ELECTRONIC COMPONENTS

The EU market for embedded systems

Publication date: March 2010

Report summary
This CBI market survey discusses the following highlights for the EU market for embedded systems:

- The open EU market for embedded systems is expected to grow in the long term because, among other things, electronic equipment manufacturers will increasingly outsource development and production of embedded systems.
- The largest EU market segments, in order of share, are automotive, consumer electronics, telecommunication and industrial electronics.
- Developing countries (DCs) are attractive in terms of wage costs. At the same time, accessing the EU market will not be easy; some major threats are the strong and flexible position of EU producers and the growing consolidation in the sector.
- The major prospects for embedded systems of DC exporters are small and medium-sized companies that produce electronic equipment.

This survey aims to provide developing-country exporters of embedded systems with product-specific market information related to gaining access to the EU market(s). By focusing on the EU market(s) for one product or service, this document provides additional in-depth information, complementary to the more general information and data provided in the CBI market survey 'The electronic components market in the EU', which can be downloaded from http://www.cbi.eu/marketinfo. Detailed information on the selected products is given in Appendix A. This survey discusses the EU in general and the following markets in particular: France, Germany, the Netherlands, the UK and Italy.

1 Market description: industrial demand and production

From mobile phones to set top boxes to photo cameras to freezers to dryers, people are constantly using embedded systems for different purposes in daily life. Refer to Appendix A for an extensive description of embedded systems.

Industrial demand

The total demand for embedded systems consists of the open market and the in-feed market. The open market is the market for embedded systems that are developed and produced by third parties or subcontractors. This market takes roughly 25% of total demand. The in-feed market covers the market for embedded systems that are developed and produced in-house. So far, 75% of all embedded systems in the EU are developed and produced in-house. Roughly 50% of the in-feed market is within reach of third parties; the remainder will never be subcontracted due to the need for confidentiality.

As a result of the large share of the in-feed market, the value of the EU market for embedded systems is difficult to measure. While one research agency (Bitkom) estimates the global market to reach €138 billion by 2010 and the German market alone at €19 billion in 2008 with €4 billion for the open market, another research agency (VDC) estimates the EU market to be €2.6 billion with the open market worth €640 million. Other sources (e.g. Microsoft) estimate the EU market to be €60-70 billion. Following the Bitkom data, 40% is embedded hardware, one sixth is embedded software and 40-45% is services (development of system, of which 70% of the time is reserved for the writing of firmware). VDC does not take into account

services; according to VDC, 95% of total sales consists of embedded hardware; less than 5% is embedded software.

Regardless of the exact market value, the demand for embedded systems has shown quick growth in recent years. According to industry experts, growth in the EU has totalled about 10-15% per year in the period 2004-2008. In the years to come, some industry experts expect growth to reach over 10% per year, while other experts forecast a growth of 4-5%.

Worldwide, the US is seen as the largest market for embedded systems with some 40% market share. The EU represents some 25% of the global market and the Asia-Pacific region accounts for 35%. Within the EU, Germany is the largest market for embedded systems by a long way. It is followed by France and the UK. Sweden, Spain, the Netherlands, Italy, Belgium and Denmark are smaller markets, but still medium-sized ones in the EU. So far, Central and Eastern European (CEE) countries are not playing an important role in this market; probably the largest market is Poland, followed by the Czech Republic, Hungary and Slovakia.

Market segmentation

Embedded systems are applied in all segments of the electronics industry. The largest segments are automotive, consumer electronics, telecommunication and industrial electronics. Additionally, there are also some smaller segments that are sometimes included in industrial electronics. Examples of these smaller segments are defence, aerospace and the medical industry. Major characteristics of the embedded systems market in Europe are:

- Relatively large share for automotive, as a result of the large automotive industry in the EU. Leading countries in this segment are countries with large automotive industries, such as Germany, France, Spain, the UK and Italy.
- The share of embedded systems in industrial applications is relatively large compared to the global picture. This is a result of the leading position of the innovative EU engineering and process industry in Europe. Please note that industrial electronics cover a very wide range of applications and industries, ranging from automation, drives (AC/DC drives and motion controllers), environment, building control and heating, ventilation and air-conditioning, to automatic ID, security technology, instrumentation, test & measurement equipment, power/energy and transportation/infrastructure.
- Relatively strong positions of innovative industries such as medical technology and defence and aerospace.
- The share of embedded systems in consumer electronics is somewhat below the global average. To a lesser extent this is also true for telecom. This is because most production in these segments has been moved to low cost countries outside the EU.

