

**UNECE**United Nations Economic Commission for Europe

**Embargo:
21 October 2003,
00:01 hours GMT**

Press Release ECE/STAT/03/P01
Geneva, 17 October 2003

Is recovery around the corner? Robot orders in first half of 2003 were up by 26% to the highest level ever recorded

Worldwide growth in the period 2003-2006 forecast at an average annual rate of 7.4%

Household robots are starting to take off
UNECE issues its 2003 World Robotics survey

Below are some of the many questions answered by the newly released survey **World Robotics 2003** produced by the United Nations Economic Commission for Europe (UNECE) in cooperation with the International Federation of Robotics (IFR). The following questions and answers provide an executive summary of this 380 page in-depth analysis:

- **How did the economic slow-down in 2002 affect the robot business?** *"The world market fell by 12% as a result of falling demand in all major markets. However, robots did much better than many other similar types of investment goods. Machine tools, for instance, fell in major markets three times as much as robots, says Jan Karlsson, responsible for the UNECE/IFR publication. The robot market in the United States fell by 8%, by close to 11% in Japan and by 16% in the European Union. The drop in the European Union market should, however, be seen in the light of the fact that with the exception of 1997, when the market fell by 1%, the European Union has had market growth since 1994 and, except for 2001, double digit-growth.*
- **What about the trends in 2003 and the forecast for 2003-2006?** The UNECE/IFR quarterly survey on order intake of industrial robots, which includes most of the world's largest companies, showed that worldwide order intake increased by 26%, compared with the same period in 2002. It was the highest order intake of industrial robots ever recorded, worldwide and in all regions, except in North America where it was the third best half year recorded. The order intake, by regions, of industrial robots during the first half of 2003, compared with the same period in 2002, was as follows:

North America +35%, Europe +25%, Asia +18%, Other regions +19%

These figures indicate that a strong recovery is in sight in the investment propensity in industry. The results for the first half of 2003 point to total sales of over 80,000 robots in 2003, compared with 68,600 in 2002.

How many robots are now working out there in industry? Worldwide at least 770,000 units (possibly the real stock could be well over one million units), of which 350,000 in Japan, 233,000 in the European Union and about 104,000 in North America. In Europe, Germany is in the lead with just under 105,000 units, followed by Italy with 47,000, France with 24,000, Spain with 18,000 and the United Kingdom with 14,000.

- **What is the forecast for 2005?** A conservative forecast points to some 875,000 units worldwide, of which 333,000 in Japan, 303,000 in the European Union and 135,000 in North America.

- **Is Japan's lead position in automation eroding?** Robot business was booming in Japan in the 1980s and early 1990s. The optimism was unlimited. It seemed as if everything that could be robotized was robotized. Since the middle of the 1990s, the momentum in the robot business has moved to Europe and North America. In 2002, the robot stock increased by 6% in both regions. In Japan it has steadily been falling since 1998.
- **Why invest in robots?** In the last decade the performance of robots has increased enormously while at the same time their prices have been plummeting. A robot sold in 2002 would have cost less than a fifth of what a robot with the same performance would have cost in 1990. In the last few years the price decrease of robots has, however, started to level off. Profitability studies have shown that it is not unusual for robots to have a pay-back period as short as 1-2 years.
- **And not hire people?** In Germany, for instance, the prices of robots relative to labour costs have fallen from 100 in 1990 to 34 in 2002 and to 17 when taking into account the radically improved performance of robots. In North America, the relative price dropped to 24 and to about 12 if quality improvements are taken into consideration. *"Falling or stable robot prices, increasing labour costs and continuously improved technology are major driving forces which speak for continued massive robot investment in industry"*, concludes Jan Karlsson. Even in developing countries like Brazil, Mexico and China, robot investments are starting to take off at an impressive rate.
- **If robots are so profitable why is there not an even stronger rush to invest?** Robots are not products to be acquired "over the counter". In order to reap the benefits of robots, potential user companies must have sufficient in-house technological know-how as well as a thorough comprehension of their production processes.
- **How many robots per employee in the manufacturing industry?** About 310 per 10,000 employees in Japan, 135 in Germany, 109 in Italy, 91 in Sweden and between 50 and 70 in Finland, France, Spain, Benelux and the United States (the figure for Japan includes all types of robots while for all the other countries only multipurpose industrial robots are included. The figures are therefore not comparable).
- **In the car industry?** In Japan, Italy and Germany there is more than 1 robot per 10 production workers.
- **Are we seeing any service robots in our homes?** At the end of 2002 more than 50,000 autonomous vacuum cleaners and lawn-mowing robots were in operation. By the end of 2006, a tenfold increase is predicted.
- **How are service robots for professional use doing?** Medical robots, underwater robots, surveillance robots, demolition robots and many other types of robots for carrying out a multitude of tasks are doing very well. A stock of some 19,000 units was estimated at the end of 2002. In the period 2003-2006, another 30,000 units are projected to be added to the stock.
- **In the long run service robots will be everyday tools for mankind.** They will not only clean our floors, mow our lawns and guard our homes but they will also assist old and handicapped people with sophisticated interactive equipment, carry out surgery, inspect pipes and sites that are hazardous to people, fight fire and bombs and be used in many other applications described in the present issue of *World Robotics 2003*.

