The DTI drives our ambition of ‘prosperity for all’ by working to create the best environment for business success in the UK. We help people and companies become more productive by promoting enterprise, innovation and creativity.

We champion UK business at home and abroad. We invest heavily in world-class science and technology. We protect the rights of working people and consumers. And we stand up for fair and open markets in the UK, Europe and the world.

A large number of senior people from electronics companies, Government departments, Trade Associations, universities and research bodies have been involved in the Electronics Innovation and Growth (EIGT) team. This report reflects the broad consensus of their views, though not necessarily those of the Government, nor individuals, companies or organisations.
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I would like to introduce my remarks on the valuable work done by the Electronics Innovation and Growth Team by first extending my thanks to the wider electronics industry – the businesses, trade associations, employees’ representatives, financiers and others from outside Government – for engaging so constructively with officials in the DTI, the Regional Development Agencies, the Research Councils and UK Trade and Investment in this significant consultation exercise.

The EIGT has taken a candid and refreshing look at some challenging issues that must be resolved if we are to secure a bright future for UK electronics and UK plc. The EIGT 2015 review differs from other IGTs in that it had no preconceptions. It took a clean sheet of paper as the starting point, and was not afraid to take criticism from industry or Government circles. The criticism is constructive and the recommendations are designed to strengthen the relationship between Government, industry and the wider stakeholder community.

The report findings reflect on the profound changes that are occurring throughout society, business and the global technology environment. Support for the electronics sector is a vital feature of the DTI’s Manufacturing Strategy, and is already delivering an infrastructure to enable UK-based manufacturers to thrive.

However, the electronics sector is operating against a backdrop of continuous change, fierce global competition, and a need to generate carefully controlled exploitation of intellectual capital. The skill set required is changing and the EIGT recognises we need greater diversity to bring forward the people with the skills needed for tomorrow’s business successes.

Electronics today tends to be invisible but in fact is all pervasive, and is commonly an enabler in most sectors – from retail to defence and healthcare. The trend continues to accelerate with more and more embedded electronic systems in everyday products and services.

We recognise there are a considerable number of recommendations to consider in this report, as a result of an all encompassing consultation exercise featuring a wide and diverse body of opinion. Government will reflect on those recommendations directed towards it, and expects Industry to take a hard look at itself. Together we can ensure that the UK continues to benefit, grow and prosper from an electronics sector that is underpinned by innovation and a desire for world-class performance.

Rt Hon Patricia Hewitt
Secretary of State for Trade and Industry
Minister for Women and Equality
EIGT Chairman’s foreword

Patricia Hewitt, the Secretary Of State for Trade and Industry, invited me to chair the Electronics Innovation and Growth Team in July 2003.

The Terms of Reference that the Team accepted were to engage all relevant UK stakeholders, and conduct a strategic review of the industry, in order to:

- Evaluate key factors that will impact on the electronics sector globally and identify the associated opportunities & challenges for the UK;
- Formulate a vision for the future of the electronics industry in the UK; and
- Agree a roadmap (i.e. recommendations) for industry and Government to deliver this vision.

I would first of all like to thank all the individuals and organisations who contributed so generously of their time and experience to assist in this work. I am particularly indebted to the Steering Board and Working Groups, and the many companies and stakeholders who assisted us in validating our research and conclusions, and the Secretariat based at the Electronics Unit at the DTI.

I would also like to thank the Sector Skills Council for Science, Engineering and Manufacturing Technologies (SEMTA) for their assistance with our analysis of the key training and skills issues affecting the industry. This has proved to be a crucial area as it impacts across all the other issues we considered.

The EIGT undertook its work against a paradigm shift in the global electronics industry, which has resulted in serious loss of UK competitive position. The pace of change will continue to gain momentum over the next decade. We can’t avoid the convergence of globalisation, commoditisation and international competition. Simply doing something better will not protect our industry – we must do better than the rest.

However, it is important to remember that significant change also offers significant opportunity, with potential benefits not limited to the electronics industry. Electronics is a propellant for change in most other sectors.

Given the potential impact of the industry, it was important that we started our analysis without any preconceived ideas of the underlying causes for poor UK performance, compared to other competitors who face similar competition in a challenging global environment.

Our initial analysis revealed that the fragmented, diverse nature of the industry, and its difficulty representing itself to Government and vice versa, led to delays in addressing some of the key issues which impact on its performance. It is vital that the UK electronics industry re-energizes itself, with better networking and collaboration to enhance its reputation in all parts of the global value chain.

Naïvely, UK industry often feels it can retreat to the high ground and concentrate on high value-added products, e.g. system design. Whilst we have significant strengths in this area, it is clear that these are under threat from other countries who are exploiting their skills base and new technologies to show how massive demand can be satisfied by a small region.
We must create an environment where the cycle of developing new ideas and turning them into successful commercial products is sustainable. In addition, we must leverage the inevitable convergence of markets and technological discontinuity as areas of core competence, supported by a healthy entrepreneurial environment in the UK.

The electronics supply chain is global, complex and demanding and will continue to become more so. We have significant skill in this area, but this must become a core competence for the whole industry. Understanding and designing lean, flexible supply chains to meet the needs of our customers is a given.

We must also make efforts to improve vital leadership, management and marketing skills. Moreover, our approach to the continuous development of our people must respond to the rapidly changing nature of the business if we are to compete globally. Shortage of future science skills is a major problem for the UK. On this topic we must reinforce the message of other IGTs. It is clear that the UK will not survive in any sector if we fail to address this issue.

The industry and its stakeholders, in partnership with Government, must address a number of challenges if the industry is to maintain a significant presence in the UK. The EIGT strategy can be split into four key areas, each addressing major challenges to future success:

- Maintaining the **visibility** of the UK industry on a world stage;
- Raising the industry’s **confidence** in its own capabilities and ability to continually improve;
- Establishing **focus** and strategic relationships across the whole of the industry;
- Identifying and communicating to the industry the most important **opportunities** and how they might be exploited.

If we can address these areas successfully, then I firmly believe the electronics industry will continue to make a significant contribution to the economic prosperity of this country. We must take immediate and decisive action if we are not to be left behind by a global industry whose economic cycles are ever-shortening, and technology and markets are ever-changing.

We believe this is the most comprehensive analysis of the UK electronics sector ever undertaken. The UK electronics industry should take heed and adopt this strategic plan of action with its partners in Government and elsewhere as a matter of urgency in a highly competitive global arena. I look forward to working together with all parties concerned to achieve our goal.

David Kynaston
*Chairman of the Electronics Innovation and Growth Team*
EXECUTIVE SUMMARY

Building a successful future for the UK electronics industry

Over the last twelve months the EIGT has built a picture of the challenges facing the UK electronics industry and created a strategy for innovation and growth. We found a sector that is significant in its own right and which is also a driver for innovation and growth in almost every other sector of the economy. Yet we found a sector that is largely invisible to itself, to Government and other key movers and shakers. We have found a sector that is proud and confident about its technical capability, but a sector that lacks confidence in its ability to exploit that capability. We have found a sector that has been trying to solve its problems, but through unfocused initiatives that lack critical mass. And we have found a sector facing almost endless opportunities, not least in areas where public procurement plays a key role, yet a sector that is frustrated by barriers to these opportunities.

In this report we analyse the issues and make recommendations for a strategic way forward, which is summarised in the diagram below. Success will depend on cooperation across all stakeholders. This is a national strategy for the UK electronics industry – one in which Government, industry stakeholders, education, academia, the Regional Development Agencies (RDAs) and the Devolved Administrations (DAs) have a role to play.
Make it visible

The UK electronics industry needs to improve its visibility. It is a value chain of highly interdependent sub-sectors with fragmented and under-resourced representation. As a result it lacks vision and leadership and is not able to exert influence to the degree that a sector of this size should.

But just how big is the sector? The candid answer is that we just do not know. We have found that official measurements are based on unreliable data. But we believe that it is significantly bigger than the 2% of GDP that official statistics record. Similarly its R&D is more significant than official statistics and the R&D scoreboard suggest.

The sector is poorly networked, thus stifling the transfer of knowledge and best practice which is a key to innovation and growth.

Better signposting

Government services are also poorly signposted for the sector, and few RDAs have recognised the sector as being amongst their regional strategic priorities. This is because the sector is regionally dispersed with no obvious clusters. Various initiatives have evolved in a sub-critical and uncoordinated way. This has led to confusion, especially for SMEs, and occasional rivalry. The EIGT calls for greater focus through a National UK Electronics Strategy which highlights several areas where RDAs could play a significant role.

The EIGT is clear that the future success of the industry depends on more cross-sector working. Such are the challenges from globalisation, convergence and regulation that no part of the sector can successfully tackle these issues alone. The EIGT, therefore, makes a number of recommendations for focussed activity around big projects, opportunities and challenges.

Building confidence

The industry is just recovering from a major global downturn, during which a paradigm shift has taken place and supply chains have become vastly more complex and extended. During this period it is not surprising that industry’s confidence has been challenged. In order to grow and innovate the electronics industry needs to grasp some tough truths about its management, skills, employment practices, and supply chain management. Only then will it have the confidence to seize the opportunities facing it.

The industry is not only competing for market share on a global stage, it is competing for talent and investment at home. The EIGT makes several recommendations for improving supply chain management, image and skills, including action to redress the shortage of students wishing to study science and engineering.

The UK electronics industry is highly regarded for the quality of its R&D, but with a few exceptions, systematically fails to exploit this and grow medium and large
companies. The EIGT report discusses the causes and makes recommendations to address this and other major challenges.

Some of these challenges are down to individual companies to tackle, others need to be tackled collectively by the industry.

**Seizing opportunities**

The EIGT began by looking for key opportunities on which to base its strategy. In the end, we found that opportunities were almost limitless, both within the sector and in other sectors too. Public procurement has a large role to play, particularly in defence, health, transport and security, but barriers to engagement need to be overcome.

Regulation is currently seen as a burden, and so it will remain unless the industry improves its influence and engagement at the early stage of formulation. But regulation is itself setting new challenges, such as designing for energy efficiency and recycling, as well as creating business opportunities in end-of-life management and control and instrumentation.

Technology will continue to be the main driver for change. Electronics design is a UK success story. We need to keep it so. Carbon-based electronics also presents an exciting future opportunity, and one in which the UK has strong growth potential.

**BUILDING GOVERNMENT AND BUSINESS ENGAGEMENT (Chapter 3)**

Effective Government and industry stakeholder engagement is essential to ensure the right climate for the electronics industry to grow and prosper. Electronics industry representation is very fragmented. Consequently there is lack of clear leadership and the critical mass to ensure visibility and influence. Networking is poor between Government and business, business-to-business and between business and the academic community. Consequently, there is a lack of effective influence on key policy areas and failure to engage with the RDAs.

The problem is compounded by the lack of reliable data for measuring the industry and its performance. Official statistics underestimate the contribution of the electronics industry to the economy.

The challenge is to create strategic management and leadership within the UK electronics industry, and an industry-wide alliance with high quality analytical and leadership skills. An **Electronics Leadership Council** could tackle and prioritise significant opportunities in technology, public procurement, skills, regulation and the global supply chain.

In chapter 3 the EIGT examines:

- Representation and networking;
- Measurement;
- Legislation and influence;
Intelligent public procurement;
Investment decisions;
Accessing UK government and EU support;
Priorities for DTI.

The UK electronics industry needs strategic leadership to steer through a national strategy for electronics that will be implemented by government, the RDAs and industry stakeholders working together. In addition, the various trade associations representing the industry need to work closer together to improve networking and information for the industry.

**Key EIGT Recommendations**

3.1: The EIGT recommends the establishment of an Industry/Government Electronics Leadership Council (ELC).

The ELC should be a relatively small but influential body that is business led on behalf of the whole industry and key stakeholders. There should be appropriate senior Government and RDA involvement. The council will monitor the implementation of the recommendations of this EIGT report, and also initiate work streams for tackling some of the strategic problems that the EIGT has identified. The ELC will not duplicate activities that are working well, but may provide the glue to give critical mass to existing activities or enhance existing activities where a more strategic input is needed (e.g. in the area of skills).

3.1.1: Priority work streams will be established to bring focus and critical mass to key issues relating to technology, skills, the supply chain and public procurement. Leaders of the priority work streams would also form part of the ELC.

3.1.2: The EIGT recommends that a further work stream of the ELC should address industry representation, as a UK Electronics Alliance (UKEA).

The key task of the UK Electronics Alliance should be to develop and implement effective mechanisms to support and represent the shape and challenges of the electronics industry in 2015.

The Electronics Alliance must work in a way that builds and sustains trust across all parts of the industry and marshals activities in a more cohesive manner. The Alliance needs to consider how best to address the interests of the SME community and add value to the industry. It should provide a single point of contact on behalf of the industry for interfacing with the RDAs, and help bury rivalry between trade associations and predatory behaviour. The EIGT believes there is much activity of mutual benefit, including:

- Collaboration on the implementation of regulatory best practice, possibly as a joint bid for Government business support-funded best practice activity.
- The development of a make-or-buy tool kit.
Improved careers material to boost the image and visibility of the industry.

A new raft of pay-as-you-go services for SMEs.

Creation of a regulatory information portal.

Joint regional seminars to improve SME networking and engagement with the RDAs.

Networking opportunities across the whole electronics industry, including links with customers and supply sectors outside the electronics arena.

Encouraging companies to benchmark performance and promote best practice to drive up productivity and competitiveness.

Co-ordinating overseas mission activities.

Better measurement

According to EIGT interviews, few companies take SIC codes seriously and there is little effort or incentive within companies to ensure that statistical returns are correctly targeted. This has led to enormous anomalies. Measurement matters, and without reliable and timely data companies can be lulled into a sense of complacency about their performance, and Government and RDAs will make wrong decisions on issues that affect the industry. Considering that a major international review of SIC codes is to take effect from 2007, the EIGT recommends:

3.2: The DTI, ONS and the UK Electronics Alliance must take the opportunity of the international review of SIC codes to devise and press for a more relevant structure.

A test of success will be the ease with which companies can accurately and easily assign themselves.

Increasing influence

The EIGT strongly supports the recommendations of the Innovation Review and its conclusions about the role that innovation and public procurement can play in stimulating innovation and growth.

It will be essential for UK electronics companies to have the management and leadership qualities to seize strategic opportunities that come from regulation and public procurement. Business needs to be more adept at horizon scanning and influencing UK and other member states negotiators at the right stage. This task is beyond that of all but the largest companies, so the EIGT recommends:

3.3: An Electronics Regulatory Group (ERG) should be established to increase industry influence on EU regulation.

The ERG should consist of trade association representatives and officials from the main regulatory departments that impact on the sector – currently DEFRA, HSE, DTI, HO, Treasury. The ERG would help to ensure a better understanding between Government and business of the individual and cumulative impact of regulation.
The ERG should work closely with the ELC and should include a senior representative from the Supply Chain work stream to ensure that all implications for the supply chain are understood.

**Public procurement**

The public sector is the largest market for the UK electronics industry. UK companies should be able to bring together the best of business and science capability to ensure public procurement is the best fit for purpose, encourages innovation and is good value for money. The public sector should be at the forefront of technology use and a showcase for UK capability. The combined mass of public procurement should be a lever for inward investment and ongoing product support and development. But current procurement processes are a barrier to this vision and opportunities are being lost to overseas competition. The EIGT recommends:

3.4: Public procurement should be one of the future work streams of the ELC. Procurement and technical strategy roadmaps should be created by all Government departments, and pilot task forces developed for new procurement opportunities.

3.4.1: Government should allocate a percentage (2 – 4%) of its procurement budget for technology development.

3.4.2: The EIGT acknowledges the substantial changes already planned as a result of the implementation of Office of Government Commerce (OGC) reforms, and urges sustained and rapid progress in that direction.

Economic impact should be used as a selection factor to aid innovation but not to prop up old technologies.

3.4.3: Procurement departments should improve signposting of opportunities for partnership between SMEs and large companies, and RDAs should help to build SME consortia.

**GLOBAL MARKET SECTOR AND TECHNOLOGY OPPORTUNITIES (Chapter 4)**

The EIGT considered the market prospects for electronics companies in established application vendor sectors, selected overseas territories, and in particular those opportunities that may be presented by emerging technologies.