Market segments that performed relatively well in 2007-2008 were transport/infrastructure, power/energy, medical technology, security technology and telecommunication. Also in 2009 these segments are expected to have performed better than other segments.

Tip – Spread your activities. As a producer/developer of embedded systems, it is wise to spread your activities to several market segments. For the company's continuity, these should at least contain market segments that are relatively independent of the economic cycle (such as medical technology, power/energy, security technology and infrastructure).

Characteristics and requirements

The subcontracting of development and manufacturing of embedded systems by European companies is expected to grow in the long term. This provides many opportunities for embedded systems manufacturers from DCs. A special focus on one or some market segments is not necessary; opportunities exist in virtually all market segments. This is because the basis of embedded systems is the hardware. By only changing the software, a producer can supply several market segments with one type of system.

The major benefit of DCs is the relatively low wage costs. Also important are infrastructure, distance to markets and the availability of a skilled labour force. However, it is essential to

realise that DC manufacturers only have chances as embedded systems providers to EU customers if they already have a wide experience in the development and production of embedded systems. The engineering department plays a critical role in this. It should take control of product design, redesign for cost-improvement purposes and cost reduction component changes. This department should consist of highly qualified engineers who should at least speak English and preferably German as well.

Other actions that could be taken to improve chances to become a supplier of EU customers are:

- Lowering production cost levels, since the break-even point where subcontracting to a DC producer becomes advantageous will be reached much more quickly.
- Make your organisation as efficient as possible and organise processes according to the generally accepted quality standards, or even better. No matter which product you make, quality standards play an important role as they will give potential clients trust. Therefore, it is essential that the quality of the product can be fully guaranteed!
- Focus on product innovation. Offering innovative products does not only improve your chances of becoming a supplier to EU customers with these products, it also shows prospects that your company possesses sound product development capacities.
- DC manufacturers can also improve their chances by cooperating with other manufacturers in their country. This can only be realised if DC manufacturers do not see other companies as competitors but as colleagues. Cooperation is possible in many business processes, such as production, purchasing, engineering, sales and marketing activities.

Production

Of the global open market, 80% is in the hands of only 20% of all companies. When taking a look at the largest producers in the world, it can even be concluded that five manufacturers together dominate the open market. These five companies are Kontron (http://www.kontron.com; Germany. Kontron's EU sales in 2008 were €230 million), Emerson (http://www.powerconversion.com; US), GE (http://www.gefanuc.com; US), Advantech (http://www.advantech.com; US) and Radisys (http://www.radisys.com; US).

Within the EU, Germany is the leading country in terms of embedded systems development and production. It accounts for approximately one third of EU embedded systems production. France follows in second place (20-25% share). The UK follows in third place, followed by a range of countries such as the Netherlands, Italy, Spain, Sweden and Denmark. The major CEE country in terms of embedded systems production is Poland.

Some examples of EU embedded systems producers are:

- Axiomtek (Germany) - http://www.axiomtek.de
- Adeunis RF (France) - http://www.adeunis-rf.com/en
- Chess (the Netherlands) - http://www.chess.nl
- Concurrent Technologies (UK) - http://www.cct.co.uk
- Congatec (Germany) - http://www.congatec.com
- Deltatec (Belgium) - http://www.deltatec.be
- Eltan (the Netherlands) - http://www.eltan.com
- Engineering Spirit (the Netherlands) - http://www.engineering-spirit.nl
- Erco and Gener (France) - http://www.ercogener.com
- Etas (Germany) - http://www.etas.com – specialized in automotive.
- FORTEC Elektronik (Germany) – http://www.fortecag.de
- INCOstartec (Germany) - http://www.incostartec.com
- Lucius-Baer (Germany) - http://www.lucius-baer.de
- Microtronics (Austria) - http://www.microtronics.at
- Nolam (France) - http://www.nolam.com
- RDA (Germany) - http://www.rda-online.de
- Seco (Italy) - http://www.seco.it/en
- SIE (Austria) - http://www.sie.at

- Sioux (the Netherlands) – http://www.sioux.nl
- Steatite-Embedded (UK) - http://www.steatite-embedded.co.uk
- Sundance (UK) - http://www.sundance.com
- TES Electronic Solution (France) - http://www.tesbv.com
- TTech (Austria) - http://www.tttech.com (also cooperates with GE)
- Ultratronik (Germany) - www.ultratronik.de
- XOR Systems (the UK) - http://www.xors.com

A general characteristic of these companies is that they are very flexible and have strong relationships with their customers. Also note that sometimes these companies look very much like service providers (e.g. TES).

