

CURRENT SCENARIO AND PROSPECTS IN WELDING INDUSTRY

Mihaela POPESCU*, Gheorghe GLITA*, Aurelian MAGDA*

*Universitatea Politehnica Timisoara

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Abstract: Despite these areas of growth and new innovations in welding, Frost & Sullivan's analysis recognised that there were still threats to the industry as a whole, including: the global recession; the advanced maturity and growing decline of markets such as shipbuilding and electronics; downward pressure on prices, increasing intensity of competition and the bargaining power of end-users.

1. General problems

Despite recent recessionary pressures, which have hit all aspects of the manufacturing industry, the welding equipment industry is now showing signs of recovery.

2. Welding in Europe

Indeed in Europe, in spite of the impact of the slowing Asian and North American economies, causing a decline in manufacturing projects and plant relocation to the lower-cost areas of Central and Eastern Europe, there are good signs of revenue growth. In 2000, revenues rose to 1,73 billion US-Dollar, 2001 and 2002 revenues are widely believed to have been lower. The second half of 2003 is likely to see a small rise, with better order books transferring to significant additional sales revenue in 2004 [1, 2, 3, 5, 6, 10].

Table 1 European metallic welding equipment market: Market drivers ranked in order of impact, 2001-2007 (Source: Frost & Sullivan)[10].

Rank	Driver	1-2 years	3-4 years	5-6 years
1	Increasing demand for automation	Hight	Hight Hight	Medium Hight
2	Increasing use of aluminium	Medium	Medium	Low
3	Technological refinements	Hight	Medium	Medium
4	Reduce cost and increased productivity	Medium	Medium	Medium
5	Software	Medium	Medium	Low
6	Inovation in steel	Medium	Low	Medium
7	Internationally accepted welding edication certificate	Low		

Acording to Frost & Sullivan's analysis, areas which grew in the European metallic welding equipment market and which could spell a more lucrative future for the industry as a whole included the following [10]:

- **Increasing demand for automation**

Representing a potential gain in productivity and speed, automation cuts manufacturers' labour costs and helps them to remain competitive.

- **Increasing use of aluminium**

Aerospace and automotive manufacturers, the largest markets for welding equipments, saw a growing trend towards the use of aluminium.

- **Technological refinements**

Value adding features such as weld quality sensors and improving user friendliness helped to increase demand for metallic welding equipment.

- **Reduced costs and increased productivity**

Newer products were becoming more efficient and producing less defects, leading to an overall reduction in cost to the end-user.

- **Software**

Graphical user interfaces are made for more user-friendly welding equipment. The use of such software has been increasingly integrated into welding equipment and will become of growing importance over the next few years if the level of skilled professionals in the industry continues to fall [1, 2, 3].

- **Innovations in steel**

Many welding applications rely on steel, a material that is unfortunately in decline. To combat this, steel producers conducted research to develop new types of steel.

- **Internationally accepted Welding Education Certificate**

The European Welding Federation (EWF) has been working on proposals to develop a recognised qualification for welding professionals to promote a healthier industry. Currently, there is a shortfall in skilled labour in Western Europe, which has partly led to relocation of many manufacturers. Such certification could revive some welding applications and stimulate demand for new welding equipment [10].

- **Laser beam welding**

The laser welding market was expected to see the highest growth in the total European metallic welding equipment market. Although extremely expensive, this technology offers the benefits of the fast, high quality welds which result in a high demand for this equipment over several industry sectors including automotive, metal fabrication and aerospace. In 2000, revenues for laser welding totalled 101,3 million US-Dollar and strong growth over the next few years is expected to cause the market to nearly double in size to 192,5 million US-Dollar in 2007, representing 9,9 percent of total market revenues [10].

- **Electric arc welding**

Arc welding is a very versatile and cost effective process that can be used for various applications and metals. In 2000, electric arc equipment accounted for 30,6 percent of total revenues in the European market for metallic welding equipment. Falling demand saw a slowdown in its use, but revenue growth is expected to recover over the next few years. Revenues are expected to rise to 572,4 million US-Dollar in 2007, representing a revenue share of 29,6 percent in the total market.