There are major new market opportunities for those companies active in the electronics sector. Global growth is forecast across all sectors, ranging from 2-6% p.a. Global opportunities in each sector need to be set against UK strengths and success depends on numerous factors, so the EIGT cannot be prescriptive. Functional convergence offers an opportunity for companies that can adapt existing offerings to new applications. There is also considerable potential for those involved in public procurement, as national programmes can stimulate innovation, and underpin business opportunities in key areas such as healthcare and security.
The UK is well placed, primarily due to its excellent science base, to take advantage of emerging technologies. This would be underpinned by promoting an enthusiasm for new technology, through the development of aspirational projects, maintenance of research ‘critical mass’ and greater coherence of technology strategies across Government.

Considering the international market potential, China represents a massive opportunity notwithstanding the risks to IP. India also represents a good opportunity given a shared cultural heritage, willingness to work co-operatively with UK businesses, and a supply of good quality people. Inward investment to the UK by US corporations also provides access opportunities to an otherwise highly parochial market.

UK application vendor companies should rapidly refocus as opportunities emerge from convergence. Government and industry representative bodies must be active and flexible in the way they engage.

The UK should play to its strengths. We remain ahead of the game in terms of electronics design and can maintain this advantage. There is realisable critical mass in the health and defence sectors, and the UK should strive to be a world-class supplier in these areas. Significant potential exists in security, environmental service and energy efficiency applications.

The UK could have a world-class capability in auto-identification and data capture (AIDC) and certain RFID solutions in both the private and public sectors. The UK AIDC community can benefit from massively increased market opportunities given extensive regional activity to accelerate the adoption of these solutions across all business sectors.

**Key EIGT recommendations**

4.1: Public sector purchasing should be used as a driver for innovation and business success.

This will require the further development of strategic relationships between the supply side (including academia), Government sponsor departments, customer departments and their purchasing agencies. In chapter 3 we note that combined public expenditure on health, transport and defence will rise by 26% p.a. to £141bn by 2007/8.

4.1.1: Government departments should have closer dialogue with the electronics industry to determine the immediate and future technology needs of the various Government departmental programmes.

Purchasing agencies should reflect more strategic thinking in the design of procurement programmes to draw forward innovation and develop key capabilities within UK industry.
4.1.3: The Government should give greater opportunity for SMEs to participate in publicly procured projects.

Prime contractors should involve their UK suppliers more closely in the development of relationships with Government procurement departments. This type of approach was used in the run up to Y2K. An additional benefit to prime contractors would be the development of resilience in their supply chains, whilst lowering the barrier to participation that bars a more strategic engagement on the part of SMEs. Greater use should be made of mechanisms like the Northern Defence Industries (NDI) initiative whereby SME collaborators are assembled to bid into significant public procurement projects.

Global markets

UK electronics companies should be confident and competent in penetrating more risky markets. Then UK plc could enjoy an increased market share based on secure IP and confident marketing skills.

4.2: The ability to succeed in Asian markets should be replicated widely across the electronics sectors. There is scope for corporate mentoring including the spread of best practice in IPR protection.

4.2.1: There should be an increased role for bodies such as the China-Britain Business Council (CBBC) and the Asia Europe Meeting (ASEM).

There is a need to cultivate bilateral trade association relationships, to build a far greater degree of IP trust in business relationships, possibly through the introduction of an IP ‘trust mark’. It will also be worth exploring whether, through the relevant professional bodies, there is scope for introducing an element of ‘best in class’ IPR training and development for Chinese chartered engineers and supply chain executives.

Emerging technologies

The EIGT envisages creation of a thriving UK community comprising a world-class science base, coupled with a wide range of industry eager to engage in and exploit emerging technologies, underpinned by clear, joined-up Government strategies so we can benefit from emerging technologies as opportunity presents itself.

4.3: A national enthusiasm for new technology should be promoted. The electronics sector must develop genuine capability among the higher educational institutes (HEIs) in the sciences underpinning the emerging technologies.

Industry at all levels should be encouraged to engage in the development of coherent technology strategies that pull through promising emerging technologies across Government departments.
4.3.1: Aspirational visions should be set that engender enthusiasm for new technology.

In the course of the EIGT consultations there was discussion of the development of aspirational projects that would push the boundaries of electronic technologies, like a ‘Manned mission to Planet Zog’ or ‘The ultimate robot’. These projects would challenge thinking and promote truly innovative solutions. It is not clear to the EIGT what would constitute such a project. The DTI proposes to hold a competition, in partnership with a leading electronics company and open to schools and trade associations, seeking suitable projects. The competition will open in April 2005.

4.3.3: There should be greater coherence in Government departments’ technology strategies to underpin and pull through promising emerging technologies.

The DTI leads the Technology Strategy, and this should form the basis of a National Technology Strategy. A close dialogue must be maintained with industry to ensure that elements within DTI’s Technology Strategy reflect the potential of emerging technologies.

SUPPORTING A STRONG ENVIRONMENT FOR INNOVATION AND R&D (Chapter 5)

Innovation and R&D performance

Despite a few outstanding exceptions, official data showed that the UK electronics industry spends significantly less on R&D (as a percentage of sales) than our major competitors, particularly the US. However, the UK figures should be treated with some caution, as the R&D spend in the UK by foreign multinationals tends to be under-recorded in the UK R&D scoreboard.

The strong message of the EIGT consultation process was that “the UK has a strong electronics R&D base”. Many companies maintained they were not constrained on R&D spend, and recognised the importance of R&D whether in a defensive or market growth mode. However, to remain competitive, the UK electronics industry needs to increase R&D intensity. And in particular, improve the effectiveness of current R&D by addressing the problem of turning innovation into market leadership and growth.

The industry has a structural problem compared to the US, as there is a severe lack of middle-sized, R&D intensive electronics companies. The UK industry is dominated by SMEs, which mostly lack sufficient resources for intensive R&D, and rarely grow to become medium-sized companies. There are a number of reasons, including the dearth of risk capital, the risk-averse culture in the UK, and foreign acquisitions.
Key EIGT recommendations

5.2: The Government and industry should encourage growth of successful indigenous UK electronics SMEs, through the IPO-phase, to successful, high growth, medium-sized companies which have the capacity to resource and exploit R&D at an appropriate level.

Finance for innovation and R&D

Companies need access to sufficient finance to invest in R&D and facilities for the UK electronics industry to grow. Generally, SMEs receive a poor reception from UK institutional investors. Venture capitalists are considered to be risk averse about high technology and extremely conservative towards new investment, following low returns on high-tech funds and projects in Europe. They favour management buy-outs, as they generate large overall returns at lower risk. By contrast, US technology funds have delivered better returns to their investors, and so have been more successful in maintaining funds.

There are a number of cases where innovative companies had little or no success raising funds from UK VCs, but secured substantial sums from US banks and VCs. Such inflows of funds are clearly beneficial and should be encouraged by facilitating interaction between foreign financiers and innovative UK firms.

Seed and early-stage funding seem particularly scarce. While there is a fairly strong business angel funding community in the UK, it is rather dispersed and there is benefit to be gained in aggregating investments to spread the risk.

Several DTI schemes have helped companies to bridge the funding gap. Support under SMART (now Grant for R&D) has also helped SMEs secure funds for innovative projects, while LINK has acted as a spur to companies to seek out high quality university research groups. Some companies remain confused about what Government support is available to help business.

5.2.1: DTI and industry should encourage the finance sector to work closer with the electronics industry to improve business plans for raising funding, and in particular their marketing and commercial content.

Taxation and fiscal environment

The UK electronics sector needs more incentives to help ensure that R&D is performed and exploited in the UK, rather than migrating overseas due to globalisation. UK R&D tax credits have helped leading edge, R&D intensive SMEs in particular, but more support is needed for these sectors to thrive. Problems remain in defining the extent to which developmental work applies and which costs are eligible. The level of credit also needs to be raised to make a substantial difference.

Some other fiscal changes over the past few years have also helped create an environment more conducive to innovation. In particular, the capital gains tax taper relief is encouraging more entrepreneurs to develop businesses in the UK. This measure would be even more effective if the relief was extended to prevent
investors in unquoted companies being disadvantaged in the event of the company being acquired by a quoted company.

5.4: The Treasury should simplify and broaden the scope and applicability of the R&D tax credit to a level where it makes a difference to both SME and large companies’ investment decisions, and helps strengthen the commercialisation process.

5.4.1: The Treasury should make amendments to the capital gains tax taper to encourage more recycling of money into further initiatives and to encourage ‘serial entrepreneurs’.

Knowledge transfer and collaboration

While the UK science and engineering base appears to be fairly strong, exploitation by UK firms is often inadequate. SMEs in particular find it difficult to access university research. This is a long recognised problem, though mechanisms to encourage knowledge transfer and industry-academic collaboration (such as the LINK scheme) have been in operation for over two decades. However, LINK scheme coverage has been patchy.

In addition, a number of Faraday Centres have been established over the past six years to encourage knowledge transfer. But there has been little strategic direction, and no Faraday Centres directly address the needs of the electronics industry.

Though the creation of successful relationships between universities and industry can be difficult, there have been some notable successes.

Although a number of electronics-related regional networks are underway, better use should be made of them by creating and linking certain RDA forums, incubators and clusters into a national network. This would create better coherence and improve global perceptions of the UK’s capabilities.

There are significant areas of opportunity like polymer electronics, optoelectronics and electronics design, where the UK has world-leading technology. Exploitation of these should be encouraged through the new DTI Technology Programme.

5.5: The Technology Working Group of the Electronics Leadership Council (ELC) should work with the RDAs to identify and develop core competencies, creating incubators and clusters (including virtual clusters) in support of them.

5.6: The DTI Technology Strategy Board should consider adopting disruptive electronics as a priority technology area, and encourage collaborative R&D and the formation of a Knowledge Transfer Network in Electronics Design. The network should also give access to people who are not directly involved in electronics design.

There are very few large indigenous electronics OEMs in the UK. This is a significant problem because companies tend to establish higher value activities, like R&D, in their home country. Despite this, the UK is considered to be strong in areas like electronics design and electronics systems integration. These strengths,
together with the UK’s academic prowess in emerging fields, should attract inward investment if marketed correctly.

**5.8:** The DTI and UKTI must step up efforts to encourage global electronics companies to establish R&D centres in UK, through missions, better marketing of UK excellence and targeted financial assistance.

**5.9:** DTI and ELC should protect our UK design base, by encouraging integration of related activities into core-competency clusters, and also increasing electronic design support for non-electronic companies.

**OPERATING EFFECTIVELY IN A GLOBAL SUPPLY CHAIN (Chapter 6)**

The electronics supply chain is highly dynamic, complex and disaggregated, following significant changes in recent years, including offshoring to lower cost economies, and increased product complexity. These changes bring new challenges for UK-based electronics companies in terms of managing the extended supply chain, strategic decision-making, and e-business. There are also challenges associated with the new environmental regulations, especially in design and end-of-life management. New skills are required, particularly for SMEs, if the vision of establishing a global presence and global best practice in supply chain management is to be fulfilled. These issues are important given that the supply chain can represent up to 95% of a product’s manufacturing costs.

The EIGT believes that UK companies should focus on: strategic decision-making, managing the extended supply chain, and e-business in order to improve their competitive position on a global basis. There are also challenges associated with the new environmental regulations that address end-of-life management.

**Strategic supply chain decision-making**

UK electronics companies need to have a full understanding of all the cost elements of their supply chains and access to the necessary, up-to-date information to make both strategic and tactical decisions (including ‘make or buy’). Getting access to this information can be a major challenge, especially for SMEs, and unless electronics companies are able to make informed strategic decisions, they run the risk of making decisions that could ultimately damage their competitiveness and capability.

The EIGT suggests it would be helpful to have a ‘toolkit’ containing up-to-date information for companies, particularly SMEs, to enable them to make better strategic outsourcing decisions, and give them a full understanding of all the cost elements of their supply chains.

**Key EIGT recommendations**

**6.1:** A ‘toolkit’ should be created which could provide a single access-point to source all necessary information on which to base strategic supply chain management decisions.
Supply chain management skills

The UK electronics sector needs to operate the most efficient supply chain management system in the world in order to succeed in this extended global market. This would bring about a step change in productivity for both the UK electronics industry and its customers. UK universities need to be globally acknowledged experts in supply chain management research, and training providers should teach best practice. Companies need continually to refresh their skills in this area.

Currently the UK electronics industry recognises the increasing importance of supply chain management but lacks effective skills, particularly within the SME community. This hinders the efficient operation of supply chains and ultimately competitiveness. Companies have found to their cost that some off-shoring decisions were wrong.

6.2: The RDAs and other devolved administration, working with SEMTA as appropriate, should ensure that appropriate training provision of global supply chain management skills is provided in their regions, and that universities and business schools also capture best practice in supply chain skills in their courses.

6.2.1: The industry should urgently strengthen its supply chain management and should benchmark its supply chain management both internally within the sector and against other sectors to identify and address weaknesses.

Lack of e-business uptake

Pragmatic deployment of e-business in an organisation can deliver significant improvements in productivity and margin by enabling cost reduction, optimising the supply chain, improving responsiveness to customer requirements and maintaining closer links with suppliers. Through the use of e-business, the UK industry will be able to achieve more tightly integrated global supply chains, minimising ‘information latency’ and optimising supply chain efficiency. This will result in world-class performance in customer service, payments, stock control, timely delivery to specification, and the potential to eliminate obsolete stock when cyclical downturns occur.

This level of integration will help to deliver high quality management information so senior management of electronics firms can make strategic decisions to maintain or increase their competitive edge.

But there are barriers that need to be overcome to secure this vision. The industry needs to adopt common open standards to encourage appropriate e-business adoption. This calls for leadership from the OEMs, and the need to work closer with software suppliers to adopt low-cost, effective e-business options (e.g. outsourcing IT implementations and on-demand computing) that enable organisations, including SMEs, to retain their competitive edge.

The electronics industry, and especially SMEs, need help to understand the opportunities presented from new and emerging technologies, services and
software, including leveraging broadband and wireless connectivity applications, and to enable flexible working and cost reduction.

It is widely accepted that Europe still lags behind the US in leveraging efficiencies via the deployment of e-business. The UK is more or less on a par with its main European competitors in terms of e-business uptake, and the UK electronics sector performs better than many other sectors in the UK. However, there still remains a section of the UK electronics SME community that is reluctant to adopt e-business due to a number of factors.

6.3: The Electronics Alliance should promote the cost effective adoption of common open standards to facilitate greater uptake of e-business.

Environmental legislation impact

Recent developments in environmental legislation are significantly impacting on the electronics supply chain. Industry needs to embrace the opportunities presented whilst ensuring that it influences the shape of legislation at a strategic level from an early stage. Businesses will need to think carefully about the environmental impact of their entire supply chain for current and new products. They will need to take legislation into account when designing new products, and work more closely with suppliers and customers to eliminate environmental risks, not just for manufacture but also with regard to end-of-life management.

Significant regulatory developments include: the Waste, Electrical and Electronic Equipment (WEEE) directive; the Restriction of the use of Hazardous Substances (RoHS) directive; the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) directive; and the Energy-using Products (EuP) directive.

Some of these directives will require investment for compliance but will provide new opportunities for UK business. End-of-life management systems will need to be established. Markets for recycled materials will have to be found or new business models developed for leasing and upgrading products to eliminate environmental burdens. Manufacturing processes will have to be reviewed and modified, as well as make-or-buy decisions. Companies will also have to consider their reputations in terms of Corporate Social Responsibility for supply chain decisions.

Because of fragmentation of representation, the electronics industry exerts poor influence on the legislative process with the emergence of ‘unintended’ consequences and uncertainty over implementation. There are strongly held fears that regulations will penalise UK manufacturers and non-compliant imports will still reach the European market.

6.4: Government and industry should participate fully in the Electronic Regulatory Group (ERG) in order to influence the detail of regulation more effectively and to stimulate industry networking for developing and sharing best practice on implementation.

6.4.2: Government should ensure uniform interpretation and application of regulations across Europe, and ensure that imported goods are compliant.
UK electronics companies need to be more strategic in addressing skills if they are to raise productivity and compete effectively. This means a step change in management and leadership skills, technical and engineering skills, general business skills, procurement and supply chain management skills, all of which are essential for the future survival and success of the industry. Government also needs to target the available resources better to stimulate the take-up of people development activity.