Furthermore, note that many of these companies are benefiting from the knowledge and experience gained through the several technology clusters in the EU. The Netherlands, Germany and France but also other EU countries are home to such clusters specialised in electronics. One example of a relevant cluster is Minalogic (http://www.minalogic.org) in France. It is located in the Rhone-Alpes region and it pools research and cooperation in developing miniaturised chips, using micro- and nanotechnology and embedded software education. Several French companies have become part of this cluster and have started focusing on developing internal design capabilities, forging alliances or acquiring design houses. By doing so, they share the high costs and risks of developing new products.

From Practice - Kontron relocated production to Asia. Wage costs in the EU are high compared to wage costs in Asia (about $25/€20 in Europe and $1.50/€1.20 in Malaysia). That is why Kontron has relocated production from the EU to Malaysia in Asia. As a result, nowadays more than 60% of Kontron's production is done in Asia and production costs only amount to 6.6% of total revenues compared to 8.8% in 2005. An additional benefit of the production facility in Asia is the fact that high volumes of more than 100,000 units can be offered by Kontron on a cost-efficient basis.

The major trend among producers is an ongoing concentration, making the (five) leading producers control an ever-growing share of the open market. Another trend that can be seen from producers is relocation of high volume production to more cost-efficient locations. On the other hand, small series production (series of less than 15,000 pieces) usually remains in the EU.

Trends

The global economic growth in the last decennia has continued to fuel the open market demand for embedded systems. The major driver of this growth has been the continuous growth in the need for controlling technical systems and applications by use of modular-designed, independently operating, intelligent and electronic brains. Technological progress has also stimulated demand to a large extent; think of the current standard of high bandwidth wireless, web-integrated data exchange and video streaming. In addition, there has been an ongoing trend towards outsourcing embedded systems that companies previously developed in-house. Read further below for more information on these two major drivers of growth and on some more specific trends related to embedded systems.

Unlimited range of applications

The possibilities in applications for embedded systems are virtually unlimited. Mobility has become a key concept in day to day life and people, products and data travel across the world at ever greater speed and in rising volumes. Technological progress has led to a new economic reality, in which terms such as connectivity and real-time processes are playing a key role. It has resulted in an ongoing growth in demand for embedded systems that must be multifunctional, networkable, computer performance reliable and delivered in real-time.

In the years to come, the application of embedded systems will experience high growth in the market segments medical technology, automotive, education and agriculture. Examples of applications in these segments are portable X-ray ultrasound machines, car collision avoidance systems, remote holographic educational tools and satellite sensing based farming techniques.

More outsourcing

It is a continuous trend that a growing number of companies decides to outsource the development and production of embedded systems. Especially in difficult times companies tend to discontinue the lengthy and costly development of proprietary embedded systems and outsource it to specialised companies. In general, reasons why companies decide to outsource their embedded systems development and production are 1) the high level of complexity involved, 2) the high level of costs of in-house production and 3) too much time-to-market pressure. On the other hand, companies that outsource embedded systems development and production mention that they regard 'dependency on embedded systems suppliers' as a relatively high business risk.

Growing complexity

Embedded systems become increasingly complex due to the growing amount of functionality. Nowadays, a system contains one or more processors, plenty of memory and a varying amount of additional logic. At the same time, the amount of software running on these processors is increasing drastically. Moreover, the embedded software is also progressively influencing the hardware and the most challenging is often to get the software to work with limited memory. The development of a system thus requires deep knowledge of both embedded hardware and software. In practice, therefore, the hardware and software are selected and verified together (so-called co-verification), keeping the focus on the performance, reliability and cost effectiveness of the system.

45nm technology gives new opportunities

The entrance of the 45nm technology standard (2007/2008) opened up thousands of new embedded applications that would not have been possible to date. One example of this technology is the Intel Atom processor that is in widespread use in today's notebooks. Major benefits of this processor are its extremely low power dissipation of less than 5 watt and its low price. Examples of applications that will be equipped with embedded systems based on this technology are mobile multimedia systems, as well as systems for supermarkets such as cash desks and weighing systems, mobile medical devices, compact control and operating equipment and gaming and home entertainment applications.