Details of the market development for industrial robots in France, Germany, Italy, Spain, United Kingdom and United States are presented in a separate press release for each of those countries.

The facts

World market fell by 12% in 2002...

Worldwide sales of multipurpose industrial robots peaked in 1990 when they reached over 80,000 units. Following the recession in 1991-1993, worldwide sales fell to about 53,000 units in 1993. The world robot market then started a period of strong recovery, which peaked in 1997 when it reached a level of 82,000 units. In 1998, however, sales plunged by 15% to just under 69,000 units. The market recovered sharply in 1999 with sales of nearly 80,000 units, an increase of almost 15% over 1998. In 2000, growth accelerated to 24%, attaining a record of almost 99,000 units. In 2001 and 2002, however, the world market fell by 21% and 12%, respectively, reaching 68,600 units (see table 1 and figure 1).

...as a result of falling demand in all major markets

After two years of falling or stagnant sales, there was a sharp recovery in Japan in 2000. Sales of all types of industrial robots surged by 32% over 1999, reaching almost 47,000 units. As from 2001, data for Japan excludes almost all dedicated robots (only dedicated robots for machining are included). Data for 2000 and 2001 are thus not comparable. Between 2001 and 2002, however, sales in Japan fell by almost 11% to about 25,400 units.

From 1995 to 2000, the robot market in the United States was booming every second year and, in the years between, it was flat or falling. In 1995, 1997 and 1999 it increased by 32%, 28% and 37%, respectively. By contrast, in 1996 and 1998, the market dropped by 5% and 13%, respectively, while in 2000 it was almost flat (+1%). However, the highest sale of industrial robots ever recorded was in 2000 when it reached nearly 13,000 units. In 2001, the market fell by nearly 17% to 10,800 units followed by another drop of 8% in 2002 to just under 10,000 units.

... but robots did much better than many other types of investment goods

While the market for industrial robots fell by 8% in the United States, the market for machine tools fell by as much as 36%. In Japan and Germany the same pattern was prevailing. Machine tools fell by 32% and 20%, respectively, while robots "only" fell by 11% and 7%.

After years of booming sales the robot market in the European Union fell by 16% ...

In the European Union, sales of multipurpose industrial robots rose by 19% in 2000 to 29,800 units. In 2001, sales continued to grow but by a modest 3%, reaching 30,700 units. With the exception of 1997, when the market fell by 1%, the European Union has had market growth since 1994 and, except for 2001, double-digit growth. This came to a halt in 2002, when the market fell by 16% to just under 26,000 units. Almost all EU countries showed a falling demand. In the United Kingdom, the market plummeted by as much as 61%.

Is recovery around the corner? The first half of 2003 was the best first half ever recorded for robotics

Looking at the first half of 2003, the UNECE/IFR quarterly survey on order intake of industrial robots, which includes most of the world's largest companies, showed that worldwide order intake increased by 26%, compared with the same period in 2002. It was the highest order intake of industrial robots ever recorded. The order intake, by regions, of industrial robots during the first half of 2003, compared with the same period in 2002, was as follows:

North America	+35%	Europe	+25%
Asia	+18%	Other regions	+19%

These figures indicate that a strong recovery is in sight in the investment propensity in industry. They also give solid support to the forecasts described above. In fact these results for the first half of 2003 point to total sales of over 80,000 robots in 2003, compared with 68,600 in 2002 (it should be noted that the forecast of merely 73,400 units for 2003, which is indicated in table 1, is part of a trend forecast for the whole period 2003-2006 and not a short-term forecast as presented here).

Table 1

Installations and operational stock of multipurpose industrial robots in 2001 and 2002 and forecasts for 2003-2006.
Number of units

Country	Yearly installations				Operational stock at year-end			
	2001	2002	2003	2006	2001	2002	2003	2006
Japan	28,369	25,373	27,300	33,900	361,232	350,169	344,000	333,400
United States	10,813	9,955	11,400	14,500	97,257	103,515	111,100	135,200
European Union	30,735	25,866	26,600	31,800	219,515	233,139	248,100	303,500
Germany	12,706	11,867	12,000	13,900	99,195	105,217	111,300	136,400
Italy	6,373	5,470	5,700	6,600	43,911	46,881	50,500	62,000
France	3,484	3,012	2,900	3,300	22,753	24,277	25,900	31,700
United Kingdom	1,941	750	800	1,100	13,411	13,651	13,700	14,400
Austria a/	330	670			3,153	3,521		
Benelux a/	620	620			8,590	8,674		
Denmark	330	249			1,683	1,853		
Finland	408	248			2,927	3,023		
Portugal	100	100			800	844		
Spain	3,584	2,420			16,378	18,352		
Sweden	859	460			6,714	6,846		
Other Europe	698	744	800	1,100	11,002	11,013	10,500	12,100
Czech Rep. a/	70	90			985	1,025		
Hungary	27	64			120	176		
Norway	98	80			618	664		
Poland	20	150			520	644		
Russian Fed. a/	150	190			5,000	5,000		
Slovakia b/								
Slovenia b/								
Switzerland a/	333	170			3,759	3,504		
Asia/Australia	5,310	5,108	5,600	7,500	56,997	60,412	64,300	73,300
Australia	270	510			2,953	3,310		
Rep. of Korea (all types of industrial robots)	4,080	3,998			41,267	44,265		
Singapore a/	300	100			5,458	5,346		
Taiwan, Province of China	660	500			7,319	7,491		
Other countries a/	2,250	1,520	1,700	2,300	10,374	11,640	12,900	17,800
Subtotal, excl. Japan and Rep. of Korea	45,726	39,195	41,800	51,900	353,878	375,454	446,900	541,900
Total, including Japan and Rep. of Korea	78,175	68,566	73,400	91,100	756,377	769,888	838,400	875,300

