the metal and machinery industry, the pharmaceuticals and cosmetics industry, the food and beverage industry and the electronics industry as well as a stagnating demand from the automotive industry and decreasing sales to the rubber and plastics industry.

Germany – the largest market for industrial robots in Europe – again reached a peak level of robot sales in 2008. About 15,200 industrial robots were sold, 4% more than in 2007. This was due to significantly increased demand from almost all industries, especially in the first half of 2008. With the start of the financial and economic crisis robot sales fell dramatically. Nevertheless, the non-automotive sectors especially the metal and engineering industry and the food industry substantially increased their robot purchases.

Italy – the second largest market – was down by 18%, to 4,800 units. Especially the main customers of industrial robots, the automotive industry and the rubber and plastics industry cut their robot purchases substantially. The supply to other industries like the industrial machinery, the food industry and the pharmaceutical /cosmetics industry largely increased.

The yearly supply of industrial robots in **France** decreased by 5% to about 2,600 units. This was the result of a remarkable increase of sales to the automotive industry on the one hand but decreasing demand from all other sectors.

Sales to **Spain** stagnated and the robot shipments to the **United Kingdom** were down. Robot sales to **Central/Eastern European** countries surged by 22%. In particular, **Hungary, Poland and Slovakia** saw remarkable increases in robot supplies.

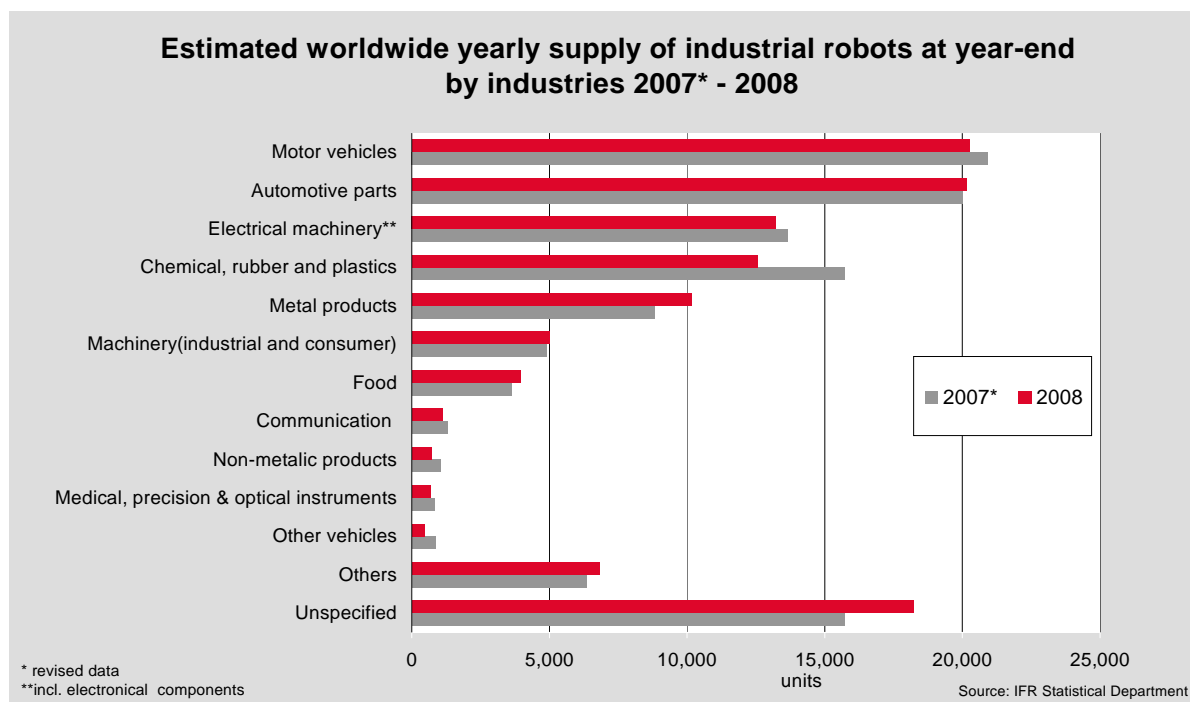
Continuing increase of robot sales to the food and beverage industry