More power and memory available at lower costs

In earlier years, possibilities were limited because of cost requirements, which was also the reason of a market segmentation into 8, 16 and 32 bit processor architectures. Now, cheap 32 bit processors with a lot of memory have become widely available. This certainly gives enormous opportunities for innovation, but system innovation is only possible with the development of more complex and more diverse software.

Application of digital signal processing

The application of digital signal processing (DSP) has broadened the possibilities of embedded systems. Through DSP, embedded systems can have a human interface in the form of audio and video capabilities. The continuous improvements in DSP technologies in terms of processing speeds, programmability and real-time performance have resulted in an ongoing rise in the number of embedded video, voice and data systems.

Development of standards

In recent years, companies in the industry have jointly developed standards ('open modular computing specifications'), whereby previously developed technology is reused to a large extent. One example is Advanced Telecom Computing Architecture (ATCA - http://en.wikipedia.org/wiki/Advanced_Telecommunications_Computing_Architecture), in which Intel acted as lead developer. ATCA was developed primarily for the communications industry (thus the backbones for telephony and data processing) and will replace previous

proprietary solutions[1] thanks to considerably better price/performance ratios. ATCA is also applied in other fields such integrated control systems for wind farms, energy distribution plants, medical technology and industrial automation applications. It is important to realise that OEMs increasingly demand these industry standards. The following standards are in general use:

- ATCA – communications and other (see above).
- Posix – telecommunications and military
- OSEK – automotive (http://en.wikipedia.org/wiki/OSEK)
- DO-178B – commercial and military aviation (http://en.wikipedia.org/wiki/DO-178B)

Furthermore, numerous open source operating systems have also become available in recent years. An overview of these systems can be found on http://en.wikipedia.org/wiki/Comparison_of_open_source_operating_systems.

Tools shift to Eclipse

Gradually, in recent years the Eclipse Framework has become the standard in embedded tools, at the cost of proprietary embedded tool chains. This is evidence for the fact that the embedded-tool industry is shifting to open-source architectures. Also refer to the Eclipse Foundation for more information - http://www.eclipse.org.

Long term outlook and effects of the crisis

Growth in embedded systems demand has decelerated remarkably since the third quarter of 2008. As a result, growth in 2008 totalled only 3.1%, far below the double-digit growth rates of the years before.

Among the main effects of the recession are the following:

- Outsourcing of development and production has become more attractive to companies that have not outsourced before. They increasingly acknowledge the benefits of production outsourcing, among which are lower costs of ownership and a better cash flow. According to experts, these OEMs are mostly in the defence, aerospace and medical segments.
- The market environment for small embedded systems producers may become increasingly difficult. On the one hand, the leading producers were already in a concentration phase, more or less forced by the rising project volumes and the increasing project complexity. In addition, the economic situation of 2009/2010 will make it even more difficult for individual smaller producers to continue to exist. As a smaller producer, it is elementary to have a sound financial situation, since the rating of customers and suppliers has become increasingly important. According to industry experts, there is an obvious risk that smaller and financially weak companies will no longer be invited to tender for projects.

Furthermore, also in the years to come it is expected that some embedded systems development and production will be relocated from the EU to countries outside the EU (note that at the same time OEMs are expected to outsource more production to embedded systems producers).

Opportunities and threats

Trends and market developments offer opportunities and threats to exporters. A given trend can be a threat to some and an opportunity to others at the same time. The following trends should, therefore, always be analysed in relation to your specific circumstances. Refer to Chapter 7 of the CBI market survey covering the EU market for electronic components for further information.

+ Since the nineties of the twentieth century, the market for embedded systems has continued to rank as one of the electronic markets showing the highest growth rates.

[1] A proprietary solution is a hardware or software product or combination of products and services that is marketed by one specific company, to the exclusion of all other companies.

+ Growing open (subcontracting) market for embedded systems – partly as a result of the economic recession of 2008/2009 – in the long term offers opportunities to embedded system producers from DCs.
± Embedded systems customers increasingly demand industry standards for operating systems.
– Embedded systems producers in Western Europe are very flexible and have strong relationships with their customers. Additionally, they are benefiting from the knowledge and experience gained through network clusters.
– Increasing consolidation will make it more difficult for small embedded systems producers to survive.

