

Growth of Robotics Industry Early in 21st Century

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Abstract:

Robotics Industry includes two types of robots: Industrial Robots and Service Robots. The automation and modernization of manufacturing processes depends on the industrial robots. Service robots are enriching innovation or products development in different applications, whether professional or personal. Industrial and service robotics is mature as a technology and is well established. This paper analyzes the growth in the Robotics Industry worldwide in the early age of 21st century both for industrial robots and service robots. The growth of industrial and service robots is explained on the basis of the average increase in the sales during 2000-2011. In this paper the market trends for both types of robots is compared which contributed in the expansion of robotics industry for the same period.

Keywords: Applications of robots, Automation, Industrial Robots, Market analysis, Robotics industry, Service Robots, Types of robots.

1. Introduction

Robots have a long history. The first digitally operated and programmable robot, the Unimate, was installed in 1961 at General Motors. Since 1961, the world around us is changing at unprecedented and unimaginable speed which gives new pave to Robotics Industry. The robotics industry includes vast range of industrial robots and service robots. As defined by ISO 8373, the industrial robot is 'an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications.' According to the International Federation of Robotics, another professional organization, a service robot is 'a robot which operates semi or fully autonomously to perform services useful to the well being of humans and equipment, excluding manufacturing operations'. The early age of 21st century sees that both types of robots are capturing the market rapidly to fill the emptiness in our society world-wide. In this paper, the growth of robotics industry is analyzed between 2000 and 2011 for industrial and service robots. During the early age of this century, various applications of robots, ranging from manufacturing processes to non-manufacturing processes and from professional uses to personal or domestic uses, are changing our society. To do this robots are becoming more powerful, with more sensors, intelligence and cheaper components. In order to show the comparisons between service robots and industrial robots, the number of units sold worldwide is analyzed during 2000-2011.

2. Market analysis

Robotics is an exciting and multi-disciplinary area that dominates 21st century. Robotic industry is entering a period of rapid growth[1]. Industrial robots and service robots both contributed in the success of this industry. The statistical data used from Table 1. to Table 3. has been taken from the International Federation of Robotics (IFR) and the Economic Committee data from UN for Europe (UNECE) [2,3,4,5,6,7,8]. The graphical representation, has been showed from Figure 1a.&b. to Figure 8. is prepared after analyzing the Table 1., Table 2. and Table 3.

2.1. Analysis of market for industrial robots

Industrial robotics applications have evolved from simple tasks like 'pick & place' to complex functions like welding and assembling & disassembling. Post 2000, showed growing demand, competition and pressure to increase productivity due to increased globalization and drive of modernization. Since the industrial robots started to be introduced in industry at the end of the 1960s, total accumulated yearly sales amounted to more than 1,149,290 units worldwide at the end of 2000 which is the start of 21st century, where as 1,600,000 units sold worldwide at the end of 2005, that is amounted to more than 2,284,230 units by the end of 2011[2,6,8].

Following information is retrieved from Table 1. in order to explain the growth in industrial robotics worldwide in early 21st century:

- 1) In 2009, only 60,000 units were sold which is the least amount in early 21st century, because of recession.
- 2) Year 2011 is showing highest sales amounted to 1,66,028 units ever recorded .
- 3) During 2005-2011, average increase in sales of 13.65% has been estimated.
- 4) During 2000-2004, average increase in sales of 0.645% has been estimated.
- 5) Between year 2004-2005, 24.70% increase is calculated[Figure 2.].
- 6) In 2005, first time sales estimated above 100,000 units.

- 7) High intensification in sales is estimated during 2004-2011.
- 8) Industry showed average growth of 36.39% during 2000-2011.