In 2008, world-wide shipments to the **automotive industry** slightly decreased by 1% compared to 2007. In 2008, business restructuring of the motor vehicle suppliers continued due to the shrinking demand for cars in the traditional markets in Western Europe, North America and Japan. Finally, the financial crash in September 2008 resulted in a massive economic crisis for this sector. Scheduled investments were postponed or cancelled in growing markets. The automotive parts suppliers, who were already affected by the restructuring of the motor vehicle suppliers, were further strained. The supply to the automotive industries in China, Thailand, Malaysia and India further increased in 2008.

After strong investments in robots in 2004 and 2005 in the **electrical/electronics industry** worldwide (including office and computing machinery and equipment, radio, TV and communication devices and equipment, and medical, precision and optical instruments), installations slowed down in 2006 and 2007. In 2008, the slowdown continued worldwide.

After continued growth over years shipments to the **rubber and plastics industry** were down by 22%, whereas all other chemical products such as pharmaceuticals and cosmetics were again up by 14%.

The **food and beverage industry's upward trend continued**, with a further increase of 10% in supply. About two thirds of the worldwide sales to this industry were made in Europe. Sales to the **metal products industry** also increased by a further 15% and to the **machinery industry** by 2%.



More than 1,000,000 industrial robots in operation at the end of 2008

Total accumulated yearly sales, measured since the introduction of industrial robots in industry at the end of the 1960s, amounted to more than **1,970,000 units** at the **end of 2008**. **This includes, as mentioned before, the dedicated industrial robots installed in Japan up to and including 2000**. 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.

**The total worldwide stock of operational industrial robots
at the end of 2008 was in the range of 1,036,000
and 1,300,000 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 then result in a **worldwide stock of 1,300,000 units**.

An increase of 4% is evident as we compare the minimum 2008 stock of 1,036,000 units with the 994,000 units at the end of 2007.

Value of the market increased to \$6.2 billion

The total value of the world industrial robot sales was about \$6.2 billion in 2008. It should be noted that the figures cited above generally do not include the cost of software, peripherals and systems engineering. This may result in the actual robotic systems market value to be about two or three times as large. The world market for robot systems in 2008 is therefore estimated to be \$19 billion.

High potential for robot installations in the “general industry”

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).

Following the IFR calculations only Japan has a relatively high degree of robot density in the general industry. But it must be pointed out, that this high degree is mainly influenced by the robot units installed in the electronics industry. So there is still a potential for robot installations in other sectors. In Germany, Korea, Sweden and Finland the robot density in the general industry is already at a considerable level but can still increase. Taking into account the size of a country and the size of their manufacturing industry the potential is very high in USA, Canada, Korea, Brazil, most of the Western European countries and predominantly in China. The trend toward automation is especially growing in the electronics industry and in the food and beverage industry. On a more long term prospect, Russia and India will provide a tremendous potential for robot installations. The demand for quality and productivity is also rising in the so called low-wage countries, such as the Eastern European or the South East Asian countries. Furthermore, the wages in these countries are expected to rise.

Just a calculation: The estimated average robot density in the total manufacturing industry in the world is between 50 and 100. In order to increase this density to about 200, between 1.2 million and 1.5 million new robots will have to be installed.

Slump of robot sales in 2009 – Recovery between 2010 - 2012

The current economic and financial crisis affected the robot business strongly in 2009. The worldwide demand suddenly declined. The strong trend to automation had been interrupted and the success story of robotics had been thwarted. But incentives to automate will force the manufacturing industry to continue to improve their production processes:

- **Decreasing product life cycles**
- **Need of shorter time-to-market**
- **Ever greater flexibility**

- **Production expertise**
- **Global competitiveness**
- **Demographic shifts**
- **Environmental regulations**
- **Energy costs**

Industrial robots and robotic systems are key components of automation. There are many good reasons¹ for the manufacturing industry as well as for several non-industrial sectors to invest in robot installations immediately and in the future:

- **Reducing operating costs**
- **Reduce capital costs**
- **Improving product quality and consistency**
- **Improving quality of work for employees, complying with health and safety rules**
- **Increasing production output rates**
- **Increasing flexibility in product manufacturing**
- **Reducing material waste and increasing yield**
- **Save space in high value manufacturing areas**

The trend towards automation will go on! Industrial robots are a key component in the automation of processes, and automation is the key to a more eco-friendly production, to rising productivity, to more quality and safety of the work place and to solve the problem of demographic shifts in our societies.