Useful sources

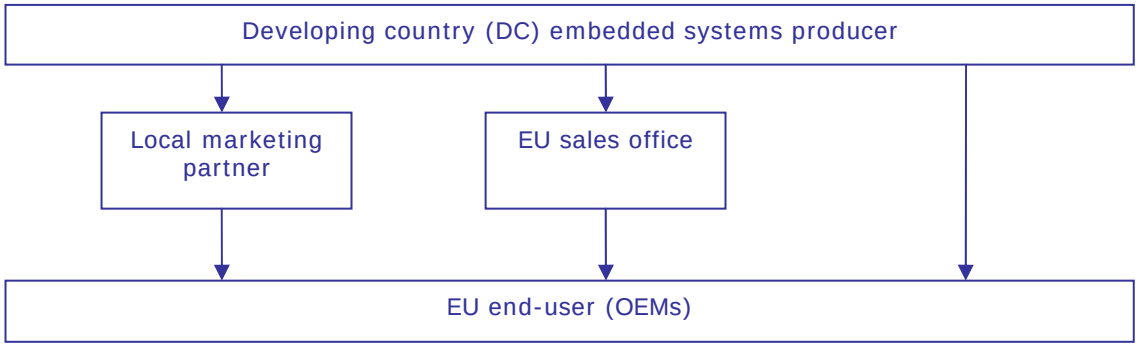
- Artemisia - https://www.artemisia-association.org – association for research & technology for embedded intelligence and systems.
- EE times - http://www.eetimes.eu – electronics news. Enter a keyword (for example 'embedded system') and click on 'search'.
- EMS Now - http://www.emsnow.com – search the news within this site by using a search engine with relevant keyword 'embedded system'.
- Evertiq - http://www.evertiq.com - news on company level in the industry. Click on 'Embedded'.
- Microcontroller.com – http://www.microcontroller.com – portal for the embedded industry.
- PCI Industrial Computer Manufacturers Group of the EU - http://www.picmgeu.org

2 Trade channels for market entry

Basically, the prospects for embedded systems are companies that produce electronic equipment, since virtually any electronic equipment contains one or more embedded systems. These electronic equipment producers are usually Original Equipment Manufacturers (OEMs) and sometimes also other producers of embedded systems that produce one or more embedded electronic products (usually stand-alone products such as scanners and other customized mobile devices).

Generally speaking, the DC exporter should focus on small to medium-sized electronic equipment manufacturers. This can be done by the DC exporter itself or by using his own sales office in the EU (direct sales). It can also be done with the help of a technically competent local marketing (or trading) partner in the EU. In most cases, the technically competent local marketing partner that would suit a DC exporter the most is a distributor. Since virtually all embedded systems are customised, close contact with the EU customer is very important, particularly during the design phase.

Figure 2.1 Trade channels embedded systems



OEMs

Original Equipment Manufacturers are producers and/or re-sellers of electronic devices and systems. Most of the time they have specialised in one or a few market segments. The EU is

home to many OEMs, ranging from a limited number of very large ones to a large number of small and medium-sized ones. France, for example, is home to 10-15 large OEMs and to more than 5,000 small and medium-sized OEMs. Some OEMs have moved on to become Original Design Companies (ODMs) only, just inventing, designing and marketing products, but no longer producing them. Some examples of OEMs in the EU are:

- ABB (multinational company from Sweden/Switzerland) - http://www.abb.com - engineering products
- Agilent (France) - http://www.agilent.com - test and measurement equipment
- Alcatel-Lucent (France) - http://www.alcatel-lucent.com – communication technology
- Alsthom (France) - http://www.alstom.com - global leader in equipment and services for power generation and rail transport
- Fico Molding Systems (the Netherlands) - http://www.ficomolding.com - lithography
- Gemalto (France) - http://www.gemalto.com – world leader in digital security
- Indesit (Italy) - http://www.indesit.it - home appliances
- Ingenico (France) - http://www.ingenico.fr - payment and transaction solutions
- Kathrein (Germany) - http://www.kathrein.com - telecom applications
- Miele (Germany) - http://www.miele.de - home appliances
- Oce (the Netherlands) - http://global.oce.com - printers
- Schneider Industrial (France) - http://www.schneider-electric.fr
- Seb (France) - http://www.groupeseb.com - small home appliances
- Smiths (the UK) - http://www.smiths-group.com – industrial equipment
- Thomson (France) - http://www.thomson.net - digital video technologies
- Valeo (France) - http://www.valeo.com – automotive applications

Distributors

Generally speaking, distributors don't play a large role in the trade of embedded systems; only 10-20%[2] of the open market in the EU goes through distributors. This is mainly the result of the tailor-made characteristic of an embedded system. A few examples of distributors in the EU are:

- Axess Technology (France; part of Avnet) - http://www.axess-technology.com
- Cefra (Italy) - http://www.cefra.it
- Logic (the Netherlands) - http://www.logic.nl
- MSC (Germany) - http://www.msc.de
- Parhelia (the Netherlands) - http://www.parhelia-bv.com/services/about-us
- RS components (UK) - http://uk.rs-online.com/web
- Rutronik (Germany) - http://www.rutronik.com

Refer to the CBI market survey covering the EU market for electronic components for more information on distributors.