**Key EIGT recommendations**

**Tackling the disconnect in skills demand and supply**

There is a market failure in matching skills supply to demand in the electronics industry. There are some self-help measures that could start to address this mismatch. Improved supply chain management and the use of e-business should improve business understanding of labour market trends. Steps to improve the visibility of the sector will also help the labour market to see opportunities. But in themselves these steps will be insufficient – at least in the short-term.

Business and training providers need to understand each other’s requirements and work together to secure the best economic outcome and training material should reflect global best practice. Training should be undertaken before demand takes off, rather than afterwards. Reliance on unskilled temporary staff should reduce. The EIGT believes there would be merit in exploring fiscal and other mechanisms to address counter-cyclical so that the downturns in business cycles are used for up-skilling rather than lay-offs. In this way, the UK electronics industry will be better positioned when each upswing arrives. The EIGT also suggests that temporarily surplus/laid-off industry people could be redeployed to fill electronics-related teaching vacancies. The EIGT recommends:

7.6: DfES and the Treasury should work with the industry to consider innovative mechanisms for tackling the market failure in matching training provision to the electronics business cycle.

**Management and leadership skills**

The UK needs electronics leaders with vision and the ability to communicate it, as well as technologists with strong business skills, academics who understand business, and an education system that delivers this vision.

The sector needs to gain new business insights and raise its innovation and productivity by embracing diversity and adopting best practice from other sectors. In this way, the industry will recognise and continually respond to the challenge of re-skilling for growth.

The Government’s skills strategy already places emphasis on management and leadership skills. The EIGT recognises that most of the responsibility for addressing this problem rests with business itself, and recommends:
7.1: Members of the Electronics Leadership (ELC) Council should be exemplars in management and leadership and should create a mechanism for recognising outstanding leadership. Working through both its skills and working group and the Electronics Alliance, it should promote a leadership challenge to senior managers in the sector.

7.1.1: RDAs and Business Links should help to promote management and leadership training opportunities to electronics companies in their regions.

7.2: Businesses must review their recruitment and employment patterns and practices in order to attract and retain a more diverse workforce.

7.2.1: The Electronics Alliance (EA) must establish a high profile and challenging diversity award for companies in the sector to reflect effort and progress in achieving diversity.

Recruitment and image

The electronics sector has a weak reputation among young people as an employer. In addition to its lack of diversity, employment practices tend to be short-termist. The invisibility of the industry contributes to its failure to attract much career interest. Even where interest exists, opportunities for capturing it through work experience are being ignored, despite research that shows that work experience leads to subsequent recruitment and retention. The EIGT recommends:

7.4: The Electronics Alliance, SEMTA and the professional institutions must work closer together to represent the exciting career opportunities in the sector for both women and men.

This cooperation should not just focus on the engineering opportunities. As a driver for change across all sectors, and operating in global markets, the range of jobs and opportunities offered by the electronics sector should be a unique selling point. The sector needs to gain a better understanding of the target market and re-evaluate the impact of existing recruitment methods.
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<td><strong>3: BUILDING GOVERNMENT AND BUSINESS ENGAGEMENT TO MAKE CHANGE HAPPEN</strong></td>
<td><strong>3.1:</strong> Establish an Industry/Government Electronics Leadership Council (ELC).</td>
<td><strong>3.1.1:</strong> Priority work streams should be established in order to bring focus and critical mass to critical issues. Initially these would be technology (see ‘Innovation’ chapter 5); skills (see ‘Skills’ chapter 7); supply chain (see ‘Supply chain’ chapter 6) and public procurement (see 3.4). <strong>3.1.2:</strong> A further work stream of the ELC should address industry representation as a UK Electronics Alliance (UKEA).</td>
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<td><strong>3.2:</strong> The DTI, ONS and the UK Electronics Alliance must take the opportunity of the international review of SIC codes to devise and press for a more relevant structure.</td>
<td><strong>3.2.1:</strong> Education and training is necessary for companies to improve data. <strong>3.2.2:</strong> Companies should increase awareness and take-up of best-in-class benchmarking. Links should do more to encourage SMEs to use the Benchmark Index, and use consultants to help pull metrics together to monitor the sector’s progress.</td>
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<td><strong>3.3:</strong> An Electronics Regulatory Group (ERG) should be established to increase industry influence on EU regulation.</td>
<td><strong>3.3.1:</strong> Government departments should pursue more objective-based regulation and avoid prescription that impedes competitiveness and innovation. The electronics industry should identify existing legislation that is having this effect. <strong>3.3.2:</strong> The UK Electronics Alliance should help to bring about significant improvement in the quality of evidence on regulation, address supply chain implications, and provide mechanisms for SME issues to be taken on board.</td>
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| 3.4: Public procurement should be one of the future work streams of the ELC. | 3.4.1: Government should allocate a percentage (say 2 – 4%) of its procurement budget for technology development. | 3.4.2: The EIGT acknowledges the substantial changes already planned as a result of the implementation of Office of Government Commerce (OGC) reforms and urges sustained and rapid progress in that direction.  
3.4.3: Procurement departments should also improve signposting of opportunities for partnership between SMEs and large companies, and RDAs should help to build SME consortia along the lines of the Northern Defence Industries (NDI) initiative. |
| 3.5: The UK, through the EU and WTO, must maintain efforts to monitor and where necessary challenge state aids that distort competition and investment decisions. | |
| 3.6: DTI and the RDAs should work together to identify and signpost all existing support initiatives that are appropriate to the electronics industry. The Electronics Alliance should work with them to help to identify more effective channels for communicating with this diverse sector on a systematic basis. | 3.6.1: Government should provide more support to enable UK companies to access EU Framework Programmes and work to persuade the EU to simplify and streamline the application process.  
3.6.2: Selective Finance for Investment should be targeted at high quality and sustainable investments in priority opportunities. |
| 3.7: DTI Electronics Unit should be resourced and restructured to support implementation of the EIGT report, facilitate the Electronics Leadership Council and influence key policy areas of skills, regulation, public procurement and technology strategy and key initiatives. | |
## EIGT Recommendations (Chapter 4)

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<tr>
<td><strong>4: GLOBAL MARKET SECTOR AND TECHNOLOGY OPPORTUNITIES</strong></td>
<td><strong>4.1:</strong> Public sector purchasing should be used as a driver for innovation and business success.</td>
<td><strong>4.1.1:</strong> Government departments should have closer dialogue with the electronics industry to determine the immediate and future technology needs of the various Government departmental programmes. Purchasing agencies should reflect more strategic thinking in the design of procurement programmes to draw forward innovation and develop key capabilities within UK industry. <strong>4.1.2:</strong> The DTI should continue to help promote AIDC solutions nationally, RDAs should develop regional initiatives to the benefit of local business and in development of local expertise in AIDC technologies and applications as appropriate. <strong>4.1.3:</strong> The Government should give greater opportunity for SMEs to participate in publicly procured projects. <strong>4.1.4:</strong> Greater use must be made of the Small Business Research Initiative (SBRI) to increase near-market R&amp;D activities in SMEs.</td>
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<td><strong>4.2:</strong> The ability to succeed in Asian markets should be replicated widely across the electronics sectors. There is scope for corporate mentoring including the spread of best practice in IPR protection.</td>
<td><strong>4.2.1:</strong> There should be an increased role for bodies such as the China-Britain Business Council (CBBC) and the Asia Europe Meeting (ASEM).</td>
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<td><strong>4.3:</strong> A national enthusiasm for new technology should be promoted. The electronics sector must develop genuine capability among the higher educational institutes (HEIs) in the sciences underpinning the emerging technologies.</td>
<td><strong>4.3.1:</strong> Aspirational visions should be set that engender enthusiasm for new technology. <strong>4.3.2:</strong> OST and the Research Councils should ensure that funding for exploration of new technologies within the science base achieves critical mass. <strong>4.3.3:</strong> There should be greater coherence in Government departments’ technology strategies to underpin and pull through promising emerging technologies.</td>
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### EIGT Recommendations (Chapter 5)

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<td><strong>5: SUPPORTING A STRONG ENVIRONMENT FOR INNOVATION AND R&amp;D</strong></td>
<td>5.1: DTI should revise methods of collection of statistics for the R&amp;D Scoreboard to reflect more accurately the level of electronics R&amp;D undertaken in UK, particularly in high R&amp;D SMEs.</td>
<td>5.1.1: The Government should also consider introducing a means of measuring innovation that mirrors the European index.</td>
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<td>5.2: The Government and industry should encourage growth of successful indigenous UK electronics SMEs, through the IPO-phase, to successful, high growth, medium-sized companies which have the capacity to resource and exploit R&amp;D at an appropriate level.</td>
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| | 5.3: DTI and industry should encourage the finance sector to work closer with the electronics industry to improve business plans for raising funding, and in particular their marketing and commercial content. | 5.3.1: DTI and UKTI should encourage foreign financiers to invest in UK electronics firms by raising the profile and increasing awareness of opportunities. Tasks should include the provision of good marketing material and organising targeted investment missions to and from the US and Asia.  
5.3.2: DTI should draw up a simple guide to grants and other Government assistance for technology projects.  
5.3.3: DTI and RDAs should encourage business angels to get together for co-investment in certain initiatives, to spread the risk and aggregate money.  
5.3.4: DTI and Treasury should work with the London Stock Exchange to improve the stature of AIM and give a profile nearer to NASDAQ. |
<p>| | 5.4: The Treasury should simplify and broaden the scope and applicability of the R&amp;D tax credit to a level where it makes a difference to both SMEs and large companies’ investment decisions, and helps strengthen the commercialisation process. | 5.4.1: The Treasury should make amendments to the capital gains tax taper to encourage more recycling of money into further initiatives and to encourage ‘serial entrepreneurs’. |</p>
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<td><strong>5.5:</strong> The Technology Working Group of the Electronics Leadership Council should work with the RDAs to identify and develop core competencies, creating incubators and clusters (including virtual clusters) in support of them.</td>
<td><strong>5.6.1:</strong> DTI should commit a much higher proportion of UK science and innovation budget to knowledge transfer and collaborative R&amp;D. <strong>5.6.2:</strong> EPSRC should continue to encourage the acceleration of critical mass in research by judicious deployment of its funding. It should also encourage more collaborative projects between universities and across disciplines. <strong>5.6.3:</strong> DTI and EPSRC should work together to produce a database of business and academic research capabilities in a national framework, improving signposting for collaboration between industry and universities. <strong>5.6.4:</strong> OST and Research Councils should encourage wider industry participation, particularly SMEs, in academic research.</td>
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<td><strong>5.6:</strong> The DTI Technology Strategy Board should consider disruptive electronics as a priority technology area, and encourage collaborative R&amp;D and the formation of a Knowledge Transfer Network in Electronics Design. The network should also give access to people who are not directly involved in electronics design.</td>
<td><strong>5.7.1:</strong> The electronics industry should work closer with universities to develop best practice in exploitation of their IP. <strong>5.7.2:</strong> Universities should be benchmarked on the success of their IP exploitation.</td>
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<td><strong>5.7:</strong> DTI should commission a study, working with the Patent Office and the European Commission, on measures to reduce the cost of EU patents.</td>
<td><strong>5.8.1:</strong> DTI and ELC should look for measures of fiscal encouragement and deregulation to encourage SMEs to grow to mid-range companies and stay in the UK.</td>
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<td><strong>5.8:</strong> DTI and UKTI must step up efforts to encourage global electronics companies to establish R&amp;D centres in the UK, through missions, better marketing of UK excellence and targeted financial assistance.</td>
<td><strong>5.9:</strong> DTI and ELC should explore ways to protect our UK design base, via integration with related activities into core-competency clusters, and also increase electronic design support for non-electronic companies.</td>
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<td><strong>6: OPERATING EFFECTIVELY IN A GLOBAL SUPPLY CHAIN</strong></td>
<td><strong>6.1:</strong> A ‘toolkit’ should be created which could provide a single access-point to source all necessary information on which to base strategic supply chain management decisions.</td>
<td><strong>6.2.1:</strong> The industry should urgently strengthen its supply chain management and should benchmark the performance of its supply chain management both internally within the sector and against other sectors to identify and address weaknesses. <strong>6.2.2:</strong> Trade Associations and RDAs (via the Electronics Leadership Council) should run regional initiatives, such as seminars, on the issue of supply chain management to raise awareness of the importance of the activity, and to learn from other sectors about best-in-class practice.</td>
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<td><strong>6.2:</strong> The RDAs and other devolved administration, working with SEMTA as appropriate, should ensure that appropriate training provision of global supply chain management skills is provided in their regions, and that universities and business schools also capture best practice in supply chain skills in their courses.</td>
<td><strong>6.3:</strong> The Electronics Alliance should promote the cost effective adoption of common open standards to facilitate greater uptake of e-business.</td>
<td><strong>6.3.1:</strong> The Electronics Alliance should develop a communication programme to inform the SMEs of the low cost, low resource intensive options associated with e-business such as outsourcing, hosting and on-demand computing. <strong>6.3.2:</strong> The Electronics Alliance should forge relationships with related sectors in order to ensure that UK electronics companies are well placed to take advantage of sectoral convergence.</td>
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<td>6.4: Government and industry should participate fully in the Electronics Regulatory Group (ERG) in order to influence the detail of regulation more effectively, and to stimulate industry networking for developing and sharing best practice on implementation.</td>
<td><strong>6.4.1:</strong> Industry should re-assess how it will adapt its management of reverse logistics in line with compliance of new regulations.</td>
<td><strong>6.4.2:</strong> Government should ensure uniform interpretation and application of regulations across Europe, and ensure that imported goods are compliant.</td>
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<td><strong>6.4.3:</strong> The Electronic Leadership Council’s supply chain group should work with Government and the RDAs to ensure that Business Support best practice products address supply chain issues and technology development associated with regulatory best practice, and the setting up of infrastructure for recycling.</td>
<td><strong>6.4.4:</strong> Design for the environment and eco-design principles should be built into education and training programmes at both an academic and internal organisation training level.</td>
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### EIGT Recommendations (Chapter 7)

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<td><strong>7: GROWING SKILLS TO MEET THE CHALLENGE</strong></td>
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<td>Members of the Electronics Leadership Council should be exemplars in management and leadership and should create a mechanism for recognising outstanding leadership. Working through both its skills working group and the Electronic Alliance, it should promote a leadership challenge to senior managers in the sector.</td>
<td>7.1.1: RDAs and Business Links should help to promote management and leadership training opportunities to electronics companies in their regions.</td>
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<td>7.5:</td>
<td>DfES, HSE and teacher representatives should address the barriers to practical science teaching, and produce guidance for teachers and school governors that encourages more practical work to be undertaken in schools.</td>
<td>7.5.1: More electronics companies and Trade Associations should engage with SETNET activities.</td>
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<td>7.6:</td>
<td>DfES and the Treasury should work with the industry to consider innovative mechanisms for tackling the market failure in matching training provision to the electronics business cycle.</td>
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CHAPTER 1

The EIGT approach

From the outset the EIGT Steering Group decided to approach this wide-ranging study of the electronics sector with no preconceived ideas about the issues being faced or the possible solutions. We wanted our findings to be based on sound analysis and our conclusions to have been tested thoroughly. We rigorously resisted lobbying from special interest groups.

The EIGT commissioned several detailed pieces of analysis:

- Competitiveness Studies were conducted by NERA\(^1\) and PDZ\(^2\) to analyse the relative productivity of the sector and factors affecting productivity, competitiveness and innovation.

- Market studies were conducted by Gartner and Findlays looking at the application areas and geographic regions where opportunities might arise, and also electronics companies and their employment within the UK.

- A survey by Intellect examined investment strategies and location decisions. Questions focused on the ‘offshore’ issue, in order to assess the level of migration that is actually taking place, and what motivation is driving the shift to the ‘low cost’ regions.

- Reports were also analysed relating to trends in the electronics industry from the commercial sections of UK embassies operating in key markets.

We also worked closely with SEMTA\(^3\), the Sector Skills Council for Science, Engineering and Manufacturing Technologies, to share and analyse data on the labour market and skills trends in the electronics industry.