- **Electric resistance welding**

Widely used in the automotive industry, this technology has faced strong competition in Europe from alternative joining techniques, especially laser beam welding. In 2000, it generated a share of 27,0 percent and by 2007, revenues are expected to rise to 490,7 million US-Dollar, accounting for a share of just 25,3 percent in the total European market.

- **Gas cutting and welding**

This type of welding has been in decline for several years due to a decline in applications for this technology and the inferior performance it delivers compared to more

advanced technologies. Although automated gas cutting machines are increasing in use, they also face competition from laser, plasma and waterjet equipment. In 2007, revenues were forecasted to decline to 263,9 million US-Dollar, representing a reduced revenue share of 13,6 percent for the total market [10].

- **Welding robots**

With their largest application being the automotive industry, welding robots can easily be reprogrammed to accommodate flexible production processes. A growing demand for automation coupled with the high cost of labour means that in 2000, revenues for welding robots totalled 318,9 million US-Dollar and is expected to rise to 384,0 million US-Dollar in 2007, obtaining an increased revenue share of 19,8 percent of the European market [10].

- **Other electric welding equipment**

The smallest market within the total European market, this segment has seen steady growth over recent years. The use of this equipment has remained limited to certain niche applications, although friction stir welding shows strong growth potential due to the versatility of the process. Non-vacuum electron beam welding also presents new opportunities due to the speed and cost advantages created by the elimination of the vacuum chamber. In 2007, the other electric welding equipment market is forecast to rise to 38,6 million US-Dollar, representing a revenue share of 2,0 percent in the total European market [10].

- **New technologies and their impact**

Adding value to current equipment has meant manufacturers can offer higher levels of satisfaction to the end-user and reverse the downward trend in prices, thereby having a positive effect on the industry overall. Some of the ways this has been done is as follows:

- **Welding automation**

A growing number of manufacturers are moving towards the provision of complete solutions rather than acting as simple equipment suppliers due to the increasingly complex requirements of the end-user.

- **Integration of tooling and control systems**

Offering a focal point for competitive advantage, manufacturers can differentiate their products from the competition by integration of tooling and control systems. Advances such as welding sensors, enabling information about the progress and quality of the weld to be relayed to a control device, and the integration of computers and advances in fieldbus technology are also adding value to weld systems [10].

- **Welding process simulation**

Delivering opportunities to refine the welding process and increase productivity, mathematical models allow engineers to study the interaction of thermal and metallurgical phenomena by simulating the physical properties of metals and the complex changes that occur during welding. This will ultimately cut down on time and money, as there will no longer be the need for costly research [10].

An upward trend

The European metallic welding equipment market is expected to face various changes and challenges over the next few years. In such a mature market as welding however, changes occur only gradually. Yet, if manufacturers continue to actively pursue new opportunities in markets such as the automotive, aerospace and metal fabrication sectors and continue to add value to their existing welding techniques by using the computer software available to them, a gradual upward trend should occur in the years to 2007.

There is little doubt that with this kind of attitude in the industry, revenue growths will increase. According to Frost & Sullivan, with a growing demand for laser welding equipment and automated machinery, in 2007, revenues are expected to rise to 1,94 billion US-Dollar, with a forecast, compound annual growth of 1,6 percent for the period 2000 to 2007. If manufacturers keep an eye on improving current processes and searching for new technologies, while also reducing the level of power consumption, there will still be good potential for revenue growth and increased market share [10].

Advancing market maturity and a weak economy pose an immediate challenge to manufacturers in the European welding equipment and consumables market figure 1 [6].