The consequences of the worldwide economic and financial crisis affected the robotics industry heavily. **In 2009, the sales will slump by about 40%** provided the economic recovery starts that same year. If the investments of the robotics customers stay restrained until 2010, the situation will become even grimmer. The recovery of the worldwide economy is forecasted to be slow and long-term. Therefore it will take years until the robotics industry can attain the high production levels of its most successful years 2005, 2007 and 2008. The trends in the manufacturing industries can be summarized in one term: **“Green Automation”**. Energy-efficiency, reduction of CO² output and quality management are the main factors of future production processes in all industries. The successful robot suppliers will be the ones that can provide the right solutions for the industry in order to face the challenges ahead. **After the substantial fall of robot sales in 2009, an increase will resume in the period between 2010 and 2012 about 15% per year on average attaining a level of more than 100,000 units. In the Americas** sales will slump by 47% in 2009, **in Asia/Australia** by 40% and **in Europe** by 36%. Between 2010 and 2012 robot shipments will increase by about 15% per year on average in all three regions. The decrease in Europe is not as high as in the Americas or in Asia. This is due to the fact that beside the automotive industry in Europe other existing industries also play a major role in the market. The food and beverage industry, the pharmaceuticals industry, the photovoltaics industry and to some extent also the metal products industry are not as heavily affected by the global economic crisis as the automotive industry.

In terms of units, it is estimated that the worldwide stock of operational industrial robots will increase **from about 1,036,000 units at the end of 2008 to 1,057,000 at the end of 2011**, representing an average annual growth rate of less than 1%. The strong decrease in 2009 and the slow recovery will result in a more or less stagnating operational stock in the forecasted period. In most of the traditional robotic markets the stock will stagnate or even decrease, while in the emerging markets it will further increase.