Sources: UNECE, IFR and national robot associations.

a/ Estimated by UNECE and IFR for some or for all the years.

b/ As from 1999 included in the aggregate "Other countries".

Europe and the United States are rapidly catching up with Japan...

In the early 1990s, installations of multipurpose industrial robots in the European Union and the United States only amounted to about 20% and 7%, respectively, of Japan's installations of (all types of) industrial robots. Following the more restrictive reporting by Japan, data show that as from 2001 more multipurpose industrial robots were installed in the European Union than in Japan.

Looking at the operational stock of industrial robots, again relating Japan's stock (to which all types of robots were added up to and including 2000) to those of multipurpose robots in the European Union and the United States, the same pattern prevails. The EU stock rose from 23% of that of Japan in 1990 to 67% in 2002. The corresponding figures for the United States were 12% and 30%, respectively. Again, if separate data had been available for multipurpose industrial robots in Japan, they might very well have shown a stock of a magnitude between that of the United States and that of the European Union.

Figure 1. Yearly installations of industrial robots, 2001-2002 and forecast for 2003-2006

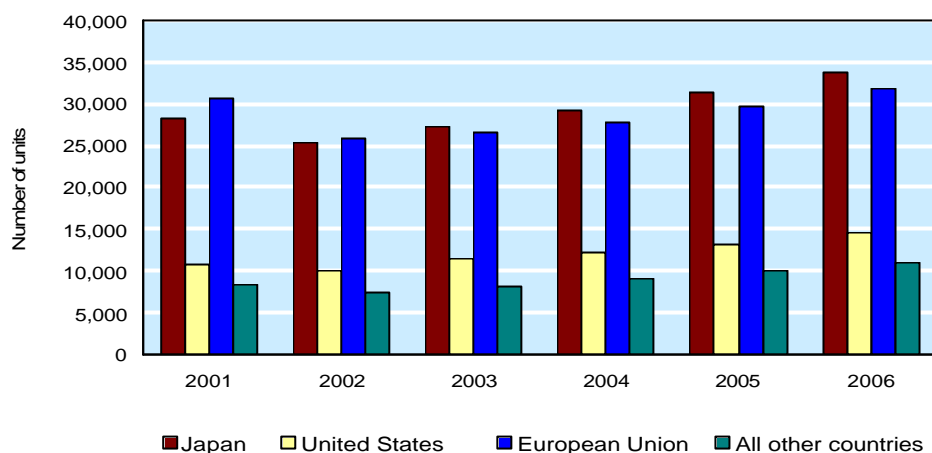
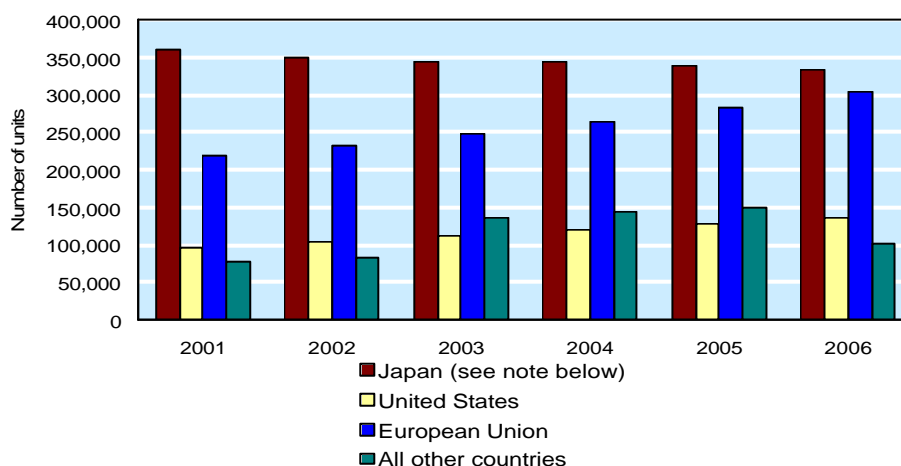


Figure 2. Estimated operational stock of industrial robots 2001-2002 and forecast for 2003-2006



Note 1: Addition to the stock data for Japan included dedicated robots up to and including 2000. Stock data shown here are therefore not fully comparable with those of other countries.

Estimate of the worldwide operational stock of industrial robots

Total accumulated yearly sales, measured since industrial robots started to be introduced in industry at the end of the 1960s, amounted at the end of 2002 to some 1,328,000 units, including, 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. UNECE and IFR estimate the

total worldwide stock of operational industrial robots at the end of 2002 between a minimum of 770,000 units and a possible maximum of 1,050,000 units

The minimum figure above is derived on the assumption that the average 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 1,050,000 units.