The EIGT established five work streams to examine key areas in depth and undertake further analysis where necessary. These work streams were:

- Government and industry
- Skills
- Innovation
- Supply chain management
- Market sectors and technologies

The work streams also undertook supplementary analysis in their own areas of study, e.g. in depth examination of electronics companies in the DTI Benchmarking Index, service testing, analysis of value added, and much else besides. This work

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1. NERA: ‘Competitiveness in the UK electronics sector’, 2004
2. DTZ Pieda Consulting, www.dtzpiedaconsulting.co.uk
3. www.semta.org.uk
led us to a comprehensive picture of the key issues affecting the industry, which we attempted to validate in a major consultation exercise involving participants from the SME community through to major multinationals and also the industry’s stakeholder organisations.

Members of the EIGT team conducted one-to-one interviews with senior executives from 55 of the UK’s leading companies in and around the electronics sector. The feedback from the sessions was overwhelmingly positive that we were addressing the key issues. Many participants told us that the consultation process had stimulated them to consider issues they’d previously sidelined.

In parallel to these interviews, the EIGT ran a series of regional workshops with SMEs in Leeds, Nottingham, Taunton, Birmingham, Cambridge, Livingston and Birmingham. These sessions were run using small group discussions to address the same questions and issues as the one-to-one interviews. As a result, the EIGT was able to gain a very clear picture from about 60 SMEs. Again companies told us that they had found this a valuable and stimulating experience. The RDA or Devolved Administration for each area assisted in recruitment for these sessions, and participated in the running of the event.

The EIGT also held a skills workshop, which included some members of SEMTA’s Electronics Sector Strategy Group. This was attended by delegates drawn mainly from industry and also included a number of academics.

Two final workshops were held to allow the industry’s stakeholders – trade associations, professional bodies, trade unions and other industry support organisations and the academic community – to comment on the conclusions. These sessions followed the structure of the regional workshops and captured views from a further 25 organisations.

Throughout the consultation phase of the EIGT the DTI website contained an electronic questionnaire, which allowed anyone to comment by e-mail on the main issues. The e-questionnaire only elicited four comments, which in itself is instructive about how the industry prefers to communicate.

The EIGT consultation phase took place between 9 June and 30 September 2004. Considering the vast scope of the report, the data available on this sector is of variable quality and often anecdotal. Where data is missing or evidence conflicting, we have tried to reinforce our conclusions with evidence from the interviews. This is not ideal as official data in this fast-moving sector is often three years out of date.

Nevertheless, we sincerely believe we have been able to build (probably for the first time) a comprehensive picture of the UK electronics industry with widespread consensus on the key challenges and opportunities to be addressed over the next 10 years.
What is the UK electronics industry?

Electronics is a cornerstone of modern society pervading most products and services. However, the UK electronics industry is a difficult sector to define. It tends to be fragmented into silo-like sub-sectors, lacks strong visibility, and hence fails to influence policy that reflects its importance to the economy.

Paradoxically, the UK still has a vibrant electronics sector despite its low key, embedded nature, and the battering it has taken during the recent global downturn. We have world-class academic research and leading edge firms, e.g. in instrumentation, process control, electronics design, systems integration, and other areas.

The low profile belies the fact that UK electronics production ranks seventh in the world, just behind our nearest European rival Germany (Fig 1.1). Once again we are attracting substantial levels of foreign direct investment (FDI) through electronics related projects. All of these enterprises are high value-added activities and offer good quality jobs, many with a strong R&D element.

Fig 1.1: National electronics production and markets 2003

Nonetheless, we should be very concerned that a sector that is so vital to the health of the UK economy is undervalued, lacks visibility and the ability to influence wider policy development at all levels.
A pervasive global industry

Electronics manufacturing, products and services underpin the Information Age and are critical to our national and international development and success. Despite the importance and growth in value of the electronics sector, there are some marked contradictions.

The world market for electronics-based equipment has grown in recent years at an average of 8% pa (see Fig 1.2) and now exceeds $1,200bn (£669bn). Consider semiconductors, the building block for all electronic systems, which has grown 17% p.a. on average for the last four decades to represent about 20% of the above value. However, the unit price of semiconductors has fallen by several times this rate, and hides the pervasiveness of electronic components and systems (Fig 1.3).

Fig 1.2: The pyramid of value

Electronics and electronic components lie at the heart of most modern products, where they typically represent over 20% of the cost of a product. For example, the massive improvements in car safety and reliability are largely due to the incorporation of electronic systems. Systems integration has been so successful that most drivers are unaware of the 30 or so microprocessors that are hard at work as they drive.
Electronics is a truly global industry with some very strong national players. Many countries consider that electronics, and semiconductors in particular, are a ‘must have’ industry and have invested many billions of pounds to join the world leaders. This trend started with the USA, who were then challenged by Japan, and in turn were overtaken by Taiwan and South Korea. Europe has fought back in recent years with the help of large pan-European co-operative R&D programmes, such as the Microelectronics Developments for European Applications (MEDEA) Programme\(^1\), and now has a number of top world-class companies. While China is rapidly emerging as the next world leader in electronics manufacturing.

### A matter of definition

The electronics sector is broad and complex. The industry tends to see the sector more in terms of product types, e.g. semiconductors, printed circuit boards (PCBs) or markets\(^2\), e.g. automotive, telecoms, medical, defence. Market forecasts are readily available for most sub-sectors and market sectors. However, the only official annual data is published by the Office of National Statistics (ONS) Annual Business Inquiry, which lags up to two years.

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2. Key electronics markets include: aerospace & defence, automotive, EDP and office equipment, control & instrumentation, medical & industrial, telecommunications, consumer electronics, semiconductors, and other components.
For the purpose of the EIGT analysis, electronics manufacturing (including embedded software) and design were defined using Standard Industry Classification (SIC) codes 30, 32, and 33, and distribution by SIC 51.4. The automotive and aerospace & defence markets were not included in the consultation exercise as they have recently been involved in separate IGT reports.

During the research and consultation process, the EIGT realised that available statistical and other data was neither reliable nor sufficiently up-to-date to describe the sector adequately. There is good evidence that the industry’s size and economic importance is significantly understated in available statistics. The important issue of measurement is considered further in Chapter 3, which addresses Government and business engagement.

Where does the UK stand?

There is a widespread and harmful perception that the UK is not seriously involved in electronics. In part this is due to electronics content being ‘hidden’ in key industry markets, such as automotive, aerospace and defence. The UK electronics sector is characterised by many inter-dependent sub-sectors, with strong individual identities (e.g. semiconductors, PCBs, design), as can be seen from the supply chain diagram in Annex 1 of this report.

The main areas of activity in the supply chain are raw material suppliers, component/sub-component manufacturers, design, production, distribution and logistics, R&D, and quality control.

There are interesting variations between sub-sectors, as shown in Table 1.4, which gives a broad feel for the shape of the sector. The UK electronics sector is dominated by small and micro-sized companies, which account for 80-90% of total UK enterprises, but contribute only about 10% of total turnover. Most firms are micro-sized, with the exception of electronic component and process control equipment manufacturers, where there is a higher concentration in the small-to-medium range. The few large UK-based companies employ about 50% of the workforce, and generate about three quarters of the wealth. Only a handful of firms have over 1,000 employees, and most of these are non-UK owned.

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3 SIC definitions used by the EIGT for electronics industry analysis:
3000 Manufacture of office machinery & computers
32.10 Manufacture of electronic components
32.20/1 Manufacture of telecommunications equipment
32.20/2 Manufacture of other radio & electronic capital goods
32.30 Manufacture of consumer electronics goods
33.20/1 Manufacture of electronic instrumentation
33.30/1 Manufacture of electronic industrial process control equipment
33.40/2 Manufacture of optical and photographic equipment
51.64 Wholesale of office machinery and equipment
Table 1.4: The shape of the UK electronics industry 2003

<table>
<thead>
<tr>
<th></th>
<th>% of total number of enterprises</th>
<th>% of total employment</th>
<th>% of total turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro (1-9 employees)</td>
<td>80 – 90</td>
<td>5 – 15</td>
<td>2 – 12</td>
</tr>
<tr>
<td>Small (10 – 49 employees)</td>
<td>10 – 20</td>
<td>6 – 18</td>
<td>6 – 12</td>
</tr>
<tr>
<td>Medium (50 – 249 employees)</td>
<td>6 – 8</td>
<td>17 – 30</td>
<td>10 – 20</td>
</tr>
<tr>
<td>Large (250 or more employees)</td>
<td>2 – 4</td>
<td>45 – 55</td>
<td>60 – 80</td>
</tr>
</tbody>
</table>

Source: Small Business Service database 2004

In 2002, the electronics manufacturing sector employed about 249,000 plus a further 230,000 in distribution, contributing more than £21bn (or 2%) to UK GDP. This is the equivalent to 6% of all UK manufacturing. The sector generated total sales of manufactured electronics products of about £37bn, from 9,400 enterprises (Fig 1.5) that employed about 26 people on average. According to the latest figures, Reed Electronics Research estimates that UK electronics production sales exceeded £29bn ($42bn) p.a. in 2003 (see Fig 1.1).

Fig 1.5: Number of enterprises per sector

An analysis of the regional distribution of electronics establishments⁴ (Figs 1.6) and their employees shows the industry is well represented across all regions, with no obvious clusters.

⁴ Source: SEMTA 2003, excluding Northern Ireland
As mentioned, the UK no longer has indigenous heavyweights in this sector. However, we have many small but world-class companies, e.g. in opto-electronics and electronic design. These companies are often powerhouses for creativity and exploitation of highly respected UK university technology and research. Many of the medium-to-large firms in this sector are inward investors. Though most have traditionally carried out R&D in their home countries, they increasingly consider the R&D capabilities of host countries in their investment decisions. This represents both a threat and an opportunity for the UK.

The electronics sector’s importance in terms of the UK’s productivity and competitiveness is not just a matter of its own success. The sector has a massive impact on most other sectors, their competitiveness, ability to enhance productivity and add value.

Consider the use of remote labelling and pricing of products in supermarkets today, which enable real-time supply chain and resource management and impacts directly on productivity. Furthermore, a major electronics supplier interviewed by the EIGT estimates that 90% of all future innovations in vehicles will be based on electronic systems, and this view is not inconsistent with the Automotive IGT’s own findings. By 2010 electronic systems will account for 40% of the total cost of a vehicle, compared with about 20% today.

**How is the market changing?**

The electronics industry, and some sub-sectors in particular, e.g. electronic components and semiconductors, are characterised by complex markets and extended supply chains, with high and spiralling capital costs. But dramatically falling product prices are driven by ever-shorter product cycles, rapid commoditisation, and continuous development of new and sometimes disruptive technologies.
The dynamics of the memory market, for example, are vividly displayed by Samsung’s prediction that the 60% growth during the summer of 2004 will slump to 5% in early 2005.

The pace of change continues to increase driven, for example, by the recent battles between Intel and AMD for the processor chip market, where talk of megahertz changed to gigahertz almost overnight. Underlying this were billion pound investments in capital equipment and new process manufacturing technologies.

Less visible but even more dramatic and economically important is the fall in the cost of components, e.g. one unit of memory, which cost £20,000 in 1970, now costs the same as a sheet of A4 paper.

A dramatic impact of globalisation is the commodisation of DVD players, where the price has fallen to such an extent that they can be purchased with groceries in the local supermarket. Nonetheless, there’s been considerable increase in functionality at the same time as costs plummet.

Global changes have had a more severe impact on the UK electronics industry than on our European competitors, because we have fewer indigenous manufacturers compared with European competitors. The UK electronics industry has undergone significant restructuring, and outflow of manufacturing to lower cost countries. Initially, UK manufacture was outsourced to Eastern Europe, but increasingly the destination is Asia Pacific and China in particular. These moves have decimated the UK’s TV, PC and mobile phone manufacturing sectors.

Major changes in employment and GVA between 2000 and 2002 are evident in Figs 1.7 and 1.8, during the time when much of the UK electronics sector downsizing occurred. Of course, downsizing also boosted productivity in some enterprises.
The UK electronics sector is at a particular disadvantage from a global perspective, due to the preponderance of SMEs, and few large firms – most of whom are inward investors – compared to its European competition.

Between 2000 and 2002 the electronics sector’s contribution to UK GDP was slashed by £3.5bn. The EIGT is particularly concerned about trends in electronics design. In the last three years, our design sector has shrunk by 19%. Most of this loss was attributed to an 80% reduction by large companies.5 Many of these

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5 Source: ‘Report on design employment trends’ for DTI by Findlays 2004
designers have set up small design consultancies. However, this move weakens the UK electronics design community and makes it more vulnerable to globalisation pressures.

**Productivity challenges**

Assessing the productivity of the UK sector compared to global competitors is challenging, (see Annex 4). There is strong evidence that the UK electronics industry is not as economically productive as equivalent firms in Europe, and other sectors in the UK and Europe, which in turn lag behind the USA. However, many UK-based electronics firms are harnessing productivity successfully. According to the DTI’s Small Business Service’s Benchmark Index, UK electronics SMEs achieve the highest pre-tax profits in terms of turnover and per employee among all other manufacturing sectors. Nonetheless, evidence is compelling that the UK electronics sector has an issue when it comes to productivity.

Fortunately there is some light on the horizon – but no room for complacency. Although official statistics are not yet available, there is good evidence that the UK electronics sector started to pick up in 2003, and will recover significantly throughout 2004 due to rising local and global demand. The signs of recovery and strong UK economy have brought renewed interest in Foreign Direct investment (FDI) by overseas electronics companies. There is also an increase in projects involving R&D and co-operation with UK universities.

One of the main attractions of the UK to overseas investors is the business-friendly environment. The UK has benefited from major inward investments in the past. Though many of these firms have moved elsewhere for manufacture, they have left their footprint, with a legacy of facilities, training and R&D, which continues to impact on our global performance.

The UK electronics industry has to face significant challenges in order to grow and prosper in the years ahead. The EIGT consultation exercise sought to identify the key issues in the most in depth IGT consultation exercise ever undertaken, and sets a thought provoking agenda of recommendations for success for Government and industry in the chapters that follow.
CHAPTER 3

Building Government and business engagement to make change happen

Effective Government and industry stakeholder engagement is essential to ensure the right climate for the electronics industry to grow and prosper. Electronics industry representation is very fragmented. Consequently there is lack of clear leadership and the critical mass to ensure visibility and influence. Networking is poor between Government and business, business-to-business and between business and the academic community. Consequently, there is a lack of effective influence on key policy areas and failure to engage with the RDAs.

The problem is compounded by the lack of reliable data for measuring the industry and its performance. Official statistics underestimate the contribution of the electronics industry to the economy.

The challenge is to create strategic management and leadership within the UK electronics industry, and an industry-wide alliance with high quality analytical and leadership skills. An Electronics Leadership Council should be created to tackle and prioritise significant opportunities in technology, public procurement, skills, regulation and the global supply chain.

REPRESENTATION AND NETWORKING

Networking is generally weak and non-strategic in the UK electronics industry. The NERA report suggests UK electronics enterprises are more insular than US or EU competitors. This is a drawback when encouraging innovation in response to information flowing up and down the supply chain. The Innovation Survey (Fig 3.1) shows the proportion of firms in each sector listed as important sources of information for innovation. As can be seen, few electronics firms rely on universities or research institutes as significant sources of information for innovation, and most innovation is internalised. In addition, our interviews showed that most academic links, where they exist, operate at a national rather than international level.

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1 NERA report, Competitiveness in the UK electronics sector
2 DTI, UK Community Innovation survey, 2001
During the EIGT consultation process many companies admitted lack of strategic networking. Generally, companies rely on customers, suppliers, trade journals and professional networks as their main sources of information. Some sought input from their trade associations. Innovative companies developed strong and strategic relationships with universities for both R&D and supply of skilled people. This is a key business differentiator but is by no means the general picture. Often relationships between business and academia stemmed from personal contacts, which were lost if individuals moved on. Only the start-ups mentioned the value of using financial institutions as part of their strategic networking.