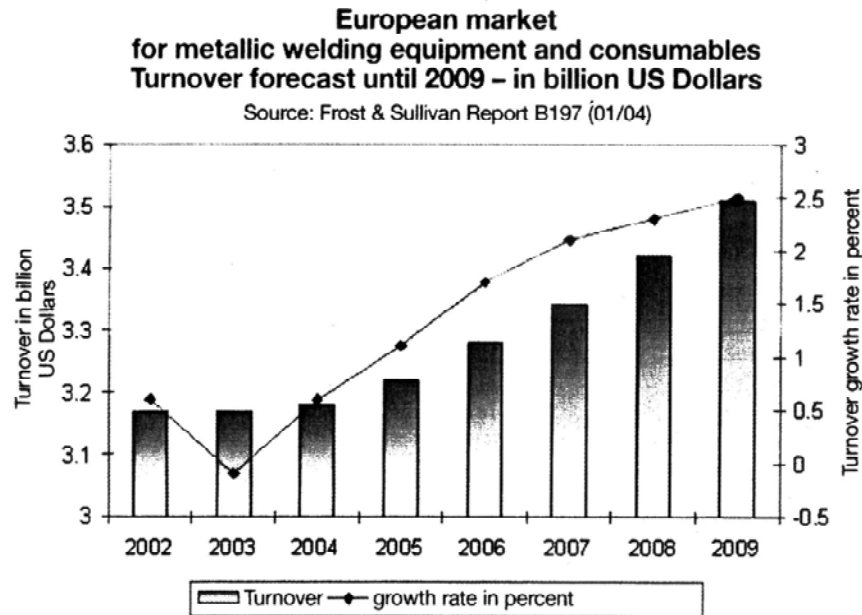


Figure 1.

Manufacturers will need to embrace the future with streamlined operations and aggressive growth plants, as it is competitive strength that will generate growth for individual companies in this mature market [6].

In keeping with end-user demands for advanced technologies, a positive aut-look is envisaged for the laser cutting and welding equipment and the welding robots product segments. Laser cutting and welding equipment, currently the fastest growing product segment, also displays the highest growth potential within the overall market. Increasing power ratings and sustained advances in beam quality and processes, such as remote welding, are expected to boost revenues. Recent improvements in solid state laser technology, including disc lasers and fibre lasers, are anticipated to reinforce growth trends [6].

The arc welding equipment and welding consumables markets remain challenging. Both markets are highly mature and certain product segments within them are expected to continue declining. Some segments, such as TIG and MIG/MAG welding equipment, are projected to see positive developments over the next few years. Some types of solid wire and flux cored wire are also expected to generate promising growth, such as stainless steel types.

Spiralling labour costs and the falling number of skilled welders coupled with the rising demand for high-precision welding is poised to drive the uptake of welding robots. The

sizeable capital investment required to install automated equipment is expected to sustain relatively stable revenue growth, however, price reductions continue to act as a barrier to more significant growth [6].

Among the application segments, the automotive vehicle manufacturer and supplier segments are the most progressive and dynamic, continually investing in new technologies such as fibre lasers, remote laser welding and enhanced robotics. Persistent demand from these sectors is expected to encourage technological advances and drive market revenue growth. Dominated by mechanical joining technologies, the aerospace sector is currently the smallest application segment for welding equipment. However, rising awareness of welding processes supported by continued advances in research and development present exciting new opportunities for welding equipment manufacturers.

Despite slowdown in other regions, the welding equipment and consumables markets in Spain and Portugal as well as in the United Kingdom have experienced steady growth. A vigorous construction sector and robust demand for automation and sophisticated product types have underscored strong performances by these regions. In Spain particularly, demand levels have registered a sharp increase in recent times due to augmented development funds and strong industrial expansion. Both Spain and the United Kingdom are forecast to account for a larger share of overall market revenue in future [6].

3. Most impressive growth in China

The steady recovery of the global economy is set to positively impact demand for metallic welding equipment and consumables from its second largest user market – the construction sector. More particularly, significant construction activity across China and Eastern Europe is expected to boost demand for welding equipment and consumables, powering overall revenues from an estimated 1,48 billion US-Dollar in 2003 to 1,86 billion US-Dollar in 2010, according to the international management consultancy Frost & Sullivan figure 2 [5].