The minimum 2002 stock of 770,000 units can be compared with 756,000 units at the end of 2001, representing an increase of just under 2%. As can be seen from table 1 and figure 2, Japan accounts for just under half the world robot stock - largely because the Japanese figures (up to and including 2000) include all types of robots. Its share is, however, rapidly diminishing.

As from 1998, the robot stock in Japan started to decline at an accelerated rate. By 2002, its robot stock had fallen to only 85% of that of 1997.

Excluding Japan and the Republic of Korea, the world stock of multipurpose industrial robots amounted at the end of 2002 to 375,000 units, or 6% more than in 2001. As for the European Union and North America, the stock of industrial robots rose by 6% in both regions, reaching 233,000 units and 104,000 units, respectively.

Forecasts for 2003-2006

The world market for industrial robots is projected to increase from 68,600 units in 2002 to just over 91,000 in 2006 or by a yearly average of 7.4% (see table 1 and figure 1).

Growth in robot investment in Japan will be spurred by an increasing demand for replacement investment. Between 2002 and 2006, sales are projected to increase from 25,400 units to almost 34,000 units, which, bearing in mind the slump in recent years, is a rather modest recovery.

Steady growth in Europe and in North America

The robot market in the European Union is expected to grow from 25,900 units in 2002 to just under 32,000 units in 2006, representing an annual average growth of 5.3% (see table 1 and figure 1). In North America, the market is estimated to grow by an average annual rate of 9.9%, which implies that it will reach between 14,000 and 15,000 units in 2006. In view of a somewhat optimistic economic forecast by OECD of a recovery, these forecasts for robotics, mainly based on the opinions of robotics experts, might be somewhat too conservative.

The operational stock of industrial robots continues to grow, except in Japan

In terms of units, it is estimated that the worldwide stock of operational industrial robots will increase from about 770,000 units at the end of 2002 to 875,000 at the end of 2006, representing an average annual growth of 4.5%.

The year 1997 was the peak one for the Japanese robot stock, when it reached 413,000 units, including all types of industrial robots. By end 2002, it had fallen to 350,000 units and is projected to fall to 333,000 units in 2006.

When excluding Japan and the Republic of Korea, the remaining world operational stock of multipurpose industrial robots is forecasted to increase from 375,000 units to 542,000 units in the period 2002-2006, representing an average yearly increase of 9.5%.

In the United States, the operational stock of multipurpose industrial robots is forecast to reach 135,000 units in 2006. The projection for the European Union is 304,000 units, of which 136,000 in Germany; 62,000 in Italy; 32,000 in France; and 14,000 in the United Kingdom (see table 1 and figure 2).

These estimates of stock data are minimum figures. Assuming a longer average service life of robots (15 years instead of 12 years) would significantly increase the estimated stock.

Growth in robot investment is spurred by plummeting robot prices but price decreases are starting to level off...

In the 1990s, prices of industrial robots were plummeting while at the same time their performance, measured both for mechanical and electronic characteristics, was improving continuously. A UNECE/IFR survey, which covered the period 1990-2000, showed the following results:

◆ List price of one robot unit.....	-43%
◆ Number of units delivered.....	+782%
◆ Number of product variants that can be supplied to customers.....	+400%
◆ Total handling capacity (including gripper module).....	+26%
◆ Repetition accuracy.....	+61%
◆ Speed of the 6 axes.....	+39%
◆ Maximum reach.....	+36%
◆ Mean time between failures.....	+137%
◆ RAM in Mbytes.....	over 400 times
◆ Bit-size of the processor.....	+117%
◆ Maximum number of axes that can be controlled.....	+45%

Prices of industrial robots, expressed in constant 1990 US dollars, have fallen from an index 100 to 57 in the period 1990-2002, without taking into account that robots installed in 2002 had a much higher performance than those installed in 1990 (see figure 3). When taking into account quality changes it was estimated that the index would have fallen to 27. In other words, an average robot sold in 2002 would have cost only a fourth of what a robot, with the same performance, would have cost in 1990, if it ever had been possible to produce such a robot in that year.

At the same time, the index of labour compensation in, for instance, the American business sector increased from 100 to 151 (see table 2). This implies that the relative prices of robots in the United States fell from 100 in 1990 to 26 in 2002, without taking into consideration the enormous improvements in robotics during this period, and to only 14 when taking such improvements into consideration. Other major robot-using countries had similar developments in their relative robot prices.

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

In figure 4 five groups of countries can be distinguished with respect to robot densities, expressed as the number of robots per 10,000 persons employed in the manufacturing industry (ISIC rev.3: D). The first group includes Japan and the Republic of Korea, whose robot stock includes all types of industrial robots and is therefore not comparable with other countries. In 2002, these two countries had robot densities of about 310 and 130, respectively. While the density in the Republic of Korea is increasing rapidly, it has fallen in Japan since the peak in 1998.