Trade association criticism

Many companies expressed surprise about the number of trade associations and industry-led initiatives in the UK electronics industry. The EIGT identified at least 30 organisations in the electronics value chain, and a similar number in materials, equipment and allied market sectors. There is no rationale for the current range and diversity of trade associations, which largely grew from a legacy of old industry structures and subsequent mergers. Fewer than 20 per cent of electronics companies belong to any trade association. A leading design house remarked, “The trade association representation of the past was largely irrelevant and expensive. We only joined out of goodwill.” EIGT consultation reveals a clear demand for better cross-fertilisation between trade associations and other stakeholders, while maintaining the need to focus on sub-sector specific issues such as technical standards.
Few companies felt that trade associations offered value for money. The exceptions were large companies who play an active role within their association and are often supported internally by well-resourced government relations’ teams. These companies find it useful to have an association as a public voice piece. A major equipment supplier said, “Membership of Intellect works well for us, but there needs to be more cross-fertilisation between the sectors. The association offers value for money, but some of the stuff it does we could do for ourselves.”

Many companies refused to join trade associations due to the cost of membership. Some companies believed the associations lacked critical mass to be effective. There is also a perception that some associations are only interested in large companies. “We don’t think trade associations like Intellect are interested in SMEs,” said one SME. A major semiconductor manufacturer commented: “Both the trade associations we belong to are overpriced and have insufficient leadership compared to sectors like automotive and pharmaceuticals. Electronics is too fragmented and doesn’t have enough collective influence. Therefore we are below the threshold for significant ministerial recognition.”

Due to high fragmentation in the industry, companies sometimes need to join several associations to get the required coverage. “We don’t belong to any trade association. We are so diverse that we would have to join several,” maintained an SME. But some major manufacturers recognised the value of variety: “We belong to NMI and Intellect. We would like to see a Federation of Electronics Industries, but we don’t want mergers as it is important that sub-sectoral interests are maintained.”
Some companies claimed information was more easily available from sources like the Internet. Others said that membership was a low business priority or had no experience of membership on which to base a judgement. SMEs in particular expressed interest in a slimmed-down information-only service from trade associations, with bespoke advice or services paid on-demand.

‘We don’t belong to any trade association. We are so diverse that we would have to join several’

The EIGT analysed the cost of trade association membership compared to other sectors (Fig 3.3). Many organisations were too small to have accounts registered. The EIGT concluded that the sum invested in trade association membership by the electronics sector is significantly less than representative bodies in other industries of similar or even smaller sizes, compared with GDP or employment.

**Figure 3.3: Comparative Trade Association income by sector in relation to economic impact and employment**

![Chart showing comparative trade association income by sector](image)

Admittedly, recession in sections of the high-tech sector has impacted on trade association income in the last three years. The effect of industry restructuring, outsourcing, fragmentation and low income inhibits the industry’s ability to punch its weight or allocate the resource and critical mass necessary to exert influence at the time it needs most help.

As a result of industry fragmentation the Government and RDAs find the industry difficult to consult, and often unintentionally directs consultation to the wrong trade association. For example, recent EU emissions trading proposals and suggested chemical bans were not targeted at all of the appropriate trade associations. Even when information is directed to the right trade association it does not always get
through to those members with an interest. For example, Patent Office consultation on the EU Computer Implemented Interventions Directive did not reach the electronics design community until late in the day, despite its implications for embedded software. This means the relevant part of the industry has little time for effective influence, and policies may not reflect the best interests of the sector.

Regional opportunity

The trend to devolve Government support to the regions is a significant opportunity for the industry. But many electronics companies claim they are not gaining benefit. Individual trade associations do not have the resource to engage effectively with RDAs. The low profile of the industry in the regions and fragmentation of representation means the sector is invisible to the RDAs. With the exception of Yorkshire Forward, the English regions rarely focus on electronics. This reflects the regionally dispersed nature of the UK electronics industry. The devolved administrations in Scotland and Wales are more effectively engaged with the industry through specific clusters. But these clusters have shrunk in recent years as a consequence of the semiconductor business cycle and the off-shoring of consumer electronics manufacture.

‘There are too many fragmented regional initiatives and not enough critical mass to pull through’

Later chapters of this report highlight the huge dependency of other sectors on electronics for their growth and innovation. For example, other IGT reports have shown that most of the innovation opportunities in sectors like automotive and aerospace are electronics-dependent. The EIGT therefore urges the RDAs to consider the dependency of their key sectors on electronics when determining the attention they give to this sector.

As a result of regionalisation, too many sub-critical initiatives often compete for attention. Though electronics is pervasive, many firms say there is difficulty seeing their interests reflected in RDA activities. A Scottish electronics supplier suggested, “We need a national UK electronics strategy, not just a Scottish one. There are too many fragmented regional initiatives and not enough critical mass to pull through.”
Electronics companies are forced to look for relevant information behind broad categories like ‘digital’, ‘technology sector’ or ‘ITEC’. Even information sources like businesslink.gov.uk ignore ‘electronics’ as a sector. Companies often have to search through hundreds of manufacturing or ITEC schemes – none of which quite meet their needs. The sector is also invisible in larger trade associations like the Engineering Employers Federation (EEF), which recently covered the sector in a report\(^3\) under the heading ‘electrical and optical’.

**Vision 2015**

A national electronics strategy is agreed and implemented by Government and industry, working through an Electronics Leadership Council. This ensures that there is a coherent approach to all issues affecting the business environment for electronics.

The true significance of the electronics industry is understood across Government and the RDAs.

The electronics industry is effective in its influence of strategic policy areas, especially regulation and technology, and is sufficiently forward looking to ensure that there are no surprises.

Major new market opportunities are captured.

A UK Electronics Alliance is created to support and represent the shape and challenges of the electronics industry in 2015.

The alliance fosters networking opportunities across the electronics industry, including links with customers and supply sectors outside the electronics arena.

The alliance has critical mass and high quality staff to engage in horizon scanning, research and analysis, so that it can influence UK and international policies affecting the industry. The alliance helps companies benchmark performance and promote best practice to drive up productivity and competitiveness. The alliance is more than simply a lobbying organisation, but one that Government and other key agencies regard as an influential stakeholder. The alliance is an authoritative voice on technology priorities, skills and regulations affecting the industry.

The alliance provides value-added services (e.g. technical, professional, standards, information, missions, events, showcases, etc.) with a structure that allows companies to buy additional services according to need. The business model is SME and sub-sector-friendly and relevant.

**Recommendations**

There is currently no coherent strategic voice for the electronics industry. The sector is fragmented and virtually invisible to key policy makers, including the RDAs. It is

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difficult for even those within the sector to name more than a few big names from the sector on the business or political stage. As a result of this fragmentation many worthy, but competing initiatives arise, but few with sufficient critical mass to succeed. Policy influencing and business opportunities are being lost or tackled in a tactical rather than strategic way. To address this:

3.1: The EIGT recommends the establishment of an Industry/Government Electronics Leadership Council (ELC).

The ELC should be a relatively small but influential body that is business led on behalf of the whole industry and key stakeholders, with appropriate senior Government and RDA involvement. The council will monitor the implementation of the recommendations of this EIGT report, and will also initiate work streams for tackling some of the strategic problems that the EIGT has identified. The ELC will not duplicate activities that are working well, but it will provide the glue to give critical mass to existing activities or enhance existing activities where a more strategic input is needed (e.g. in the area of skills).

3.1.1: Priority work streams should be established in order to bring focus and critical mass to critical issues. Initially these would be technology (see recommendation in the ‘Innovation’ chapter 5); skills (see recommendation in the ‘Skills’ chapter 7); supply chain (see recommendations in the ‘Supply chain’ chapter 6) and public procurement (see recommendation 3.4). Leaders of the priority work streams would also form part of the ELC.

The EIGT does not believe that the ELC should or could assume the role of trade associations. Nevertheless the trade associations need to review their current structure and organisation in order to tackle the weaknesses described above. There has been some rationalisation over recent years, but the legacy structures
and committees persist. As currently organised, the EIGT considers they are not run or resourced to be an effective voice with which Government or the RDAs can engage. Equally the trade associations are not able to engage effectively on the key issues affecting their members. To address this issue:

3.1.2: The EIGT recommends that a further work stream of the ELC should address industry representation as a UK Electronics Alliance (UKEA).

The key task of the UK Electronics Alliance should be to develop and implement effective mechanisms to support and represent the shape and challenges of the electronics industry in 2015.

The Electronics Alliance must work in a way that builds and sustains trust across all parts of the industry, and marshals activities in a more cohesive manner. The Alliance needs to consider how best to address the interests of the SME community and add value to the industry. It should provide a single point of contact on behalf of the industry for interfacing with the RDAs. It is important for the Alliance to bury rivalry between trade associations and predatory behaviour.

The EIGT believes that there is much activity of mutual benefit, for example:

- Collaboration on the implementation of regulatory best practice, possibly as a joint bid for Government business support-funded best practice activity.
- Development of a make-or-buy tool kit.
- Improved careers material to boost the image and visibility of the industry.
- A new raft of pay-as-you-go services for SMEs.
- Creation of a regulatory information portal.
- Joint regional seminars to improve SME networking and engagement with the RDAs.
- Networking opportunities across the whole electronics industry, including links with customers and supply sectors outside the electronics arena.
- Encouraging companies to benchmark performance and promote best practice to drive up productivity and competitiveness, e.g. by encouraging electronics SMEs to use the DTI benchmarking index.
- Coordinating overseas mission activities.

The relationship between these groups is illustrated in the Strategic Leadership Framework in Fig 3.4. The Electronics Regulatory Group (ERG) is addressed on page 58.
POOR MEASUREMENT

From the outset, the EIGT wanted to ensure its work was based on solid data and analysis. In our experience (and many others) the industry is difficult to define and measure. SIC codes are largely obsolete in definition and out-of-step with technical developments. Official data (which is largely published three years after the event) is largely meaningless for companies in a fast moving market like electronics, where product development and lifecycle is much shorter, and large cyclical swings can distort interpretation. Poor measurement hampers informed international performance comparison.

According to the EIGT interviews, few companies take SIC codes seriously, and there is little effort or incentive within companies to ensure that statistical returns are correctly targeted. This has led to enormous anomalies. Within the EMS sector, the biggest six companies are distributed across four different codes. One of the largest UK semiconductor design companies is listed as ‘wholesale electrical’. The FTSE also gives a distorted picture of the industry’s significance in the UK, given the economic contribution of foreign-owned companies and SMEs. Electronics manufacturing is often subsumed within sectors such as communications, IT and aerospace.

Whilst official measurement is a problem for many other sectors, the EIGT believes the combined effect of measurement problems for the electronics industry leads to a significant underestimate of its contribution to the economy. Therefore, Government needs to treat official figures with caution when considering regulatory impact assessments, regional priorities, labour market trends, policies and resources allocated to the sector.
There was little evidence of systematic UK electronics industry focus on ‘productivity’ as opposed to profitability. This may not be surprising, as according to the recent EEF\(^4\) report the UK electronics industry has encountered a stronger squeeze on profitability than France or Germany. Some companies benchmark internally and a few benchmark against customers and suppliers. But the EIGT found few examples of the process benchmarking or best-in-class benchmarking that has transformed the productivity of some other sectors.

Electronics distributors generally measured themselves by the number and range of items stocked, rather than the productivity or effectiveness of the service offered for the input entailed. The EIGT believes productivity is a problem in the industry, notwithstanding the measurement challenges explained more fully in Annex 4. The NERA report\(^5\) shows a marked widening of the productivity gap between US and European electronics companies over the past decade.

One of the main explanations appears to be the failure of electronics firms in the UK and EU as a whole to embrace e-business, an issue addressed in the ‘Supply Chain’ chapter 6.

The EIGT also examined the DTI Benchmark Index and determined several areas where UK electronics companies are under-performing. Nevertheless, those UK companies that take productivity measurement seriously show significant improvements in performance, leading to increased investment and sustainability. For example, National Semiconductors showed 15% productivity improvement using the right metrics. And Sony uses special project teams to address processes which are under-performing.

**Vision 2015**

UK electronics companies have world-class management and leadership. They are supported by readily accessible, reliable and timely data that reflects the character of a rapidly changing sector. Consequently, the contribution of the UK electronics industry to the economy is far better recognised.

Companies focus on productivity and innovation as well as profit, and benchmark against best-in-class process. As a result, the performance spread of UK electronics companies narrows and the UK electronics business matches world-class performers.

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\(5\) NERA report: ‘Competitiveness in the UK electronics sector’, published under the DTI economics series
Recommendations

Measurement matters, and without reliable and timely data companies can be lulled into a sense of complacency about their performance, and Government and RDAs will make wrong decisions on things that affect the industry. Considering that a major international review of SIC codes is to take effect from 2007, the EIGT recommends:

3.2: The DTI, ONS and the UK Electronics Alliance must take the opportunity of the international review of SIC codes to devise and press for a more relevant structure.

A test of success will be the ease with which companies can accurately and easily assign themselves. Any proposals must be subject to full consultation with industry, tested across a diverse range of companies. Business should be encouraged to give this consultation their attention.

3.2.1: Education and training is necessary for companies to improve data.

3.2.2: Companies should increase awareness and take-up of best-in-class benchmarking. Business Links should do more to encourage SMEs to use the Benchmark Index, and use consultants to help pull metrics together to monitor the sector’s progress.

LEGISLATION AND INFLUENCE

The EIGT examined the impact of legislation on behaviour, performance and opportunity for the UK electronics industry (See Fig 3.5). Over the past 20 years there has been a significant increase in legislation affecting electronics industry directly. Recently there has been an increase in legislation affecting employment and environmental issues. Prior to that the key legislation related to health and safety. The EIGT consultation exercise revealed that most companies feel over-burdened by the cumulative impact of legislation. Though the objectives were often laudable, some companies expressed concerns about the impact of new regulations on competitiveness. SMEs in particular found that the cumulative burden of regulation consumed a significant proportion of management time without obvious benefits. Most companies relied on consultants and specialists for advice, and claimed the advice was not always helpful.
The EIGT found little evidence of companies considering legislation either strategically or as a business opportunity. Knowledge of forthcoming legislation varied and was generally delegated to the operations level – where the issue was typically dealt with by HR or production. Legislation was largely treated as a burden that gets in the way of the real job! The tactical response was to ‘wait and see’ the detail, rather than to try and influence legislation or see if it presented a strategic opportunity.

There were notable exceptions of companies working for first mover advantage. Sony is typical of many Japanese consumer electronics companies, and aims to be lead-free before legislation comes into force. HP is trying to produce the most energy efficient products. Some UK start-ups recognise real business opportunity through legislation-driven innovation, but this attitude is rare.

The Innovation Review⁶ highlighted the potential of legislation to stifle innovation. The EIGT encountered examples of this experience, but many companies were more concerned about the bureaucratic approach to regulations.

One SME complained, “Government is off-loading more onto business, especially in employment law. Large companies are buying themselves out of problems, but SMEs can’t afford to. It’s easy to fall foul of the paperwork, so companies are trying to avoid taking anyone on for more than six months.” A major consumer electronics supplier reckoned UK legislation cut into competitiveness. “Legislation is becoming a major problem with UK interpretation eroding UK competitive advantage. We urgently need to restore the balance.”

SMEs and start-ups said they were more likely to be focused on finance and employment legislation. A significant number said employment legislation was an obstacle to growth and the engagement of a more diverse workforce.

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There was widespread agreement that the sector needs to be more effective in influencing the regulatory environment. Currently the industry intervenes too little and too late. There is a need for better industry representation in order to gain critical mass for horizon scanning, better analysis and effective engagement at the ideas stage. The industry tends to react only when something is on the statute book and all the details have been clarified. Though some companies provide regulatory impact data, policy makers usually have a limited range of inputs with which to form a realistic view of impacts.

A multinational explained: “We appoint individuals to follow key regulations, such as WEEE, and have influenced the establishment of an industry organisation to deal with waste. We are increasingly regulated but would like to see the process of unification accelerated in Europe in order to facilitate trade.”

Legislation is becoming a major problem with UK interpretation eroding UK competitive advantage. We urgently need to restore the balance

Many companies felt they had insufficient power to influence policy and therefore had not tried. Others admitted they wouldn’t know where to start, as they had no direct channels to Government. Lobbying was often disjointed and poorly directed – through MPs or MSPs, trade associations and chambers of commerce – rather than via the policy department or the DTI Electronics Unit. There seemed little effort to prepare a united front in Europe or engage other member states via multinational company contacts. Some trade associations felt this should be handled by their European trade body.