Table 1. The number of units of industrial robots sold worldwide at and up to the end of the year during 2000-2011[2,3,4,5,6,7]

S. No.	At the End of Year	No. of Units Sold	Up to the end of year
1.	2000	99,000	1,149,290
2.	2001	78,210	1,227,500
3.	2002	68,600	1,296,100
4.	2003	81,800	1,377,900
5.	2004	95,400	1,473,300
6.	2005	126,700	1,600,000
7.	2006	112,200	1,712,200
8.	2007	114,365	1,826,565
9.	2008	113,300	1,939,865
10.	2009	60,000	1,999,865
11.	2010	118,337	2,118,202
12.	2011	166,028	2,284,230

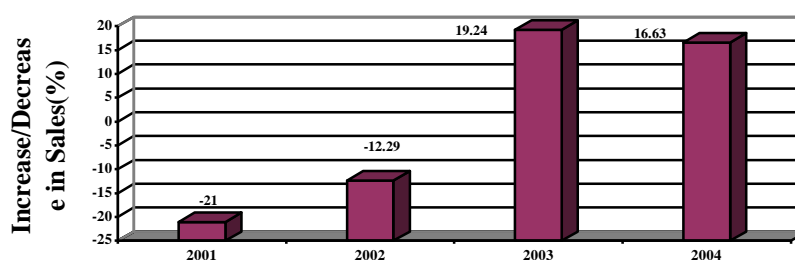


Figure 1a. Increase/decrease in sales (%) of industrial robots at the end of year during 2001-2004

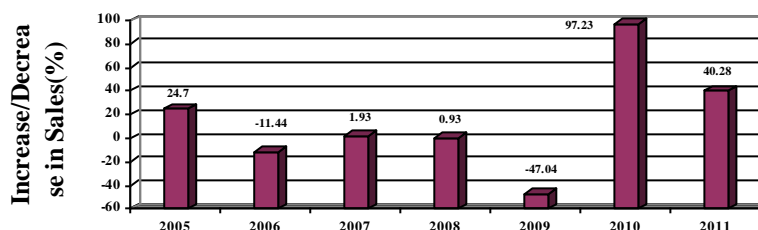


Figure 1b. Increase/decrease in sales (%) of industrial robots at the end of year during 2005-2011

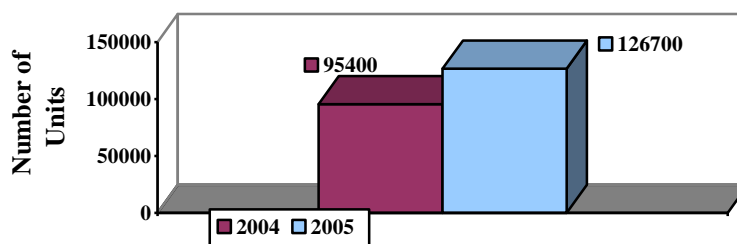


Figure 2. The number of units of industrial robots sold at the end of year 2004 and 2005

The industrial robots have captured market worldwide gradually, since 2005, with average growth of 13.65% [Figure 1b.]. 2009 is the exception, because the lowest sales are estimated at the end of year. Year 2011 is the ‘golden year’ for the industrial robotics.

2.2. Analysis of market for service robots

Service robots turn up in either of two key areas: the professional or home/domestic domain. Service robots for professional use are extremely diverse, since they are usually designed to perform a specific task. Professional service robots also can be found in public buildings for delivering goods, executing tasks in dangerous or hazardous environments, or even helping in cowsheds for automatic milking. The personal service robots have influenced the human life by doing domestic tasks, providing security & surveillance and facilitating through transportation, education & entertainment. The financial opportunities in these markets have already exceeded several billion dollars in the early decade of 21st century, and for components within them e.g., machine vision and mobile platforms.

2.2.1. Market trends of service robots for professional use.

The major application areas for professional robots are underwater robots, defence robots, medical robots, demolition robots, mobile robot platforms for multiple use, laboratory robots, and cleaning robots. Since 1998, the total no. of professional robots installed for these applications is amounted to 110,000 units worldwide in the current decade[2].

The Table 2. provides following information related to professional robots installed worldwide in early 21st century:

- 1) The average increase in the no. of units installed during 2000-2011 is about 872 units.
- 2) The no. of units installed is reached to 10,000 units first time in 2008.
- 3) The average growth of 28.97% in 2000-2011.

The decline in the sales of professional robots is seen in the year 2001, 2003 and 2009[Figure 3.]. Apart from this the demand of the professional robots increased worldwide.