The second group is topped by Germany, which in 2002 had a density of 135, followed by Italy with 109 and Sweden with 91 robots per 10,000 employed in the manufacturing industry. The third group of countries includes Finland with 68, France with 67, and Spain with 66 robots per 10,000 employed in the manufacturing industry. In the fourth group, the densities ranged between 58 and 36 in the United States, Benelux, Denmark, Austria and the United Kingdom. In Norway and Australia the density amounted to 21 and 33, respectively, while at the bottom was Portugal with 9. Countries in central and eastern Europe, with the exception of the Czech Republic, have even significantly lower densities.

Despite this large range in the robot densities of European countries, it is interesting to note that the robot density in the European Union is about 50% higher than that of the United States.

Robot densities – over 1 robot per 10 workers in the motor vehicle industry

Figure 5 shows data on the number of multipurpose industrial robots per 10,000 production workers in the motor vehicle industry. Japan is in the lead with 1,700 robots 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 Italy with a density of 1,130, Germany 1,000, United States 770, Spain 760, France 630, Sweden 570 and the United Kingdom 550. The technological level with respect to robotics is thus rather homogeneous in the motor vehicle industry in the above-mentioned countries.

When countries collect data they do not always include the same types of robots - some countries concentrate on the more sophisticated robots while others, e.g. Republic of Korea, collect data on all types of robots that satisfy the IFR definition. For this reason, country data are not always comparable. Looking only at the subset of robots with 5 axes or more, the comparability between countries is significantly improved (see table 3).

Figure 3
Price index of industrial robots for international comparison (based on 1990 \$ conversion rate), with and without quality adjustment.

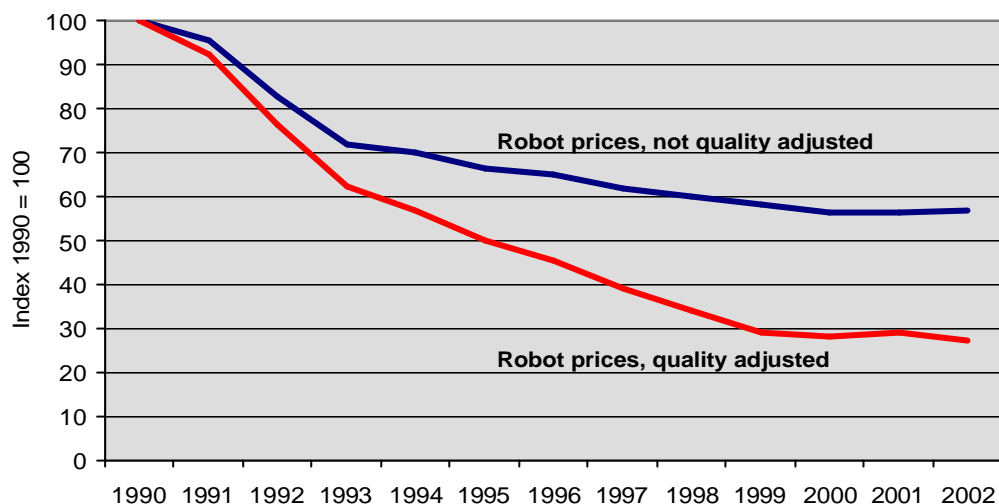


Table 2

Price index of industrial robots in the United States, with and without quality adjustment. Index of labour compensation per employee and hourly wages, excluding social costs, in selected industry branches

Year	Index of robot prices, 1990=100		Index of labour compensation		Hourly wages, excluding social costs, production workers, \$		
	without quality adjustment	with quality adjustment	Business sector a/	Manufact. industry (ISIC rev.3-D) b/	Manufact. industry (ISIC rev.3-D) c/	Food industry (ISIC rev.3: 15+16) c/	Motor veh. industry (ISIC rev.3: 34) c/
1990	100.0	100.0	100.0	100.0	10.83	9.62	14.56
1991	95.5	93.3	103.9	100.9	11.18	9.90	15.23
1992	69.0	64.7	109.8	115.3	11.46	10.20	15.45
1993	52.1	45.6	112.9	120.0	11.74	10.45	16.10
1994	55.9	47.3	115.5	123.5	12.07	10.66	17.02
1995	58.7	48.0	117.7	126.3	12.37	10.93	17.34
1996	55.1	42.3	120.6	129.8	12.77	11.20	17.74
1997	45.6	30.6	124.5	133.1	13.17	11.49	18.04
1998	45.3	28.1	130.7	136.4	13.49	11.80	17.84
1999	40.0	20.7	136.3	140.1	13.90	12.11	18.10
2000	36.6	19.2	144.4	146.1	14.37	12.51	18.80
2001	31.0	16.6	147.7	150.8	14.83	12.89	19.40
2002	36.9	18.5	151.4	156.4	15.30	13.23	20.50

Sources: United Nations Economic Commission for Europe (UNECE) and International Federation of Robotics (IFR).

a/ Source: OECD Economic Outlook, December 2002. Data for 2002 are estimated.

b/ Total compensation, blue-collar occupations. Source: U.S. Bureau of Labor Statistics. Data for 2002 are provisional.

c/ Source: U.S. Bureau of Labor Statistics. Data for 2002 are provisional.

General note: The robot price indices calculated for individual countries are always based on prices of the same seven robot models supplied by four major international robot companies with large market shares in Europe and the United States.