Helping trade associations and members better understand the regulatory process and the best mechanisms for influence must be a priority. The EIGT does not believe that UK interests can be left in the hands of European associations, where the industry structure is often different to that in the UK. Considering the absence of national champions and the high proportion of SMEs in the UK, we have a different challenge.

Several companies raised concerns about the consistency of regulatory enforcement within the UK and the EU, UK interpretation of legislation, and the cumulative affect of legislation which causes the UK to lose its competitive edge. Evidence for uneven compliance was largely anecdotal and characterised by media myths about ‘UK gold plating’. Inward investors maintained that the attractiveness of the UK was being eroded. Apparently this was a growing perception in certain parent companies, even if the view was unsupported by evidence.

SMEs were concerned about compliance and the fear of being found wanting. They would like inspectors to provide advice on compliance, rather than waiting for punishment for non-compliance. An SME maintained, “There is no effective enforcement of EMC regulations. Innovation and exploitation of new products is being inhibited. Businesses can’t find their way around the regulatory maze. We
need support.” The EIGT was particularly concerned that much product legislation will not be uniformly and consistently enforced, and believes that non-compliant products will continue to be imported while UK SMEs lose any remaining competitive edge through costly compliance.

Vision 2015

The UK has a regulatory environment that facilitates growth and innovation (as per the Innovation Review\(^7\)) and plays to UK strengths. This means objective-based rather than prescriptive regulation. Electronics companies have the management and leadership qualities to seize strategic opportunities

A UK Electronics Alliance has the critical mass, analytical and representational skills to influence proposals at the earliest stage.

There is globally uniform interpretation and application of EU regulations. UK enforcement is directed to helping business comply with regulations and retain competitive advantage, rather than punishing innocent non-compliance. Non-compliant imports are effectively barred.

Recommendations

All sizes of business need to understand the regulatory process and the critical stages at which influence is possible. This is particularly the case with EU legislation as requirements once adopted cannot be swept aside at the transposition and implementation stage. Business needs to be more adept at horizon scanning and influencing UK and other member states negotiators at the right stage. This task is beyond that of all but the largest companies, so the EIGT recommends:

3.3: An Electronics Regulatory Group (ERG) should be established to increase industry influence on EU regulation.

The ERG should consist of trade association representatives and officials from the main regulatory departments that impact on the sector – currently DEFRA, HSE, DTI, HO, Treasury. The ERG could help to ensure a better understanding between Government and business of the individual and cumulative impact of regulation. The ERG should work closely with the ELC and should include a senior representative from the Supply Chain work stream to ensure that all implications for the supply chain are understood. The relationship between the ERG and the other strategy groups is set out in Fig 3.4.

3.3.1: Government departments should pursue more objective-based regulation and avoid prescription that impedes competitiveness and innovation. The electronics industry should identify existing legislation that is having this effect.

\(^7\) Excellence and Opportunity – a science and innovation policy for the 21st century: http://www.hm treasury.gov.uk/spending_review/
3.3.2: The UK Electronics Alliance should help to bring about significant improvement in the quality of evidence on regulation, address supply chain implications, and provide mechanisms for SME issues to be taken on board.

INTELLIGENT PUBLIC PROCUREMENT

Public procurement is a significant market opportunity for electronics companies, particularly in health, defence, transport, public administration and education. Other public policy challenges relating to terrorism, sustainability, crime, identity theft and demographics offer significant opportunities for electronics businesses, which are largely being met by foreign-owned prime contractors.

The Innovation Review \(^8\) ‘Excellence and Opportunity – a science and innovation policy for the 21st century’ highlights the potential of public procurement to encourage innovation. The review also shows that public spending provides significantly greater opportunities for encouraging innovation than support to business through grants. The recent SR2004 spending settlement shows that the combined expenditure on health, transport and defence in 2004/5 will be £111.57bn rising to £140.75bn in 2007/8 – an increase of 26%. These are all areas with a high potential for electronics-related investment.

The EIGT consultation exercise revealed wide experience of dealing with Government procurement departments and other public bodies, ranging from the MoD, NHS, Foreign and Commonwealth Office (FCO), prison service, police, universities and the BBC. However, companies generally reported a negative experience:

- SMEs find it difficult to engage with public bodies.
- The process is too long and bureaucratic. Decision-making lacks transparency. There are political delays to the process, late specification changes add to the frustration, and costs of maintaining a bid team.
- US, French and German government procurement systems are claimed to be more efficient and less prone to political delays and uncertainties.
- Purchasing departments were often too narrowly focussed and did not address wider UK economic interests. Customer departments often ignored the high design and lead-time costs, and the need to factor in training costs of extra staff engaged to fulfil orders. In effect, companies who took on new staff were penalised.

\(^8\) The 2004 Spending Round: http://www.hmtreasury.gov.uk/spending_review
• Public purchasing staff change too frequently and are considered to be poorly skilled.

• There was a call for better inter-departmental coordination, in order to realise economies of scale in both supply and demand, reduced administrative costs for bidders, and better value for money.

• SMEs need more help to flag-up opportunities. Trade associations help to some extent but the process tends to favour large companies.

While these problems impact most heavily on SMEs, the EIGT found little support for a quota scheme to help SMEs to take advantage of public procurement opportunities. Most felt that the advantages of such schemes elsewhere (such as those in the US) were overstated in practice. However, a mechanism like the Northern Defence Industries (NDI) – where a consortia of SME companies came together under a company formed for the purpose of bidding – was mentioned as a constructive way of helping SMEs.

There is considerable divergence between the approaches used by different public procurement bodies. However, there was wide recognition that the Office of Government Commerce (OGC) and Better Regulation Task Force (BRTF) are advocating steps to improve the efficiency and professionalism of public procurement and remove barriers to SMEs. The EIGT wishes to encourage continued momentum in that direction, with all departments publishing their long-term procurement strategies and ensuring that the strategies are adopted by those undertaking procurement.

There are major concerns that current processes are a barrier rather than a catalyst to innovation. Engagement with public procurement is often considered too risky, and the pace of decision-making counter-cultural, especially for high-tech SMEs moving in fast developing markets. This is a lost opportunity for UK companies.

Earlier engagement could help bring solutions intelligence to policy and delivery challenges. Effective collaboration between Government, large companies and SMEs would encourage innovation in SMEs, and build capacity in larger companies. This would deliver more innovative service benefits and a platform to help UK companies succeed in global markets. New mechanisms should focus companies around major procurement opportunities at the policy development stage, as a platform for innovation in the UK.

During the EIGT consultation process, a major Government supplier claimed, “There is a disconnect between sensible strategy and execution by the MoD. They don’t understand lead times and the investments required to develop new technology, and are naïve about the exploitation opportunities.” An electronics SME also considered NHS procurement skills have room for improvement, but supports innovation. “NHS local buying skills are poor but we have managed successful innovation through the NHS, and helped to establish EU standards on digital cancer detection.”
'NHS local buying skills are poor but we have managed successful innovation through the NHS' 

A leading defence contractor called for expedition of public procurement. “Bids can cost up to £500,000 to support. The process is time consuming and costly so we need much faster decision-making. The MoD is an intelligent customer but procurement offices do not take account of wider economic factors. They need to evaluate more strategically, rather than on a project-by-project basis, in order to get leverage. There should also be more transparency in scoring.”

A major design house called on Government to create special task forces with industry to develop new technologies. “We need fixed-term task forces to tackle projects. The Government should be sponsoring pilot projects to allow UK consortia to develop pilots on technologies like smart cards. We have the design and system integration capability and companies willing to invest in manufacture in the UK, if the Government can only make up its mind. It is far easier to engage with other countries where government direction and commitment is clearer. We can bring consortia together to deliver. We are needlessly losing out to overseas competition.”

Vision 2015

UK companies bring together the best of business and science capability to ensure public procurement is best fit for purpose, encourages innovation, and is good value for money. The public sector is at the forefront of technology use and a showcase for UK capability. The combined mass of public procurement is a lever for inward investment and ongoing product support and development.

Recommendations

3.4: Public procurement should be one of the future work streams of the ELC. This should lead to an engagement with the main procuring departments for electronics. Procurement and technical strategy road maps should be created by all Government departments, and pilot task forces developed for new procurement opportunities. This should lead to improved understanding of the potential of new technologies for the public sector and support for developers.

3.4.1: Government should allocate a percentage (say 2 – 4%) of its procurement budget for technology development.

3.4.2: The EIGT acknowledges the substantial changes already planned as a result of the implementation of Office of Government Commerce (OGC) reforms and urges sustained and rapid progress in that direction. Economic impact should be used as a selection factor to aid innovation but not to prop up old technologies.
3.4.3: Procurement departments should also improve signposting of opportunities for partnership between SMEs and large companies, and RDAs should help to build SME consortia along the lines of the Northern Defence Industries (NDI) initiative.

INVESTMENT DECISIONS

Capital investment is an important driver of productivity and competitive advantage and also helps provide supply chain opportunities. The UK saw large investments in consumer electronics in the 1980s, semiconductors in the 1990s, and IT hardware in the run-up to the millennium. The EIGT examined how the UK is now perceived as an investment destination.

The UK is considered less attractive than it was in the past by investors. The main deterrents are the decline in the skills base, higher employment costs and the increased regulatory environment. However, UK R&D is highly valued by the foreign parents of inward investors. Many said they would still invest in UK R&D but admit they were unlikely to invest in manufacturing.

A major Japanese consumer electronics manufacturer commented: “The UK is not an attractive proposition for investment. It used to possess a flexible, highly skilled workforce and a flexible regulatory environment. That’s no longer true. In general, Western Europe is not perceived to have a long-term future for manufacturing.” This view was reflected other foreign subsidiaries who said: “We do a lot of R&D in the UK but don’t manufacture here.”

Investment decisions are being driven by incentives. Even where the UK cost base is more competitive, the ability to raise finance, capital grants and tax breaks still influence boards. This is especially so in the highly capital intensive parts of the industry, like semiconductors, where inducements elsewhere are high. In general, companies felt that incentives distorted competition, and they were often critical of the impact of past investment grants. It was nevertheless recognised that once the path of inducements was taken, it is necessary to sustain support over the long-term.

’We do a lot of R&D in the UK but don’t manufacture here’

Others focused on the ease with which it was possible to obtain investment grants elsewhere, compared with the UK. A major manufacturer remarked: “The Far East is not cheap any more. But the UK is still expensive compared to the rest of Europe, and taxes and pensions make the difference. French and German graduates are now cheaper.”
There was acceptance that successive UK governments had embarked on a low tax, low grant strategy as opposed to high tax, high grant strategy of other countries. There was general support for the Government’s priority on economic stability. But the impact of grants on the bottom line and subsequent board decisions was significant.

Another major concern was that investment grants were a tool of regional policy rather than industrial policy. Several companies found it ironic that they could not find modest funding to help to improve performance in a current location, but could secure significant investment to move to a less suitable one. Several firms mentioned frustration with major past inward investments that had not been sustainable. They thought that the money could have been better directed towards helping indigenous companies to improve skills and productivity. There was also concern that RDA decisions on investment grants have insufficient regard to displacement effects in other regions. They wanted future investment grants directed at higher value-added activity rather than commodity scale operations.

‘The VC community is poorly informed about electronics and ultra-conservative’

Foreign companies tended to take a longer-term view of investment decisions than UK companies, and were willing to pay more in order to get the right decision. One CEO of a major consumer electronics company said that his foreign managers pushed him far harder for investment for their operations than his UK managers. This opinion is consistent with the findings of a recent EEF study. The EEF report observed that investment projects in the sector are far less likely to go ahead in the UK than in France or Germany, despite meeting higher hurdle payback periods and technical requirements, because of more cautious management. The survey also indicates that UK companies are not achieving as much productivity, as opposed to short-term profitability, from investments as French and German counterparts, and wonders whether failure to adopt modern working practices and weaknesses in management could be contributory factors.

There was also criticism of the UK venture capital community. A highly innovative technology company maintained “The VC community is poorly informed about electronics and ultra-conservative”, and insisted “US bidders offer double the amount of UK investors and don’t try to rape the original inventors.”

**Vision 2015**

Distorting international incentives are challenged or eliminated. The UK is able to compete on a level playing field and companies, and is supported in its efforts to grow and capture global markets. We have the skills and business environment to win in a competitive environment globally.

UK-based managers have the confidence to make investment decisions, and introduce new business and management processes to ensure that the UK realises the full productivity benefits of investment.

The UK has a clear vision of areas of electronics where we are likely to excel, and the RDAs and devolved administrations cooperate to see the implementation of a *National Electronics Strategy* with complementary UK technology strategy.

**Recommendation**

3.5: The UK, through the EU and WTO, must maintain efforts to monitor and where necessary challenge state aids that distort competition and investment decisions.

**ACCESSING UK GOVERNMENT AND EU SUPPORT**

The EIGT examined what support mechanisms electronics companies required and whether their needs were being met. We were particularly interested in whether the sector was aware of, and taking advantage of, the support available to address its most critical weaknesses in technical collaboration, best practice and skills.
European R&D programmes

**EUREKA** is a pan-European network for market-oriented, industrial R&D. The programme supports the competitiveness of European companies through international collaboration, in creating links and networks of innovation. The objective is to bring high quality R&D efforts to the market and to use the multiplying effects of co-operation, in order to advance and improve the quality of life.

**MEDEA+** (Micro-Electronics for European Applications) is an eight-year €400m (£278m) pan-European R&D programme involving 200 partners from 17 European countries, designed to strengthen microelectronics in Europe as the enabling technology for the whole Information Society. Thereby, contributing to the creation of higher added value and jobs. MEDEA+ started in January 2001 and focuses on ‘system innovation on silicon for the e-economy.’

**ITEA** (Information Technology for European Advancement) is a €3,200m (£2,226m) pan-European collaborative industrial R&D programme dedicated to the development of ‘software for software-intensive systems’ to boost European competitiveness. With a lifespan of eight years, the programme involves over 5,000 developer-years and another 10,000 are anticipated in the next five years. Europe’s leadership in embedded software and software-intensive systems is crucial to securing future competitiveness in a wide range of industries.

**PIDEA+** is a €600m (£417m) cluster programme which aims to develop new electronic packaging and interconnection technologies for miniaturisation in order to enhance the European electronics industry. PIDEA+ is strengthening the links between various players in the European electronics industry, developing innovative miniaturised systems by mastering high density Interconnection and Packaging (I&P) technologies. The I&P of integrated circuits affects the performance, speed, power reliability and cost of electronic products in numerous fields, including consumer electronics, smart cards, automotive, aerospace and railways, and security.

Following in depth consultation, the EIGT concluded that the industry is not taking full advantage of EU programmes, largely due to bureaucracy and timeframes. More worryingly, UK academic establishments are engaging in EU programmes which often result in technology transfer out of the UK. We found interest in EUREKA was significantly greater than in EU Framework programmes. Several interviewees expressed a wish to engage in MEDEA, PIDEA and ITEA and saw Government lack of funding for EUREKA as a serious inhibitor.
Reactions to UK Government support schemes were largely based on the schemes in operation before the DTI Business Support Review. The EIGT found variable levels of awareness of the new DTI customer themes, which include:

- **Succeeding through innovation** – providing practical support for the key stages of innovation or research and development.
- **Achieving best practice** – helping businesses to become more efficient, competitive and profitable.
- **Raising finance** – supporting small or high growth companies attract investment.

But once explained, the extent of simplification and the priority themes was considered to be ‘about right’. However, views were more mixed regarding the value of regional investment grants (see ‘Investment’ section above).

Awareness of the new schemes was highest among those companies and intermediaries that had relationship managers in the DTI Electronics Unit or had contacted Business Links. Surprisingly, those companies that interfaced with RDAs were less likely to be aware of the changes. The degree of awareness seemed to correlate with views on the favourability of the RDAs. There was concern that too many schemes and initiatives were being generated, and discovering them took up too much management time.