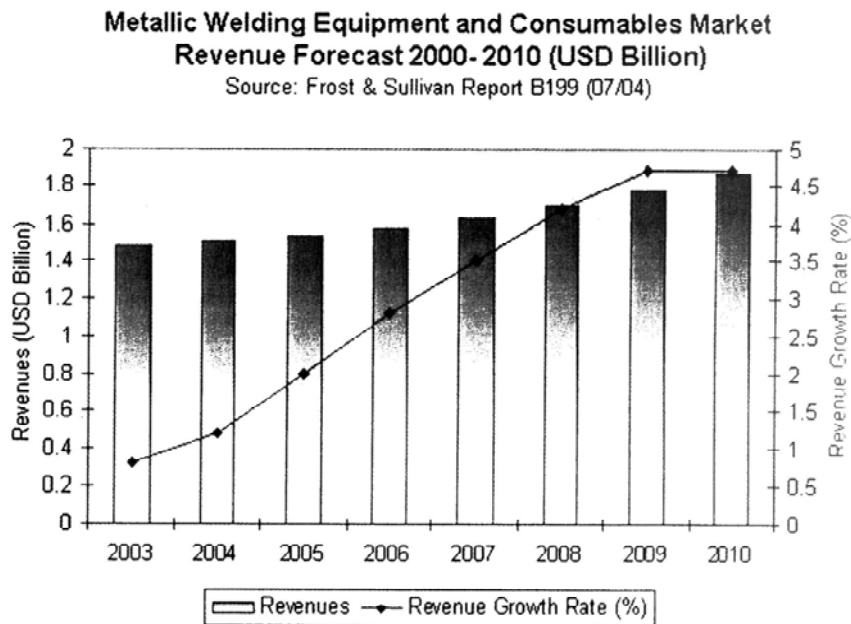


Figure 2.

Currently, North America and Western Europe account for the largest revenue shares in the welding equipment market for construction applications. However, with subdued growth forecast in these mature markets, their share of total revenues is anticipated to decline. Vigorous growth in China and Eastern Europe is expected to compensate for this stagnation. In these regions, the urgent need to develop infrastructure and housing and rapidly adopt new construction techniques and materials is expected to drive investments in new welding equipment and processes for use in construction applications [5].

While the economic slowdown in Poland has tempered growth rates in Eastern Europe, the region is nonetheless expected to experience stronger revenue increases following accession to the European Union. The most impressive growth, which should be supported by a robust economic performance, enhanced foreign direct investment flows, wider infrastructure outlays and housing and commercial developments. China's revenue share of the overall market is set to almost double from an estimated 10,1% in 2003 to 19,2% by 2010 [5].

4. Production of welding consumables in the CIS countries

The total volume of production of covered welding electrodes in 2005 in the CIS countries was 305.900 t, 79% of it being produced by enterprises of the Russian Federation, 17% - by enterprises of Ukraine, and 4% - by the rest of the CIS countries. This is indicative of a 5% increase in a total volume of production, including 7% in Russia, and 3% in Ukraine. The output of electrodes as to the covering type was as follows: rutile-ilmenite electrodes – 174.600 tons, and basic electrodes – 108.100 t. The volume of production of special application electrodes for welding high-alloy steel and non-ferrous metals was 23.800 t, the growth being 48% [7].

The volume of production of electrodes in 2005 in Russia was 240.400 t, including 120.100 t of rutile-ilmenite electrodes, 97.500 t of basic electrodes, and 22.800 t of special electrodes. Accordingly, Ukraine produced 53.000 t of electrodes, including 42.000 t of rutile-ilmenite electrodes, 10.300 t of basic electrodes, and 1.000 t of special electrodes.

The positive trend is currently towards increase in production of small-and medium-diameter (2-4 mm) electrodes. Their output has totally amounted to 270,100 t, the increase being 4,6 % compared with 2004. The volume of production of 5 and 6 mm diameter electrodes was 36.300 and 25.000 t, respectively [7].

The total output of alloyed welding wire up to 2,0 mm in diameter, intended for mechanised gasshielded welding, was 45.200 t, including 25.36 t of 0,8-1,4 mm diameter wire. Russia produced 33.400 t, including 18.200 t of 0,8-1,4 mm diameter wire; and Ukraine produced 11.800 t, including 7.200 t of 0,8-1,4 mm diameter wire.