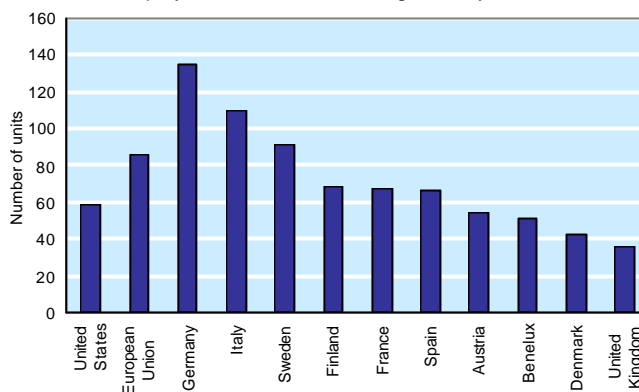
	2002
Japan a/	308
Rep. of Korea b/	128
United States	58
European Union	86
Germany	135
Italy	109
Sweden	91
Finland	68
France	67
Spain	66
Austria	54
Benelux	51
Denmark	43
United Kingdom	36
Australia	33
Norway	21
Portugal	9
Czech Rep.	8

Sources: UNECE and IFR.

a/ Up to and including 2000, data for Japan include all types of robots. As from 2001, data exclude dedicated robots, except for dedicated machining robots. As from 2001, Japanese statistics are therefore much more comparable with those of other countries.

b/ All types of industrial robots.

Figure 4. Number of robots per 10,000 persons employed in the manufacturing industry in 2002



	2001	2002
France	540	630
Germany	890	1,000
Italy	1,010	1,130
Japan	1,600	1,700
Spain	670	760
Sweden	540	570
United Kingdom	520	550
United States	690	770

Sources: UNECE and IFR.

Figure 5. Number of robots per 10,000 production workers in the motor vehicle industry, 2001 and 2002

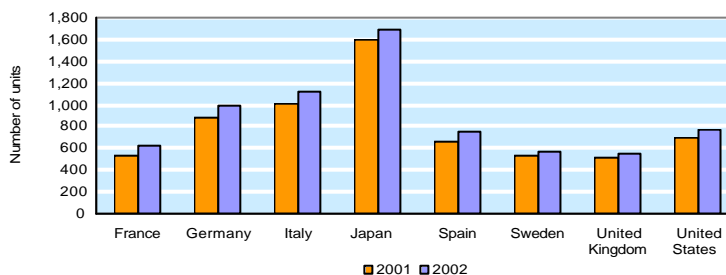


Table 3

Number of multipurpose industrial robots with 5 axes or more compared with the total number of multipurpose industrial robots in 2002. Ranking according to number of robots with 5 axes or more

	All robots	Robots with ≥ 5 axes	% share
USA	9,955	9,090	91.3
Germany	11,867	8,181	68.9
Italy	5,470	4,388	80.2
France	3,012	2,469	82.0
Spain	2,420	2,047	84.6
Rep. of Korea a/	3,998	1,142	28.6
United Kingdom	750	694	92.5
Austria	670	604	90.1
Sweden	460	449	97.6
Benelux	620	439	70.8
Finland	248	241	97.2
Denmark	249	208	83.5
Russian Fed.	190	180	94.7
Switzerland	170	151	88.8
Poland	150	136	90.7
Norway	80	68	85.0
Hungary	64	61	95.3
Subtotal	40,373	30,548	75.7
Japan	25,373	n.a.	
All other countries	2,820	n.a.	
Total	68,566		

Sources: UNECE, IFR and national robot associations.

a/ All types of industrial robots. About 26% of the robots are not classified by number of axes.

Diffusion of service robots

Table 4 gives details about the results of the UNECE/IFR survey of sales of service robots, broken down by application areas. As many companies did not provide market data, the figures reported here probably underestimate significantly the true sales amounts as well as the installed base of robots.

Except for domestic robots (so far mainly lawn-mowing robots) and entertainment robots, almost all service robots installed up to 2002 and inclusive are robots for professional use. The major application areas for professional robots are underwater robots, medical robots, demolition robots, mobile robot platforms for multiple use, laboratory robots, and cleaning robots.

Service robots for professional use: 18,600 units installed up to the end of 2002

Of the estimated 18,600 units of service robots for professional use installed up to the end of 2002, underwater robots with their 3,680 units accounted for 20% (see table 4 and figure 6). Thereafter followed cleaning robots with 18%, demolition robots with 15% and medical robots with 12%. Mobile robot platforms had a share of 10% while laboratory robots made up 6%. Milking robots had a share of nearly 4%.

As the unit values differ very significantly between various application areas - from some hundreds of thousands of dollars for underwater robots and medical robots to a few thousand dollars for laboratory robots or a few hundred dollars for domestic or entertainment robots - market data, expressed in terms of value in US dollars, might differ quite substantially from market data expressed in number of units.

Service robots for personal and private use: over 600,000 units sold up to end 2002

Service robots for personal and private use are recorded separately, as their unit value 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 marketing channels.

So far, service robots for personal and private use are mainly in the areas of domestic (household) robots, which include vacuum cleaning and lawn-mowing robots, and entertainment robots, including toy and hobby robots (see table 4). Sales of lawn-mowing robots have started to take off very strongly, with sales in excess of 10,000 units, and should continue to boom. The market potential is very large. Vacuum cleaning robots were introduced on the market at end of 2001. The market expanded rapidly in 2002-2003.