Interviewees stressed there was a major problem getting assistance where and when needed. The scope and rules of schemes are often too narrow and never quite fit. One participant in the stakeholder forum complained, “Often grants are available for the things we don’t need and not for the things we do. There are seemingly arbitrary age limits and cut-off points for things like skills development. Government should trust business judgement more where they need to invest in skills.”

A major design house maintained, “DTI schemes are too bureaucratic. Companies need to be able to respond immediately. They were helpful at start-up phase but not in expansion phase.” An SME reckoned, “The new DTI support products cover our need. We are linked to the RDA but it is opaque on the policy side. Timescales are too long. Six weeks maximum would be more realistic. The major advantage for an SME is short lead times and these are wiped out by the speed of the funding process.”

> ‘Often grants are available for the things we don’t need and not for the things we do. There are seemingly arbitrary age limits and cut-off points for things like skills development.’

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Testing sources of advice

Not all SMEs found Business Links helpful, and those that did were often not very high-tech concerns. There was a general opinion that Business Links did not have advisers who were sufficiently technically skilled to understand their needs. Many lacked the knowledge to help find the right partnerships, particularly if this meant signposting potential partners outside of the local region. In response, the Small Business Service (SBS) acknowledged that the shortcomings identified by the EIGT had been recognised, and were already being addressed. Some significant improvements had already been made.

The EIGT tested the ease by which companies could access sources of advice and support. Skills Strategy Group members made a series of cold enquiries to RDAs. They found it difficult to find the right person to speak to, and were often passed backwards and forwards between RDAs and Business Links – only to find themselves back where they started. More often than not they were told there was no support available for their need.

Members of the EIGT working group also tried to access on-line sources of advice as if they were electronics SMEs. Though these enquirers were well-informed about the workings of the RDA and Business Link network, they nevertheless had difficulty accessing relevant ‘electronics-related’ information through www.businesslink.gov.uk. This experience of www.businesslink.gov.uk contrasts somewhat to the experience of most other users. Several independent evaluations of the site have shown that the site is extremely customer-focused, and that it is delivering real value to the business users who access it.

Electronics industry users have, on the other hand, commented that “the site did not recognise ‘electronics’ as a sector”, leaving the searcher to scroll through multiple categories which yielded few relevant results. Not only is the sector invisible to Government but some Government support appears to be invisible to the sector.

This experience may lie behind the negative response companies reported in their dealings with most English RDAs, in contrast to dealing with the Welsh Development Agency (WDA) and Scottish Executive – both of whom had activities clearly focused on electronics. The only exception was Yorkshire Forward, where the Yorkshire Electronics Forum is providing a valuable focus for regional networking and a useful channel for information and exchange of best practice.

But the EIGT’s work highlights that industry fragmentation, poor networking, low e-business take-up and low trade association membership, are factors which make it
more challenging to establish effective communications channels to the sector. The DTI is committed to seeking and acting on customer feedback from all industry sectors. This feedback from the EIGT work will, therefore, form an invaluable input to the ongoing programme of channel and support improvement.

For the most part, companies and stakeholders interviewed by the EIGT were critical of the Government’s decision to transfer funding to the regions. Arguing that this makes it more difficult to deliver a coherent national strategy for electronics – for which the cluster is the UK rather than any one region.

Concerns were also expressed about the added bureaucracy imposed on companies operating in more than one region. For example, where a company rationalisation required engagement with several RDAs and occasionally devolved administrations. Others found it difficult to roll out multi-site initiatives across their UK operations where support was available from one RDA but not another. While there may be legitimate reasons for such differences sometimes (e.g. assisted area status), different regional priorities also seem to play a part. The electronics trade associations also found it required much more effort to establish initiatives to help member companies become more competitive or to create mechanisms for developing and sharing best practice.

Others were concerned that Selective Finance for Investment awarded in one region had a distorting impact on businesses operating in other regions, despite assurances that displacement effects were taken into account.

The biggest complaint was the lack of critical mass to create the infrastructure necessary to support future innovation. Several interviewees felt that politicians would bow to regional political pressures to share infrastructure, rather than ensure that the UK as a whole had, for example, one major prototyping and test centre. The Micro and Nanotechnology Network was often quoted as an example of political delay and compromise.

RDA response

The EIGT asked the RDAs for their reaction. Given the fragmented and invisible nature of the sector it was not surprising that the RDAs found it difficult to see the sector and its significance. Most RDA activity was focused on the more visible end-customer sectors or electronics application sectors, such as defence electronics or IT, rather than the main electronics sector addressed by the EIGT. Equally the dispersed nature of the industry’s own representation posed a further challenge to engagement.

The EIGT was pleased to receive assurances that the RDAs would appoint a senior lead director for electronics, and that each RDA would appoint a lead contact. The EIGT was given an assurance of the RDAs willingness to engage actively in the follow up work of the Electronics Leadership Council. The RDAs have agreed to identify existing initiatives that they operate which relate to the electronics industry, and these will be clearly signposted from www.businesslink.gov.uk. They will

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12 Micro and Nanotechnology Network www.microandnanotech.info
further consider a pilot project in one of the regions for mapping the sector’s presence in order to be able to target support more effectively.

R&D tax credits

R&D tax credits were strongly supported even though some companies were still struggling with interpretation. Venture capitalists were particularly strong supporters of the scheme. They pointed to the simplicity of its administration and the fact that, unlike grants, it could be left to accountants and not engage a lot of valuable R&D time. The EIGT was not able to access evaluation data to show whether the tax credit, for which the industry had been strong campaigners, was actually affecting the amount of R&D being done within companies. There was a risk that remoteness of the claim from those engaged in R&D activity might just lead to the credit going to the bottom line. The Treasury must assess this in its evaluation.

‘We always seem to fall between the cracks of schemes. Support should be location neutral. Overall it’s been a negative experience’

The EIGT encountered companies who were nervous about making a claim because of the fear that they may be asked to repay it. Others wanted to claim but were being told by accountants that they could only claim for £7,000 of R&D activity, despite having an R&D department of 17 staff. We also found one company where a tax inspector had told them that they shouldn’t be doing R&D because they were a manufacturing company! Other companies had been advised that quite advanced process innovation did not qualify: “We always seem to fall between the cracks of schemes. Support should be location neutral. Overall it’s been a negative experience.” Clearly, this is an area where awareness and advice needs to be continued.

Vision 2015

A well signposted, business-friendly, flexible system of support is visible and accessible to electronics companies.

Support is galvanised around a few big projects rather than small sums which are widely scattered.

UK businesses are able to engage in key international R&D projects, and win their fair share of market opportunities from emerging technology.

A National Electronics Strategy is supported by the RDAs and regional support effectively targeted.
Recommendations

3.6: DTI and the RDAs should work together to identify and signpost all existing support initiatives that are appropriate to the electronics industry. The Electronics Alliance should work with them to help to identify more effective channels for communicating with this diverse sector on a systematic basis.

3.6.1: Government should provide more support to enable UK companies to access EU Framework Programmes and work to persuade the EU to simplify and streamline the application process. Government should also make a clear policy statement and commitment to Eureka and help for UK companies to engage effectively. (e.g. the DTI technology strategy should embrace the key electronics Eureka themes.)

3.6.2: Selective Finance for Investment should be targeted at target high quality and sustainable investments in priority opportunities.

PRIORITIES FOR DTI

Fig 3.6: Business priorities for Government

Prior to the DTI Review in 2002, the Electronics Unit was mainly engaged in developing and managing technology programmes, helping companies to trade and invest in overseas markets and secure inward investment. Following the review the DTI’s sector units were refocused towards relationship management of key companies and stakeholders and influencing the policy framework in which the electronics industry operates.
In 2003, National Opinion Poll (NOP) conducted a survey to assess stakeholder views on how the change was working. The responses from the electronics industry were strongly supportive, but in one aspect their views were significantly different to those from other sectors. As shown in Fig 3.6 electronics companies put priority on the availability of grants, and no emphasis on ‘influencing’, which was completely at odds with the new direction of the sector units.

The EIGT wanted to assess whether this survey response was valid and if so why. In particular, we wanted to understand whether there were specific factors that made electronics companies respond as they did. The EIGT consultation revealed priorities were in line with the direction the DTI Electronics Unit was already moving in. There was a clear message that companies wanted more influence on policy, and competitiveness issues regarding areas like regulation, tax and finance, education, standards and a few ‘big idea’ initiatives, rather than fragmentation.

Grants remained important but this was of a secondary order and more to do with removing the confusion about availability. Businesses wanted greater emphasis on getting the business climate right and felt the survey was typical of so-called ‘grant junkies’. Others suggested that the appetite for grants reflected the dire state of profitability in the industry at the time of the survey, and the short product lifecycles in electronics. The best argument advanced for grants was that they paved the way for SMEs to collaborate with larger companies.

Company views were, however, at odds with those of the trade associations consulted in the stakeholder exercise. This is possibly because their membership is heavily influenced by large inward investors or capital-intensive companies, for whom Selective Finance for Investment and access to European R&D activities is a high concern. Some trade associations may also be grant dependent because of their low income compared to equivalent organisations in other sectors.

**Vision 2015**

UK policy framework guarantees successful business.

In its relationships with Government, business focuses on sustainable issues rather than short-term grants.

**Recommendation**

3.7: DTI Electronics Unit should be resourced and restructured to support implementation of the EIGT report, facilitate the Electronics Leadership Council and influence key policy areas of skills, regulation, public procurement and technology strategy and key initiatives.
Global market sector and technology opportunities

There are major new market opportunities for those companies active in the electronics sector. Global growth is forecast across all sectors, ranging from 2–6% per year. Global opportunities in each sector need to be set against UK strengths and success depends on numerous factors, so the EIGT cannot be prescriptive. Functional convergence offers an opportunity for companies that can adapt existing offerings to new applications. There is also considerable potential for those involved in public procurement, as national programmes can stimulate innovation, and underpin business opportunities in key areas such as healthcare and security.

The UK is well placed, primarily due to its excellent science base, to take advantage of emerging technologies. This should be underpinned by promoting an enthusiasm for new technology, through the development of aspirational projects, maintenance of research critical mass, and greater coherence of technology strategies across Government.

Considering the international market potential, China represents a massive opportunity notwithstanding the risks to IP. India also represents a good opportunity, given a shared cultural heritage, willingness to work co-operatively with UK businesses, and a supply of good quality people. Inward investment to the UK by US corporations also provides access opportunities to an otherwise highly parochial market.

MARKET SECTORS AND TECHNOLOGIES

The following market sectors were analysed by the EIGT in terms of new technology and market opportunities, as a model of UK industry overall:

- Aerospace & Defence
- Automotive
- EDP and Office Equipment
- Control & Instrumentation
- Medical & Industrial
- Telecommunications
- Consumer Electronics
- Semiconductors
- Other Components
The ‘components’ categories underpin most application sectors. The EIGT analysed these sectors with in-depth interviews and feedback from various sources, and generally found close correlation with published data on market and production forecasts.

Each sector is characteristically dominated by a handful of global players. There are relatively few medium-sized concerns in the UK but numerous small enterprises. The large companies tend to have the funds available to invest and grow. Some mainly innovate through acquisition. There are few major British OEMs and only a handful of British-owned global players across the sectors. However, in the highly globalised electronics market national distinctions are becoming less relevant. The footprints of global players, in terms of design, manufacturing, sales, service and R&D, and the share of the value chain domestic suppliers achieve, is becoming more important to national economies. The former are determined by infrastructure, government constraints and market access considerations. The latter is increasingly influenced by business’ abilities to exploit intellectual capital and seek out higher value.

Analysis of published forecasts shows there is little variation in projected growth across sectors as defined in this report. Industry growth is typically forecast to be around 2 – 6% p.a. (Fig 4.1).

**Fig 4.1: Projected growth by application sector 2002 – 2006**

Electronic components are forecast to show the highest rate of growth at around 9% p.a. This reflects the nature of the UK production base, with few OEMs but a large number of small companies feeding ‘building block’ components into the OEMs’ supply chains. Increasing convergence means component assemblies developed for one device will become suitable for other applications. This trend will
favour UK EMS companies with the capability to design and supply non-commoditised, high value-added components.

‘Emerging technologies and convergence of consumer electronics, computing and wireless technology, offer a huge opportunity’

According to the EIGT consultations, “Digital convergence will be a significant factor in the consumer electronics market,” said a major semiconductor design house. A leading electronics distributor also considered that “Emerging technologies and convergence of consumer electronics, computing and wireless technology, offer a huge opportunity.”

Some companies emphasised the importance of specialisation for future success. An electronics distributor felt that small companies could guarantee competitiveness by providing “efficient service in supplying small volumes of niche products”. This opinion was reflected by another SME that claimed, “Prototyping is on the increase in the UK PCB industry as this is more lucrative than volume manufacturing.”

The UK has particular expertise in analogue circuit design, although most end up in digital products. Hardware is again becoming significant in image processing solutions. Multi-purpose application specific integrated circuits (ASICs) and hybrid analogue/digital circuits could represent one of the better opportunities for UK firms in the short-term. A major chip supplier maintained, “The UK should focus on analogue, power and mixed signal technology.” And another foresaw “an increase in leveraging our cell phone design competencies using the latest compound semiconductors.”

The UK retains around 40% of the European silicon design market, and also does well in chip verification despite the absence of major fabrication facilities. Niche suppliers and rapid prototypers enjoy good business. But it will become increasingly difficult to compete with Asia in this sector. However, a leading semiconductor considers there are strong opportunities in CAD-based verification – an area where the UK boasts technology leaders, along with Israel and the USA.

It is difficult to give an unequivocal steer on particular vendor application sectors given the absence of any ‘blockbusters’. However, there will be major opportunities from technology convergence. UK businesses need to become agile and accomplished
‘horizon scanners’ to identify and exploit emerging opportunities. The Government must also be increasingly flexible in the technologies and markets it supports, and the types of mechanism used to assist UK industry.

There is some granularity within the sectors, e.g. use of Radio Frequency Identification (RFID) in instrumentation and control systems, and the development of small displays for telecoms and consumer products. Both these technologies are forecast to grow strongly (though from a relatively low base in the case of RFID).

The EIGT highlighted significant areas of opportunities in the public sector, e.g. for medical, defence and security – with increasing volumes of embedded systems, wireless connectivity and associated network infrastructure. There are also good opportunities in environmental services and energy management.

Embedded systems and connectivity will also play a major role in home appliances, to facilitate domestic e-enabled services.

**Defence**

Defence is a highly successful UK sector and a driver for quality electronic solutions. The UK is second in the world (after the US) in terms of share of the global defence market. The UK comes fifth in terms of global defence expenditure, and accounts for about 5% of military spend worldwide. In 2001/02 the MoD procured £12.69bn of goods and services from industry. \(^1\) £1.74bn (around 14%) was spent on data processing, electronics and telecoms. A further £2.32bn was spent on aircraft and space systems, which both have high electronics value.

\(^1\) Defence Analytical Services Agency – UK Defence Spending 2003
A leading microchip design house maintained, “Defence is a premium market which is less likely to go to cheap labour markets.” This view was reflected by another major electronics supplier: “Defence is traditionally solid, and a strong area for UK companies.”

‘Defence is a premium market which is less likely to go to cheap labour markets’

The shape of the UK defence forces (and those of many other countries) is changing, with radical emphasis on new technology. The heart of the forces’ transformation is the development of ‘Network Enabled Capability’. This technology will increase demand for rugged mobile wireless connectivity, secure ad hoc networking, advanced sensor technology and systems capability to manage integrated logistics and C3I (Command, Control and Communication) solutions.

Health

The UK has a significant national asset in the NHS and a history of healthcare invention and innovation. The current National Programme for IT is deploying £6bn of ICT infrastructure in the English NHS. It is the single largest IT project being undertaken in the world and will provide a massive impetus to e-health solutions.

The joint Industry/Government Healthcare Industries Task Force\(^3\) has a mission to make the UK “The pre-eminent supplier of healthcare solutions globally in the 21st Century.” This is achievable. Some technology players, which are not currently associated with the healthcare sector, are developing proofs of concept in the UK targeted at the global market.

An EMS suggested, “The NHS should encourage UK companies to innovate new medical technology advances.” A leading systems design house concurs, “Healthcare is a major opportunity.” A large EMS also viewed healthcare as a possible growth area for the UK, but remarked “it is technically very demanding.”