Price structure

The major difference in margins is between embedded systems for mass segments such as PCs, communication and consumer products and embedded systems in smaller volumes for niche markets. Embedded systems for mass segments are characterised by low margins. Contracts are won by offering low prices in combination with high volumes. Niche markets (or niche products) in turn are the markets (products) with the higher margins. Examples of niche markets are security technology, medical technology, power/energy and transport/infrastructure. Margins in these markets are higher; however, a higher flexibility is also expected (small orders of 100-1,000 pieces shouldn't be a problem).

Selecting a suitable trading partner

The Internet is an excellent source to identify potential customers in the EU. Some examples follow below:

- Electronica exhibitor database – http://www.electronica.de/link/en/20823885 - click on 'exhibitor database' and on 'Embedded sytems'.

[2] In absolute terms this still means a considerable market value.

- Embedded world exhibitor database - http://www.embedded-world.de – click on 'Exhibitors & Products'.
- Sachon – http://www.sachon-zvei-elektro-einkaufsfuehrer.de - this database contains German companies active in electronics. Click on English language, then search for 'embedded systems'.
- Company databases such as Europages - http://www.europages.com, KellySearch - http://www.kellysearch.co.uk, Kompass - http://www.kompass.com, ABC Direct – http://www.abcdirect.nl/e1/start.htm and Thomas Global Register - http://www.trem.biz. Refer to the manual "Digging for Gold" for guidelines on searching with these databases.

For more names and websites of associations, intermediaries, end-users and manufacturers per country, refer to the CBI country surveys for electronic components. Another option may be to make use of sources in your own country:

- The Economic Affairs departments of the official representative (Embassy or Consulate) of a specific EU country. Find the specific country's embassy in your country at http://www.embassyworld.com. Another suggestion may be to contact the consul of your own country in the country of your choice.
- Public and private trade promotion bodies.

3 Trade: imports and exports

Major importers in the EU are assumed to be Germany, France and the UK. Unfortunately, there are no available trade data on embedded systems. Nevertheless, it can be assumed that imports and exports of EU countries have grown since 2004. This also goes for imports from DCs, although so far DCs don't play a large role in embedded systems. Refer to Chapter 1 'Characteristics and requirements' for information on how to become a successful exporter to the EU.

4 Price developments

One of the most important developments that has driven the demand for embedded systems has been the continuous increase of microprocessor capacities and miniaturisation in relation to the ongoing decline in microprocessor prices. Product innovations of embedded systems producers in 2009 have shown that the technology standards have become 45nm and the use of 32 bit processors.

To improve your chances as a producer of embedded systems, it is important to keep the costs of your systems as low as possible. To realise this, it is important that your system designers aim at the reuse of system components. By doing so, they can create a wide range of embedded systems within one product family. Each system will have its own specific price, but as a result of the reuse of some or several components, these costs can be spread on all systems, keeping the costs per system as low as possible. In practice, however, this is not always possible; sometimes there are contradictory requirements between similar systems that make the use of a single subsystem design impossible.

5 Market access requirements

As a manufacturer in a DC preparing to access the EU, you should be aware of the market access requirements of your trading partners and the government. Requirements are demanded through legislation and through labels, codes and management systems. These requirements are based on environmental, consumer health and safety and social concerns. You need to comply with EU legislation and have to be aware of the additional non-legislative requirements that your trading partners in the EU might request. The following requirements (could) apply for embedded systems:

- **REACH, RoHS and WEEE**. All products sold in the EU have to comply with the Registration, Evaluation and Authorisation of Chemicals (REACH) regulation, the Restriction

of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and the Waste Electrical and Electronic Equipment (WEEE) Directive. REACH concerns toxic chemicals that are not covered by RoHS. RoHS regulates the environmental impact of electrical and electronic waste. The substances covered by RoHS are cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE). A DC supplier will have to take care that his raw material/products used complies with these directives.