Compared with 2004, the total output of wire in the CIS countries decreased by 8%. At the same time, Russia increased it by 2% and Ukraine decreased by 35%. In particular, we have to emphasise the tendency to growth of production and consumption of copper-coated wire, which is supplied by orders in required quantities in spools and reels with row winding, from 5 to 15 kg or more in weight. The output of copper-coated wire in 2005 was 12.600 t, the increase being 217% compared with the last year [7].

The amount of welding and surfacing wire produced in 2005 was 4401.8t, including 1996.3 t of welding wire, 2965.2 t of surfacing wire, and 200 t of flux-cored surfacing strip. Compared with 2004, the volumes of their production remained almost at the same level. In Russia, the output of flux-cored wire was 2965.2 t, including 1380.2 t of welding wire, and

1585 t of surfacing wire. Ukraine produced 1436.6 t of flux-cored wire, including 616.1 of welding wire, 620,5 t of surfacing wire, and 200 t of strip [7].

The output of welding fluxes in 2005 was 37779.8 t, including 12472.8 t in Russia, and 25,307 t in Ukraine. Russia increased the volume of production of welding flux by 18% and Ukraine decreased it by 4%, compared with 2004.

In 2005, the total output of welding consumables was 393.280 t, including 87.465 t of consumables intended for mechanised welding. Consumables for mechanised welding constitute 22% of the total output [7].

5. Relevant factors in indian welding industry

The study forecasts moderate global growth at 5% in construction investment up to 2012, with India growing at the highest rate amongst large economies at 9,2%. This is even higher than China. According to the study, India and China, in that order, are expected to make exciting news by offering major opportunities and increase in revenue for construction companies. In India, government infrastructure initiatives for building roads, rail roads, bridges and power lines would be helping create an expected growth rate of 10,6% over the next five years [4].

One of the Europe's leading business schools IMD, Switzerland brings out the world competitiveness report every year. In the World Competitiveness Year Book (WCYB) for 2004, India has jumped a massive 16 ranks. It now stands at 34th up from the 50th position it held in 2003. This is the largest jump by any country among the 60 countries ranked annually in the WCYB. More over, this is the best rank for India till date. The marked improvement in India's position this time is because of a huge jump in three of the four parameters on which the competitiveness is measured. These are economic performance, business efficiency and government efficiency. As far as the fourth parameter, i.e. the infrastructure goes, India still remains close to the bottom [4].

- *Present consumption.* We would like to first make an estimation of the total weld metal deposited in India during the year 2003-2004 and the share of the major welding processes. Based on the actual consumption of steel as 30,4 million tons, the total weld metal deposited in 2003-2004, 0,5% of steel has been 152,000 tons. Welding consumables industry in India is highly fragmented, with an approximate one-third of the total value shared by more than a hundred of manufacturers in the unorganized/small-scale sector. It is therefore extremely difficult to arrive at an accurate estimate of data regarding the share of various processes in the weld metal consumption. Still, based on, various inputs, we would venture an estimated share of welding processes in 2003-2004 as SMAW – 75%, GMAW – 17%, SAW – 7%, and GTAW and others – 1% [4].

- Consumption of steel in India is expected to grow at 6,5%. The share of SMAW process will decrease and the share of GMAW process will increase as the industry progresses. Such transformations have been noticed in all developed and developing countries. For the purpose of this study, we are assuming that the share of SMAW will gradually go down from the present 75 to 65%, and the share of GMAW will gradually go up from the present 17 to 27% during the 10 years since 2003-2004. As observed even in developed countries, share of SAW will not change much from the present 7%. Similarly, share of GTAW and other processes will remain around 1% [4].

Based on the inputs/assumptions mentioned above, the current and projected share of the next 8 years is given in the Table 2, (in tons).