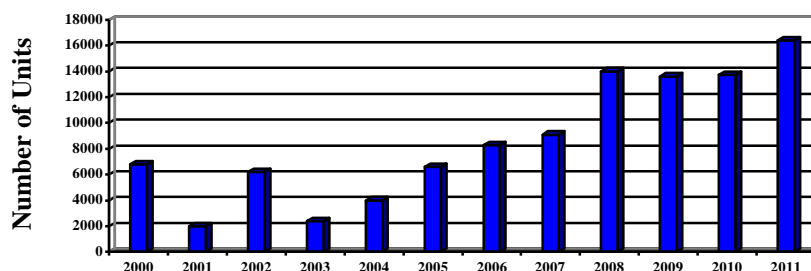


Figure 3. The number of units of professional service robots installed at the end of year during 2000-2011

Table 2. The number of units of professional service robots sold worldwide at and up to the end of the year during 2000-2011[2,3,4,5,6,7]

S. No.	At the End of Year	No. of Units Sold	Up to the end of year
1.	2000	6,815	10,415
2.	2001	1,985	12,400
3.	2002	6,200	18,600
4.	2003	2,400	21,000
5.	2004	4,000	25,000
6.	2005	6,600	31,600
7.	2006	8,300	39,900
8.	2007	9,100	49,000
9.	2008	14,000	63,000
10.	2009	13,600	76,600
11.	2010	13,741	90,341
12.	2011	16,408	106,749

2.2.2. Market trends of service robots for personal and private use. 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. Vacuum cleaning robots were introduced on the market at end of 2001[7]. The total 13.4 million units were sold up to 2011 for personal and private usage of robots.

On the basis of the data given in the Table 3., the following information is compiled:

- 1) The average no. of units sold during 2000-2011 estimated is about 217,318 units.
- 2) The no. of units sold is reached to 1 million first time in the year 2007.
- 3) The no. of units sold crosses the 2 million in 2010.
- 4) The average growth of 74.15% in 2000-2011.

The service robots for personal and private use are growing since 2000, except the years 2001, 2006, 2008 and 2009[Figure 4.].

Table 3. The number of units of personal & private service robots sold worldwide at and up to the end of the year during 2000-2011[2,3,4,5,6,7]

S. No.	At the End of Year	No. of Units Sold	Up to the end of year
1.	2000	109,500	112,500
2.	2001	64,000	176,500
3.	2002	427,500	604,000
4.	2003	706,000	1,310,000
5.	2004	790,000	2,100,000
6.	2005	800,000	2,900,000
7.	2006	640,000	3,540,000
8.	2007	1,860,000	5,400,000
9.	2008	1,800,000	7,200,000
10.	2009	1,500,000	8,700,000
11.	2010	2,200,000	10,900,000
12.	2011	2,500,000	13,400,000

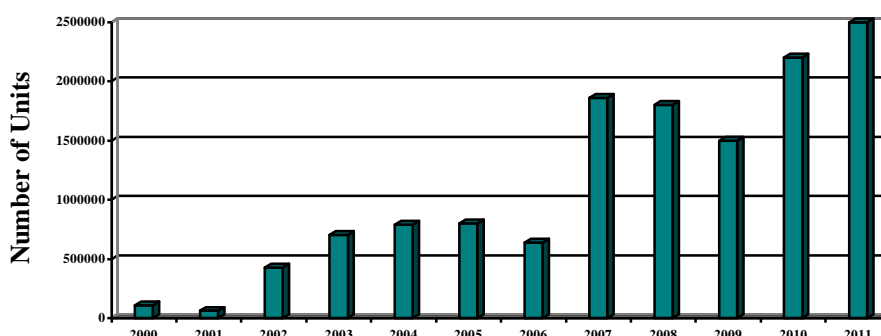


Figure 4. The number of units of personal & private robots sold at the end of year during 2000-2011

2.3. Growth in robotics industry

In early 21st century, the demand for both industrial and service robots is increasing, which in turn, boosted sales of both in order to enhance the growth of robotics industry. Since 1961, The total 15,790,979 units were sold worldwide up to the end of 2011, among these 14,734,089 units were sold in 2000-2011, for the applications area ranging from automotive to non automotive and from defense to domestic[Figure 5.]. This industry is intensified at the average of 46.50% during 2000-2011.