- **Market driven requirements.** One example is ISO/TS 16949, which only applies to embedded systems for the automotive market segment. Also refer to the trend of growing demand for industry standards for operating systems (chapter 1).

Packaging, marking and labelling

Special transport packaging is not necessary for most embedded systems. Packaging is used to protect against mechanical damage. The heavier the system, the firmer the carton boxes should be in order to avoid breaking and/or shifting. Of course the transportation volume must be as efficient as possible. In order to optimise transportation, EU manufacturers generally use boxes of which the measurements are in accordance with pallet sizes. For packaging design, the following should be taken into account: proper storage and transport, standard packaging sizes and recyclable materials or two-way systems. Moreover, it could be very well the case that the customer has his own (additional) packaging requirements and preferences.

Useful sources

- For information on legislative and non-legislative requirements, go to 'Search CBI database' at http://www.cbi.eu/marketinfo, select electronic components and the EU in the category search, click on the search button and click on market access requirements.
- Information on tariffs and quota can be found at http://exporthelp.europa.eu.
- International Safe Transit Association - http://www.ista.org
- Material Handling Equipment - http://www.ie.ncsu.edu/kay/mhetax/UnitEq (examples of packaging and pictures).

6 Doing business

General information on doing business, like approaching potential business partners, building up a relationship, drawing up an offer, handling the contract (methods of payment, and terms of delivery) can be found in the CBI market survey covering the EU market and in CBI's export manuals 'Export Planner' and 'Your image builder'. Furthermore, cultural awareness is a critical skill in securing success as an exporter. Information on cultural differences in the EU can be found in Chapter 3 of CBI's export manual 'Exporting to the EU'. These manuals can be downloaded from http://www.cbi.eu/marketinfo - go to search publications.

Sales promotion

For DC exporters, trade fairs, a professional website and trade press are among the most important promotional tools; they are briefly discussed below. Additionally, some other important tools are discussed.

Trade fairs

Visiting and participating in a trade fair is an efficient means to communicating with prospective customers. It provides more opportunities to convey one's message than any other trade promotional tool. It can also be an important source of information on market development, production techniques and new product applications. The most important trade fairs in Europe are:

- Embedded World (http://www.embedded-world.de - exhibition and congress dedicated to embedded systems, annually, March, Nuremberg, Germany
- Electronica (http://www.global-electronics.net - international electronics fair, held biennially in November, even years, in Munich, Germany,). Electronica has a special embedded systems section.

- Embedded Systems Show - http://www.edaexhibitions.com/ess - exhibition and forum for embedded systems and software developers, held annually, October, Birmingham, UK.

Other suggestions are leading trade fairs related to the numerous vertical markets, such as medical, transportation, defense and aerospace. Examples of such fairs are:

- Innotrans – http://www.innotrans.de – railway industry, biennially in September, Berlin, Germany.
- Medica - http://www.medica.de – medical industry, annually in November, Düsseldorf, Germany.
- Mobile World Congress - http://www.mobileworldcongress.com/index.htm - telecommunication industry, annually in February, Barcelona, Spain.
- SPS/IPC/DRIVES - http://www.mesago.de/en/SPS/main.htm - electric automation, annually in November, Nuremberg, Germany.

Of course, there are more trade fairs that could be interesting, depending on the market segment and target country a DC exporter focuses on. Find more trade fairs at http://www.eventseye.com or http://www.auma.de.

Website promotion

Going online is fundamental in the electronics sector, especially when taking into account that trust and credibility are major challenges for DC exporters. Your website could help meet these challenges to some extent. A website proposing well-defined products, competitive advantages (e.g. USP, quality, cost reduction and delivery reliability) and a client reference list helps create a trustworthy image. A brief scan of the presentation of EU EMS manufacturers shows that their presentation is very professional. In order to win the attention of prospects, they offer technical details on their products and technological capabilities. Refer for example to the website of the French company Erco and Gener (http://www.ercogener.com). The CBI Export Manual 'How to promote your website to the EU' gives DC exporters some excellent suggestions for marketing their website (http://www.cbi.eu/marketinfo).

Trade press

The most relevant trade magazines are:

- Design&Elektronik / Elektronik / Markt&Technik - http://www.elektroniknet.de. Some other, less relevant but still interesting, publications of this publisher are Computer&Automation and Electronic Automotive.
- Electronic Design News Europe - http://www.reedbusiness.fr
- Elektronica + Embedded Systems - http://www.engineersonline.nl/vakbladen/elektronica.html - Dutch language.
- Embedded Systems Europe - http://www.esemagazine.com – free online subscription at http://www.esemagazine.com/subscription/index.htm.
- Embedded Sytem Engineering - http://www.esemagazine.com – covers the EU.

