

Executive Summary World Robotics 2016 Service Robots

The total number of professional service robots sold in 2015 rose considerably by 25% to 41,060 units up from 32,939 in 2014. The sales value increased by 14% to US\$ 4.6 billion. Since 1998, a total of about 220,000 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 life time of 12 years in industrial robotics). Others like defence robots may only serve for a short time.

19,000 logistic systems were installed in 2015, 50% more than in 2014 (revised data: 12,652), accounting for 46% of the total units and 17% of the total sales (in value) of professional service robots. Data for 2014 of logistic systems were revised due to better information coverage. 3,410 automated guided vehicles in manufacturing environments and 15,515 in non-manufacturing environments are building up an increase of 51% compared to automated guided vehicles sales numbers in 2014. 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\$ 779 million, an increase of 52% compared with 2014.

With 11,207 units, service robots in defense applications accounted for 27% of the total number of service robots for professional use sold in 2015. Thereof, unmanned aerial vehicles seem to be the application with the highest share and their sales increased by 4% to 9,391 units. A number of 1,516 unmanned ground based vehicles which include e.g. bomb fighting robots were sold, 7% less than in 2014. The number of demining robots was 350 units in 2014, compared to 300 units in 2015. The value of defense robots can only roughly be estimated. It was about US\$ 1.038 million, only 1% more than in 2014, this number remained constant and accounts to about 23% of the total sales of professional service robots. However, the true number of these robots as well as the value might be significantly higher.

A total of 5,665 milking robots were sold in 2015 compared to 5,180 units in 2014, representing a 9% increase. 160 units of other robots for livestock farming such as mobile barn cleaners or robotic fencers for automated grazing control were sold in 2015, as many as 2014. The total number of field robots sold in 2015 was about 6,440 units, accounting for a share of 16% of the total unit supply of professional service robots. The sales value of field robots increased by 11% to US\$ 1.1 million, accounting for about 24% of the total value of professional service robot sales. Agricultural robots are getting grounded in the market also. Sales increased from 123 units in 2014 to 309 units in 2015. Automation of farming and livestock breeding is increasing.

Sales of medical robots increased by 7% compared to 2014 to 1,324 units in 2015, accounting for a share of 3% of the total unit sales of professional service robots. The most important applications are robot assisted surgery and therapy with 1,107 units sold in 2015, 12% more than in 2014, while the other medical robots decreased from 246 to 217 units in 2015. The total value of sales of medical robots increased to US\$ 1,463 million, accounting for 32% 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\$ 1.0 million, including accessories and services. Therefore, suppliers of medical robots also provide leasing contracts for their robots. Medical robots as well as logistic systems are well established service robots with a considerable growth potential.

In the survey, a number of 707 mobile robot platforms for general use were reported, 32% more than in 2014. Sales of robots for professional cleaning more than doubled in 2015 compared to 2014 to almost 600 units. About 568 construction and demolition systems were supplied in 2015, however more units were estimated to be sold (no more reliable information could be retrieved). 275 inspection and maintenance systems and 131 underwater systems were supplied. Underwater systems are among the most valuable professional service robots with an average unit price of about US\$ 0.69 million. The total value of sales was about US\$ 91 million, accounting for a share of 2% of the total sales value of professional service robots in 2015. 69 rescue and security robots were installed in 2015. This number might also be considerably higher.

Sales of Powered Human Exoskeletons were up from 273 units in 2014 to 370 units in 2015. These robots successfully are used for rehabilitation and ergonomic support for reducing loads.

In 2015, about 5.4 million service robots for personal and domestic use were sold, 16% more than in 2014. The value of sales increased by 4% to US\$2.2 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.

Handicap assistance robots have taken off to the anticipated degree in the past few years. In 2015, a total 4,713 robots were sold, up from 4,416 in 2014 – an increase of 7%. 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 2015, it is estimated that more than 3.7 million robots for domestic tasks, including vacuum cleaning, lawn-mowing, window cleaning and other types, were sold, 11% more than in 2014. 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\$ 1.2 billion. Compared to 2014, this represents a slight increase of 1%.

As for entertainment robots, about 1.7 million units were counted in 2015, 29% more than in 2014. 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.

Projections for the period 2016-2019:

About 333,200 new service robots for professional use to be installed

Turning to the projections for the period 2019-2019, sales forecast indicate an increase to about 333,200 units with a value of US\$ 23.1 billion.

Sales of logistic systems will increase considerably in this period. More than 175,000 units are estimated, thereof, about 174,650 automated guided vehicles. Logistic systems make up 53% of the total forecast of service robots in the current forecast period.

About 74,800 robots for defense applications will be sold in the period 2016-2019. They are followed by field robots with about 34,600 units. This is probably a rather

conservative estimate. These two service robot groups make up another 33% of the total forecast of service robots at the current time.

Another strong growing sector will be professional cleaning robots. About 11,700 units will be sold between 2016 and 2019, mainly floor cleaning systems.

A continued increase of medical robots is expected. About 8,150 units are estimated to be sold in the period between 2016 and 2019.

A slightly growing sector will be mobile platforms in general use. Service robot suppliers estimate that about 7,500 mobile platforms as customizable multi-purpose platforms use will be sold in the period 2016-2019.

Exoskeletons will establish in the market. About 6,600 units are estimated to be sold in this period.

A strong growing sector is public relation robots which will increase to more than 6,500 robots. These robots are increasingly used in supermarkets, at exhibitions, in museums etc. as guides or information providers. A significant higher number of robots for inspection and maintenance will be needed in the period between 2016 and 2019: 3,600 units.

Another strong growing application group is construction and demolition. About 2,800 units are estimated to be sold in the period between 2016 and 2019. This is also a rather conservative forecast. Construction and demolition robots are increasingly used in areas which are dangerous or unhealthy for humans.

About 700 robots for rescue and security applications will be sold between 2016 and 2019, mainly surveillance and security robots and 700 underwater systems.

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 2016-2019:

About 42 million units of service robots for personal and domestic use to be sold

Vacuum and floor cleaning robots will enter more and more households in the world. It is estimated that between 2016 and 2019 almost 30 million units will be sold. Regarding lawn-mowing robots, another 910,000 units are forecast for the period 2016-2019.

Service robot suppliers already estimated in 2010 a strong increase of sales of robot companions/assistants/humanoids. But now, it is projected that between 2016 and 2019 some 8,100 units of these robots will be sold. However, up till now, there have been no significant sales of humanoids as human companions to perform typical everyday tasks in production, office or home environments. Quite a few Japanese companies (Honda, Kawada, Toyota and some others) and also American, Korean and European companies are in the process of developing these general-purpose robot assistants beyond the toy and leisure stage. First shipments of these humanoid robots started in 2004 to international laboratories and universities as high-end robotics research and development platforms. So, this forecast seems to be realistic for the period between 2016 and 2019 especially given the recent successes in this field.

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 31 million units in the period 2016-2019, with an estimated value of US\$ 13.2 billion. The size of the market for toy robots and hobby systems is forecast at about 8 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 2016-2019.

Sales of all types of entertainment and leisure robots are projected at about 11 million units, with a value of about US\$ 9.1 billion.

Sales of robots for elderly and handicap assistance will be about 37,500 units in the period of 2016-2019. This market is expected to increase substantially within the next 20 years.