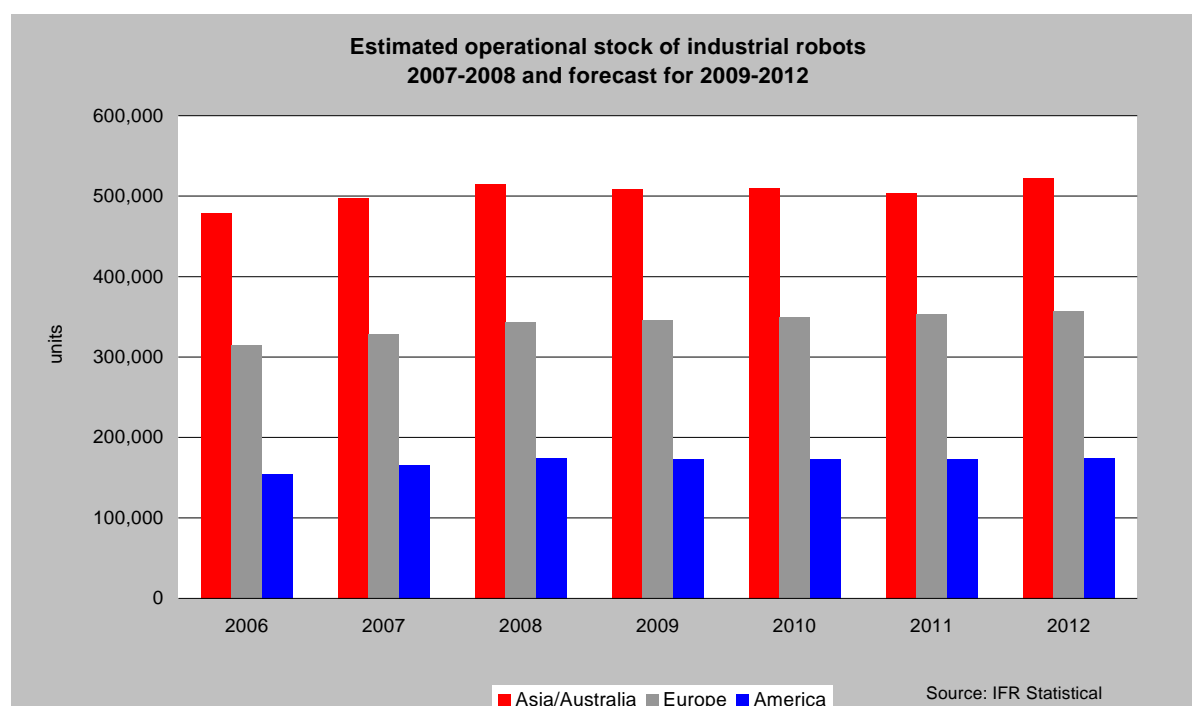
¹ Source IFR and ABB

Table 1

Shipments and operational stock of multipurpose industrial robots Number of units

Country	Yearly installations			Operational stock at year-end		
	2008	2009	2012	2008	2009	2012
America	17,192	9,600	15,100	173,977	172,800	174,400
North America (Canada, Mexico, USA)	16,242	9,000	13,500	168,489	166,800	166,100
Central and South America	950	600	1,600	5,488	6,000	8,300
Asia/Australia	60,294	35,900	54,000	514,914	509,000	523,000
China	7,879	5,000	10,000	31,787	36,800	60,400
India	883	500	1,200	3,716	4,200	7,100
Japan	33,138	18,000	27,500	355,562	339,800	298,300
Republic of Korea	11,572	8,100	9,300	76,923	79,300	97,400
Taiwan	3,359			23,644		
Thailand	1,585			6,411		
Other Asia	1,041	4,300	6,000	10,157	48,900	59,800
Australia/New Zealand	837			6,714		
Europe	35,066	22,600	34,200	343,700	346,100	357,300
Benelux	1,333			11,124		
France	2,605	1,800	2,800	34,370	34,400	33,000
Germany	15,248	10,000	13,500	144,803	145,800	149,000
Italy	4,793	3,500	5,000	63,051	62,900	60,500
Spain	2,296	1,500	2,800	28,636	27,400	20,600
Sweden	1,100			9,426		
United Kingdom	909	600	1,000	15,133	13,300	9,100
Central/Eastern European countries	2,603			9,207		
other Europe	4,179	5,200	9,100	27,950	62,300	85,100
Africa	461	300	500	1,784	1,800	1,700
Total	113,345	68,400	103,800	1,035,674	1,031,000	1,056,000

Source: IFR, national robot associations



2. World Robotics 2009 Service Robots

Service robots for professional use: 63,000 units sold up to the end of 2008

With 20,000 units the service robots in defense, rescue and security applications, accounted for more than 30% of the total number of service robots for professional use sold up to the end of 2008. Thereafter follow field robots (mainly milking robots) with 23%, cleaning robots with 9%, medical robots and underwater systems with 8%, each. Construction and demolition robots (7%), mobile robot platforms for general use (6%) and logistic systems (5%) come in the next ranges. Minor installation numbers were counted for inspection systems and public relation robots.

The **total value** of professional service robots sold up to the end of 2008 was \$11.2 billion.

Service robots for personal and private use: about 4.4 million units for domestic use and about 2.8million units for entertainment and leisure sold up to end 2009

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.

In 2008, about 940,000 vacuum cleaning robots were sold, almost 50% more than in 2007. More than 21,000 lawn mowing robots were sold in 2008.

Projections for the period 2009-2012: 49,000 new service robots for professional use to be installed

Turning to the projections for the period 2009-2012, the stock of service robots for professional use is forecast to increase to some 49,000 units. Application areas with strong growth are defence, rescue and security applications, field robots, logistic systems, inspection robots, medical robots and mobile robot platforms for multiple use.

Projections for the period 2009-2012: about 11.6 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 2009-2012 could reach some 4.8 million units.

The market for entertainment and leisure robots, which includes toy robots, is forecast at about 6.8 million units, most of which, of course, are very low cost.