Up to the end of 2002, it is estimated that some 54,000 domestic robots, all types included, have been sold. As for entertainment robots, it is estimated that almost 550,000 units have been sold up to the end of 2002.

Projections for the period 2003-2006: 30,000 new service robots for professional use to be installed

Turning to the projections for the period 2003-2006, the stock of service robots for professional use is forecasted to increase by some 30,000 units (see table 4 and figure 6). Application areas with strong growth are medical robots with more than 6,000 new robots being added, surveillance and security robots (3,800), underwater robots (3,000), mobile robot platforms for multiple use (2,800), cleaning robots (1,700) and robotic systems for milking (1,450).

Projections for the period 2003-2006: over 2.1 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 2003-2006 can reach some 638,000 units (see table 4 and figure 7). Although this number excludes the too optimistic forecasts of several millions of units made by some companies, it might in the light of sales recorded already in 2003 be far too low.

The market for toy and entertainment robots is forecasted to exceed 1.5 million units, most of which, of course, are very low cost. One company expects sales of several millions of units within the next years. This estimate has been excluded from the numbers shown in table 4 and figure 7.

Table 4

Estimated number of service robots installed up to the end of 2002, by application areas, and forecasts for the period 2003-2006

Types of robots	Stock at end 2002	Installations 2003-2006
SERVICE ROBOTS FOR PROFESSIONAL USE:		
Cleaning robots	3,370	1,710
Floor cleaning	340	520
Tank cleaning a/		
Window cleaning; wall cleaning a/		
Other (pool cleaning, cleaning aircraft, boats, reservoirs, etc.)	3,030	1,190
Sewer robots (cleaning, inspection)	80	130
Wall-climbing robots (cleaning, inspection) c/		
Inspection robots, general (power plants, nuclear sites, bridges etc.)	215	240
Demolition robots	2,700	1,510
Robots for servicing and/or dismantling nuclear, chemical, waste, military and other hazardous complexes	65	40
Underwater robots	3,680	3,050
Inspection		
Work class robots		
Medical robots	2,285	6,090
Surgical robots	2,155	4,720
Robot-assisted surgery	55	1,220
Other b/	75	150
Robots for disabled persons; Assistive robots; Wheelchair robots b/	175	140
Courier robots; Mail delivery robots b/	125	40
Mobile robot platforms (multiple use)	1,910	2,840
Surveillance robots; Security robots	260	3,840
Guide robots (e.g. in museums)	10	20
Refuelling robots	55	1,050
Fire and bomb fighting robots b/	240	350
Robots in the construction industry c/		
Robots in agriculture and forestry, of which	730	1,450
Automated milking systems	730	1,450
Hotel and restaurant robots b/ c/		
Clean-room robots c/		
Laboratory robots	1,050	410
Nano robots, micro robots c/		
Humanoid robots c/		
Space robots c/		
Other types	1,650	6,870
Total number of units	18,600	29,780
Estimated value in \$ million, of which	2,625	3,280
controls systems, sensors, software, services and R&D	165	240
SERVICE ROBOTS FOR PERSONAL AND PRIVATE USE:		
Domestic robots	53,500	638,000
Vacuum cleaning b/		400,000
Lawn-mowing		125,000
Other		113,000
Entertainment/hobby/leisure time robots b/	545,000	1,500,000
Educational robots b/	8,300	15,320
Robots in marketing	20	10,100
Customized robots	20	40
Total number of units	606,840	2,163,460
Estimated value in \$ millions	960	2,750
Total number of units (professional and private use)	625,440	2,193,240
Estimated value in \$ millions	3,585	6,030

Sources: UNECE and IFR.

a/ Included in other (pool cleaning, cleaning aircraft, boats, reservoirs, etc.).

b/ Too optimistic market estimates by companies for 2003-2006 have been excluded.

c/ No information or estimate available or data included in "Other types".

Figure 6 Service robots for professional use. Stock at the end of 2002 and projected installations in 2003-2006