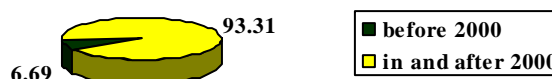


Figure 5. The number of units (%) of robots sold before 2000 and in & after 2000

3. Comparison of market trends of industrial and service robots

Both types of robots gave contribution in order to increase the market for robotics industrin 21st century. But the way they are contributing is different for these robots depending on the application area, they are being used. Following six comparisons have been identified for market trends of industrial and service robots worldwide in 2000-2011:

- 1) Since 1961, the total 2,284,230 units of industrial robots sold, while the total 13,506,749 units of service robots(including robots for professional use and personal & private use) sold, since 1998.
- 2) In early 21st century, the average increase in the sales of industrial robots is 36.39%, while it is 51.56% for service robots.
- 3) The sales of the industrial robots never reached to 1 million units up to the end of 2011, whereas the sales of service robots reached to same at the end of 2003[Figure 6.].
- 4) In 2009, the sales of industrial robots declined to 60,000 units by 47.04%, while for service robots it is declined to 1,513,600 units by 19.53%, as compared to 2008[Figure 6.]
- 5) The average increase in the no. of units of industrial robots is near to professional robots and very far from the personal & private robots[Figure 7.].

6) Since 1961, the contribution of industrial robots in the robotics industry is estimated to only 14.47% of the total units available worldwide [Figure 8.].

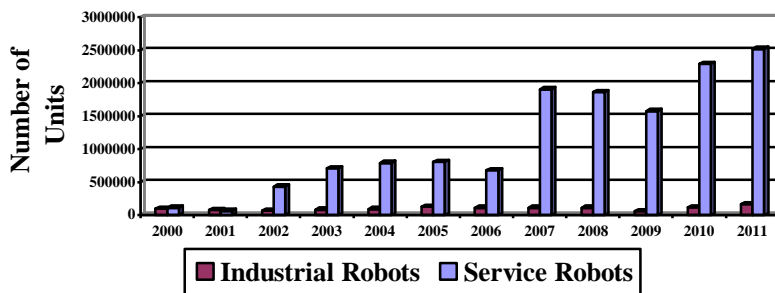


Figure 6. The number of units of industrial and service robots sold at the end of year during 2000-2011

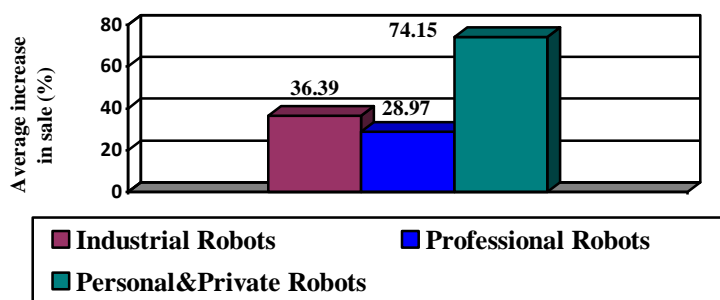


Figure 7. The average increase in sales(%) of industrial and service robots during 2000-2011

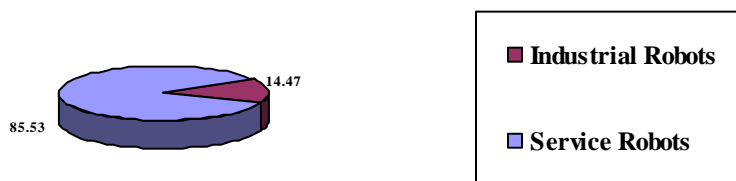


Figure 8. The contribution(% of total units) of industrial and service robots in robotics industry up to the end of 2011

4. Conclusion

The robotics industry has magnificent growth worldwide in early 21st century. Both industrial and service robots contributed in the growth. But the share of service robots is larger, among them personal robots added millions of units. So, it is expected that later in 21st century robots will be known much for household applications. Entry points into these markets worldwide are accelerating from a variety of corners and initiatives in industry, government, academia, large corporations and small startups. The technological changes and emptiness in our society increases the demand of robots in all types of industries. In order to continue this growth the robots require extensive improvement in technology.

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