Table 2. The current and projected share of welding process

Year	Parameter	SMAW	GMAW	SAW	GTAW and others	Total
2003-2004	Weld metal	114000	25840	10650	1520	152000
	Electrodes/wires	182400	28420	11700	1670	224190
2004-2005	Weld metal	119880	29160	11340	1620	162000
	Electrodes/wires	191810	32080	12470	1780	238140
2005-2006	Weld metal	125850	32760	12070	1720	172400
	Electrodes/wires	201360	36040	13280	1890	252570
2006-2007	Weld metal	132190	36720	12850	1840	183600
	Electrodes/wires	211500	40390	14130	2020	268040
2007-2008	Weld metal	138820	41050	13680	1950	195500
	Electrodes/wires	222110	45150	15050	2140	284450
2008-2009	Weld metal	145600	45760	14560	2080	208000
	Electrodes/wires	232960	50340	16020	2290	301610
2009-2010	Weld metal	153060	51010	15530	2200	221800
	Electrodes/wires	244900	56110	17080	2420	320510
2010-2011	Weld metal	160620	56690	16530	2360	236200
	Electrodes/wires	256990	62360	18180	2600	340130
2011-2012	Weld metal	168870	62900	17610	2520	251600
	Electrodes/wires	269710	69190	19370	2770	361040
2012-2013	Weld metal	176820	69650	18750	2680	267900
	Electrodes/wires	282910	76610	20630	2950	383100

- *Usage of flux cored wires.* Rough estimates of flux cored wire consumption in 2003-2004 are about 3000 tons, catered to by both local and imported products. The applications cover joining as well as hard-facing/surfacing. Good quality welds produced by flux-cored wires is a big advantage. There are a few companies in India who manufacture flux-cored wires for joining and hard-facing applications. Resultantly, flux cored wires presently constitute only around 10% of the total GMAW process and less than 2% of the total weld metal deposited in the country. This compares poorly with some of the advanced countries, where as much as 25% of the total weld metal gets deposited by flux cored and/or metal cored wires. If and when the price of flux-cored wires is brought down in the country, the share of FCAW process will find many more applications [4].

- In arc welding power sources, India is a land of contrasts. Use of antiquated bare welding transformers by roadside welders and cottage type welding works is a common sight. These energy guzzlers continue to be used at low-end applications. The organized fabrication and construction works have been gradually moving from motor generator sets to silicon diode rectifiers, which help in energy conservation. With the advances in power electronics, the cost of silicon controlled rectifiers (thristors) is much lower than the cost of generators. Although inverters have to be largely imported by India at present, the population of inverter power sources has been increasing. Since inverters reduce energy consumption by as much as 30-40% and since the cost of energy in India is amongst the highest in the world, logically the use of inverters should multiply in India. Easy availability of inverter power sources and adequate service facilities would go a long way in this direction [4].

- India has started adopting and using processes like EBW, laser welding, cutting and brazing, hybrid laser + arc welding, water jet cutting, twin wire narrow gap submerged-arc welding, automated plasma transferred-arc welding, tandem pulsed GMAW, plasma arc welding, robot welding, variable polarity plasma arc welding and friction stir welding. These advanced processes are finding applications in aerospace components, high pressure boiler fabrication, atomic energy establishments, automobiles, valves and so on. These moves are expected to gather momentum as India shapes to improve its competitiveness in the global fabrication and construction markets. Economics of scale and the need to meet compressed delivery deadlines would act as the drivers for adopting advanced, high productivity and reliable welding processes [4].

6. Conclusions

6.1. Despite these areas of growth and new innovations in welding, Frost & Sullivan's analysis recognised that there were still threats to the industry as a whole, including: the global recession; the advanced maturity and growing decline of markets such as shipbuilding and electronics; downward pressure on prices, increasing intensity of competition and the bargaining power of end-users; the decline of the steel industry and the growing use of plastics in automotive and packaging industries and the lack of skilled labour causing manufacturers to relocate from Western Europe.

6.2. China's revenue share of the overall market is set to almost double from an estimated 10,1% in 2003 to 19,2% by 2010.

6.3. The total volume of production in welding products in the CIS countries present positive trend.

6.4. Considered are the state-of-the-art and future prospects of welding production in India, as well as the current status of international cooperation in the field of welding. Prospects of development and application of power supplied are considered.

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