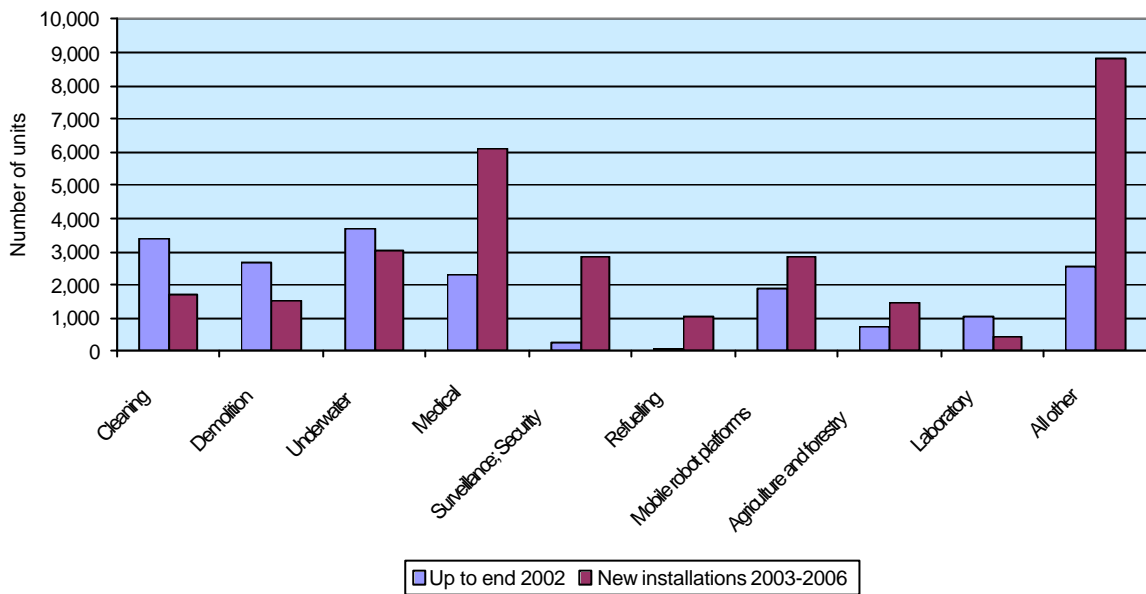
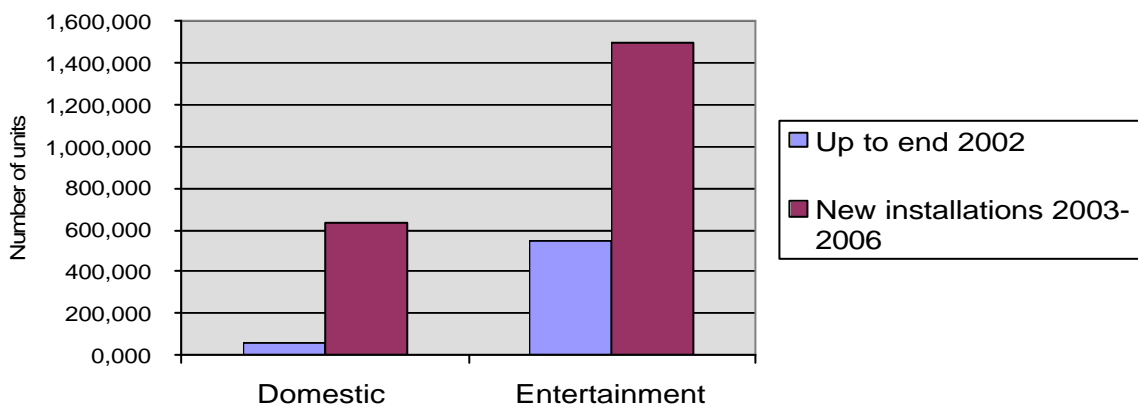
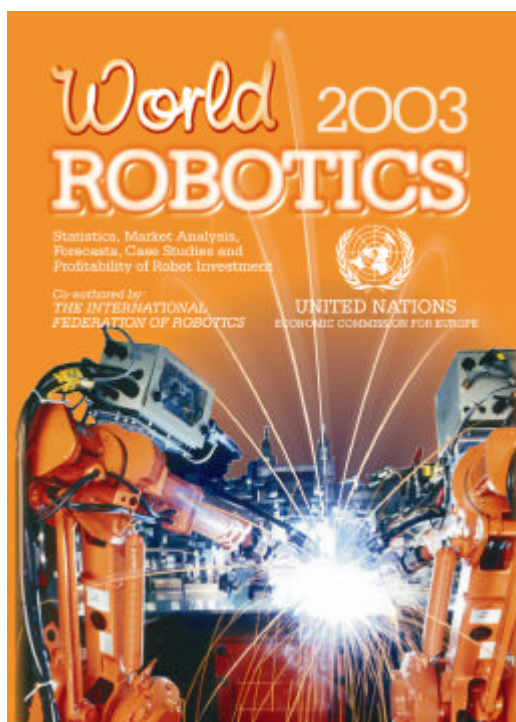


Figure 7 Service robots for private use. Stock at end 2002 and projected installations 2003-2006



The publication **World Robotics 2003 – Statistics, Market Analysis, Forecasts, Case Studies and Profitability of Robot Investment** is available, quoting Sales No. GV.E.03.0.16 or ISBN No. 92-1-101059-4, through the usual United Nations sales agents in various countries or from the United Nations Office at Geneva (see address below), priced at US\$ 130:



**Sales and Marketing Section
United Nations**

Palais des Nations
CH - 1211 Geneva 10, Switzerland

Phone: +41(0)22 917 26 00 / 26 14

Fax: +41(0)22 917 00 27

E-mail: unpubli@unog.ch

For more information about the publication, please contact:

Mr. Jan Karlsson
Statistical Division
United Nations Economic Commission
for Europe (UNECE)
Palais des Nations
CH - 1211 Geneva 10, Switzerland

Phone: +41(0)22 917 32 85
Fax: +41(0)22 917 00 40
E-mail: jan.karlsson@unece.org

or: International Federation of Robotics (IFR)
Statistics Department
c/o VDMA Robotics+Automation
Lyoner Str. 18
D – 60528 Frankfurt am Main
Germany

Phone: +49 (69) 6603 1502
Fax: +49 (69) 6603 2502
E-mail: gudrun.litzenberger@vdma.org