Also refer to the CBI market surveys covering the electronic components market in individual countries for more (general) trade magazines. Especially the one covering the German market contains a considerable number of trade magazines.

Other trade promotion tools

Other important trade promotion tools are:

- **Visiting clients**. Visiting a possible client is a serious option. This could be someone that you met at a trade fair, for example. On the other hand, an EU prospect that is seriously considering to purchase embedded systems from your company will always be interested in your capacities and your production methods, and will definitely suggest a visit to your factory.
- **Purchase partner application form**. An interesting e-business application is a so-called purchase partner application form on an EU buyer website, which provides opportunities for

getting into contact with potential clients and gives information on buyers' requirements. Some examples can be found on the following websites:

- Miele - http://www.miele.de/de/haushalt/192.htm
- Bosch - http://purchasing.bosch.com/de/start/Einkauf/ueberblick/einkaeufer.htm
- Groupe SEB - http://www.groupeseb.com/seb/en/profile_access/suppliers/quality/front.aspx
- Siemens - https://w9.siemens.com/cms/csp/de/supplier-portal/home/Pages/home.aspx
- VDO / Continental http://www.conti-online.com/generator/www/com/en/continental/portal/themes/global_sourcing/overview1_gs_en.html

- **Make yourself known at trade promotion organisations**. European companies looking for manufacturers in developing countries may contact organisations in the source country. Most of the time, trade associations, export promotion organisations, Chambers of Commerce and/or embassies are asked for more information or long lists of potential suppliers in the respective country. Make sure that these organisations know you.

This survey was compiled for CBI by Facts Figures Future in collaboration with T.C. Fandrich.

APPENDIX A GENERAL PRODUCT DESCRIPTION

An embedded system (ES) is a kind of a computer that can perform unique and complex tasks. Synonyms used for ES are ECT (embedded computer systems) and 'embedded solution'. They are used as control units ('electronic brains') across a wide range of different devices, equipment, machines and systems. With the functionality of the device defined in an early stage, major criteria in the development stage are costs, space, power consumption, reliability and performance.

ES consist of hardware and software. The hardware used in a system depends on system requirements; embedded systems that process real time inputs and that must be extremely safe to use need very reliable and thus relatively costly hardware. The basis of an ES is a microcontroller, which is a single integrated circuit (IC) that contains all technology necessary to run the application. The result is as effective as a complete computer on a chip (also called System-on-a-Chip or SoC), including a Central Processing Unit (CPU); Input/Output interfaces; Peripherals; ROM, EEPROM or Flash memory for program storage; RAM for data storage and a clock generator. The software used in embedded systems is referred to as firmware.

Many embedded systems are not visible in daily life and do not have a user interface. Some may consist of buttons and LED to input the data and to show the output respectively. Other devices, such as MP3 players or PDAs, have a complete user-friendly interface with touch screens and large amount of buttons for both input and output issues. In recent years, many embedded systems have become networkable in order to provide people with an interface to remote embedded systems accessible for more users from different locations anytime (for example home routers).

Embedded systems are applied in virtually all sectors thinkable. Examples of specific applications in some sectors are:

- Consumer electronics – portable audio and video, IP set top boxes, digital cameras and camcorders, white goods, power tools.
- Telecommunications – mobile phones, home gateways/routers, GPS receivers.
- Automotive - anti-lock braking system, electronic stability control, traction control, X-by-Wire, telematics.
- Industrial automation – robotics, data acquisition, process control.
- Office automation – computer printers, faxes, copiers.
- Medical technology – patient monitoring, imaging.

Note that in general an ES is not an exactly defined term. Many systems have some element of programmability; however they are not truly ES. One example are PDAs. These have operating systems and microprocessors just as ES, however they differ from ES because they allow different applications to be loaded and peripherals to be connected.

More information:

- Wiki on embedded systems - http://en.wikipedia.org/wiki/Embedded_system
- Wiki on microcontrollers - http://en.wikipedia.org/wiki/Microcontroller
- Wiki on digital signal processors - http://en.wikipedia.org/wiki/Digital_signal_processor
- Wiki on SoC - http://en.wikipedia.org/wiki/System-on-a-chip
- Embedded systems explained and defined - http://www.bestpricecomputers.co.uk/glossary/embedded-systems.htm