‘The NHS should encourage UK companies to innovate new medical technology advances’

Sensors, system-on-chip diagnostic aids, real-time in vivo monitoring, compact imaging technologies, telemedicine and wireless connectivity will also increasingly become mainstream applications.

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\(2\) Defence Command Paper Cm 6269, MoD, July 2004

\(3\) http://www.advisorybodies.doh.gov.uk/hitf/
Biotechnology is the fastest growing technology sector. Advances in biotechnology\textsuperscript{4}, MEMS and nanotechnology will unlock opportunities for hybrid technologies, and bioelectronics is likely to become an important sub-sector for UK companies.

**Control and Instrumentation**

Control and instrumentation is a broad sector covering electromechanical systems through to embedded systems and sensors. Although market projections are relatively modest (<4% annual growth overall) there are some significant areas of opportunity.

Chip and PIN upgrades to smartcard technology are driving the reader market. Global sales of readers were valued at £95.8m in 2002, and are forecast to reach £400m by 2005\textsuperscript{5}. Europe is the dominant market with 67.4% of all terminal and reader revenues. By 2005, North America will represent an 18.5% share of the total market.

The global annual market for RFID systems was about £550m in 2002. Europe accounts for about 40% of the market (£220m) and the UK about 25% of the European figure (£55m). Venture Development Corporation predicted a compound annual growth rate for the industry of 21\%\textsuperscript{6}. However, implementation plans by Wal-Mart, Metro AG and Target, along with the US Department of Defense, prompted the firm to increase the forecast CAGR to 37\% for RFID software and systems. Total revenue from transponders, readers and software is expected to reach £1.18bn in 2005.

The three fastest growing sector opportunities are in retail, healthcare and commercial services. The top five emerging applications are baggage handling, rental item tracking, point-of-sale/e-commerce, real time location systems and supply chain management. Some experts suggest RFID tags will eventually replace all barcodes. There is certainly a rapid rise in the number of RFID solutions used in retail and logistics operations.

The US is the largest single market for RFID (around £195m) and is increasing rapidly due to initiatives like the Department of Defense’s Total Asset Visibility programme. Japan is the leading Asian market at around £140m, but this includes some public transport smartcard systems, and innovation in areas like RFID-trackable banknotes.

The UK is the leading European adopter of RFID solutions. It has little indigenous manufacturing capability for chips or readers. Consequently these are sourced from

\textsuperscript{4} Bioscience 2015 report, www.i-bio.gov.uk  
\textsuperscript{5} Frost & Sullivan  
\textsuperscript{6} Venture Development Corporation: ‘The global markets and applications for RFID and contactless smartcard systems’, January 2003
the US, continental Europe or East Asia. However, UK strengths in service innovation, communications networks and a thriving SME systems integrator community, make it the European leader. Solutions offered typically have a ROI of one to two years, and result in at least 20% time and cost savings. Tesco claimed that it got its logistics system ‘for free’ on the back of savings at point-of-sale.

Concerns over consumers’ privacy have given rise to a deal of debate – and some poorly informed press comment – over the past year. To a large part the fears expressed are without foundation. But there are genuine issues that must be addressed for consumer acceptance of the technology.

**Semiconductors**

The EIGT commissioned an ‘Opportunity Review’ from Gartner in which the prospects for semiconductor use were analysed. The top 10 fastest-growing applications for semiconductors, as judged by their CAGR to 2007, are shown in Figure 4.2. The consumer market will be the fastest-growing application market segment during the next five years, led by demand for consumer displays, digital TVs and camcorders. There are also strong products in data processing. All together these segments will add $20bn worth of new demand to the semiconductor market up to 2007.

**Fig 4.2: Top 10 fastest growing applications for semiconductors**

![Diagram showing the top 10 fastest growing applications for semiconductors.]

The EIGT identified three other sectors with significant opportunities: environmental services, energy and security. These applications predominantly use control and instrumentation technologies.

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7 Gartner 2004
A major venture capital house and a defence supplier considered “security is a major opportunity.” A leading systems design house favoured the market for ID cards, and several companies (including a major mobile phone supplier) reckoned ‘green technology’ was a good bet for the future as 50% of the content is electronics.

The Environmental Goods and Services market was estimated to be about £290bn in 2002, and is forecast to rise to £385bn by 2010. Some 15-20% of the UK environmental industry’s turnover is generated overseas, and it is an area where the UK enjoys a trade surplus. The Joint Environmental Markets Unit (now the Environmental Markets Unit) identified environmental monitoring and instrumentation as a ‘high’ future overseas opportunity.

‘Security is a major opportunity’

Demand for better energy efficiency is becoming more pressing as the UK (and other countries) strive to meet commitments under the Kyoto protocol. Electronics is itself becoming more energy efficient through the use of ‘thinner’ silicon and embedded systems management. But there remains much scope for improved energy efficiency through networked intelligent appliances and metering solutions.

Security, in the context of heightened awareness following 9/11, is seen as a major opportunity. National security is driving a requirement for biometric identifiers for individuals, RFID tags for goods in transit, CCTV and related technologies for monitoring people and vehicles, and will result in the introduction of ID cards in the UK. As with RFID, there are privacy and civil liberties issues that must be addressed prior to public acceptance of the technology.

Product to service orientation

Across the sectors – with the exception of larger semiconductor companies – there is a trend away from simply supplying products towards ‘building a service relationship’ with customers.

A major UK defence contractor said, “It is important for UK industry to develop services as a differentiator.” Another company maintained, “Service is a key part of providing an overall solution today whatever is being manufactured.” While another major firm remarked, “As components are increasingly sold as a commodity, moving to a service model could help industry do better.”

‘It is important for UK industry to develop services as a differentiator’
Service is often the prime value-added element in new and existing electronic applications. This is also the case in non-commoditised components where service differentiation can transform a business. A defence contractor remarked, “The industry is heading towards total service solutions. This trend is less developed elsewhere in the EU and could represent future opportunities for UK companies.”

**Premier Farnell – Putting the customer first**

Premier Farnell markets and distributes a range of electronic maintenance, repair and operations (MRO) and specialist products and services throughout Europe, North America and the Asia Pacific. In 1999 the company began an ‘Investment for Growth’ programme transforming the company from a ‘one solution fits all’ approach into a highly customer-orientated, proactive organisation capable of providing high quality products and services to meet the individual needs of all its customers. Premier Farnell aims to understand its customers better than anyone else, and to use new technology and modern marketing expertise to provide services that are precisely aligned with their needs.

The group operates in 21 countries and trades in over 100, with 5,000 employees serving a customer-base of more than 2m worldwide. It stocks over 400,000 items, has access to 4m more, and represents 3,000 brands. The group’s multi-channel approach includes business contact centres, field sales force, trade counters, branch network, catalogues, direct mail, and over 40 transactional websites for e-procurement.

**Vision 2015**

UK application vendors companies can rapidly refocus as opportunities emerge from convergence. Government and industry representative bodies are active and flexible in the way they engage.

The UK plays to its strengths. We remain ahead of the game in terms of electronics design and strive to maintain this advantage. There is realisable critical mass in the health and defence sectors, and the UK is a world-class supplier in these areas. Significant potential in security, environmental service and energy efficiency applications is fully exploited.
The UK has a world-class capability in auto-identification and data capture (AIDC), and particular RFID solutions in both the private and public sectors. The UK AIDC community benefits from massively increased market opportunities, with extensive regional activity which accelerates adoption of these solutions across all business sectors.

Recommendations

4.1: Public sector purchasing should be used as a driver for innovation and business success.

This will require the further development of strategic relationships between the supply side (including academia), Government sponsor departments, customer departments and their purchasing agencies. In chapter 3 we noted that combined public expenditure on health, transport and defence will rise by 26% p.a. to £141bn by 2007/8.

4.1.1: Government departments should have closer dialogue with the electronics industry to determine the immediate and future technology needs of the various Government departmental programmes. Purchasing agencies should reflect more strategic thinking in the design of procurement programmes to draw forward innovation and develop key capabilities within UK industry.

Strategic relationships should be engineered between the electronics industry and the Department of Health (DoH) and the Ministry of Defence (MoD). There is a key role for DTI in assisting the development of these relationships. Relationships should also be developed by the industry with the Department for Transport (DoT) and the Home Office (HO). The electronics industry should develop effective vendor application representative groups to engage with relevant Government departments. These should be based on existing structures where appropriate.

4.1.2: The DTI should continue to help promote AIDC solutions nationally, RDAs should develop regional initiatives to the benefit of local business and in development of local expertise in AIDC technologies and applications as appropriate.

4.1.3: The Government should give greater opportunity for SMEs to participate in publicly procured projects.

Prime contractors should involve their UK suppliers more closely in the development of relationships with Government procurement departments. This type of approach was used in the run up to Y2K. An additional benefit to prime contractors would be the development of resilience in their supply chains, whilst lowering the barrier to participation that bars a more strategic engagement on the part of SMEs. Greater use should be made of mechanisms like the Northern

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9 The Healthcare Industries Task Force, for example, was structured around an Association of British Healthcare Industries core, but extended to bring in representatives from the bioscience, pharmaceutical, innovation support and commercial funding communities. This relationship is being developed to endure and interface with the Department of Health’s Commercial Directorate and NHS Innovations’ regional and national activities.
Defence Industries (NDI) initiative whereby SME collaborators are assembled to bid in significant public procurement projects.

4.1.4: Greater use must be made of the Small Business Research Initiative (SBRI) to increase near-market R&D activities in SMEs.

The DTI should be more directive in its oversight of SBRI\(^\text{10}\). RDAs should be informed in order to keep their local business communities informed of the SBRI opportunity, procuring departments should also ensure that they achieve the SBRI targets assigned to them.

**GLOBAL MARKETS**

The main target territories identified during EIGT interviews were China, India and the USA. All three territories present opportunities but with different barriers to successful trade.

**China**

China was the third largest electronics market in 2003 (£67bn) after the USA (£210bn) and Japan (£84bn). But China is the fastest growing market, projected to grow at 13% p.a. to 2006. It has a current production surplus of around £5.57bn, mostly accounted for in high volume low value products. It has been a voracious importer of high value electronic equipment notably in telecommunications. The Chinese are the world’s most prolific users of short messaging systems (SMS), sending around one quarter of the global total of 4bn texts.

UK companies generally have few problems accessing the Chinese market, but difficulties in protecting IPR were widely reported. Many respondents identified China as both an opportunity and a threat.

“The threat to IP can rule out interaction with some Chinese companies,” said a leading technology company. “There is a total risk to IP when operating in China,” said a start-up. One SME admitted it had fallen foul of copying “as there’s no IP protection in China.” However, a major investment house reckoned, “IP risks are high in China but can be alleviated.” And a leading systems design house said “The secret of success is to control the really valuable IP tightly.”

Most companies agreed: “You need to go into the Chinese market with your eyes open.” There was also common recognition that China would become the biggest global market within a couple of decades. One EMS had already set up some 20 partnerships and was looking to formalise their position. A venture capital firm suggested “Joint IP rights are the way forward.” Whilst a major

\(^{10}\) Innovation Report, DTI 2004
instrumentation and control company reckoned: “The IP threat from China is now under control, and the country accounts for 10% of our turnover.” A large chipmaker also saw China as a huge opportunity but insisted: “Controlled IP collaboration is essential.” Another VC outfit said “It’s worth bearing in mind that China was the most innovative place for over a thousand years, before the industrial revolution. The last 200 years could be viewed as a blip!”

‘IP risks are high in China but can be alleviated’

China is clearly the main territorial opportunity for UK companies, notwithstanding the risks to IP. It is a huge market. About a quarter of the world’s population lives there and they aspire collectively to be as technologically adept as the US, Japan and Europe. It has a pool of low cost labour, and a rapidly strengthening skills base. China is, of course, culturally very different from Europe. Several companies reported difficulties in dealing with Chinese government organisations. However, massive privatisation is underway, and some UK companies claimed relationships have improved with the new commercial firms.

Apparently, the Chinese recognise the need to get ‘western’ thinking into product design, and would prefer to partner with UK firms, rather than US or other European companies. Other interviewees felt that UK-sponsored missions were too constricting, and suggested that a mechanism should be developed to help companies help themselves. A few firms felt confident about their abilities to engage profitably in China.

India

The Indian market is relatively small, ranked 20th in 2003 terms at £4.5bn, but with a production deficit of around £1.39bn. The Indian market is currently growing at about 7% annually. India is perceived as having a better regard for IP (although a few EIGT respondents claimed India was more of a problem than China). India also has a shared cultural heritage with the UK. However, part of that heritage is a fondness for red tape, which was cited as the principal source of frustration doing business there.

‘India, like China, is a massive opportunity’

A major global electronics firm remarked: “India, like China, is a massive opportunity.” Another multinational was impressed by India’s education system and said “The country produces good engineers.” And a major VC remarked, “The UK could exploit the historical ties with India. We have shared values and regular movement of jobs and people between both our countries.”

In fact, there are an increasing number of joint venture and outsourcing arrangements between UK and India in the software and services sectors. There is also increasing Indian activity in contract PCB work, although questions about quality persist. Concerns over rising Hindu nationalism have not resulted in adverse
impacts on business. Interviewees sometimes characterised India as “like China, but 10 years behind”, and it represents a key opportunity for UK businesses.

USA

The USA remains the global driver in electronics. Its market totalled £210bn in 2003 (more than twice the size of Japan, the next nearest market at £84bn), with a production deficit of around £42bn. However, the USA ranks 44th in terms of market growth reckoned at a modest 4.2% per annum.

Many UK companies enjoy good business as suppliers to Tier One US corporations but others are frustrated by a USA-centric purchasing attitude. “Politically, the US is a closed market,” opined one leading electronics supplier. “The US government buys American and influences US companies to buy American.” One UK science park considered “The US is more difficult than China as a market.” An SME remarked, “The US is an opportunity but it can be protectionist through the use of tariffs.” Another company suggested, “The US market is stagnating due to migration of work to China.”

However, others considered “The US a massive opportunity, particularly for collaboration in the science base.” This opinion was reflected by a VC firm, which saw the US as an excellent opportunity to compete with and win R&D business for UK firms. A major semiconductor manufacturer said chip designs won in the US were sometimes offshored to the UK, “and it’s still the biggest driver for business.”

Nevertheless, the American market is difficult to penetrate. But those companies that succeed in overcoming the challenges, often find clients that work to a specification rather than a price. The principal route into the market appears to be via American inward investment. The UK also remains the preferred location within Europe for American firms. Though this probably has less to do with the ‘special relationship’, and more to do with our shared language and world-class science base.

A number of other territories were also cited as target markets, including South Korea and Taiwan. Many interviewees suggested that Russia and the central/eastern European states could develop into opportunities once their market infrastructures mature.
Vision 2015

UK electronics companies are confident and competent penetrating more risky markets. UK plc enjoys an increased market share based on secure IP and confident marketing skills.

Recommendations

4.2: The ability to succeed in Asian markets should be replicated widely across the electronics sectors. There is scope for corporate mentoring including the spread of best practice in IPR protection.

4.2.1: There should be an increased role for bodies such as the China-Britain Business Council (CBBC) and the Asia Europe Meeting (ASEM).

There is a need to cultivate bilateral trade association relationships, to build a far greater degree of IP trust in business relationships, possibly through the introduction of an IP ‘trust mark’. It could also be worth exploring whether, through the relevant professional bodies, there is scope for introducing an element of ‘best in class’ IPR training and development for Chinese chartered engineers and supply chain executives.
EMERGING TECHNOLOGIES

In the course of the EIGT exercise we considered emerging technologies, and mapped these against potential application areas and the likelihood of UK companies’ ability to exploit them (Fig 4.3).

Fig 4.3: Emerging technologies by potential application sector

<table>
<thead>
<tr>
<th>Technology</th>
<th>Info Systems</th>
<th>Instrumentation and control</th>
<th>Medical</th>
<th>Security</th>
<th>Wired Comms</th>
<th>Mobile Comms</th>
<th>Consumer Electronics</th>
<th>Energy and Lighting</th>
<th>Automotive</th>
<th>Defence and Aerospace</th>
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<tbody>
<tr>
<td>Carbon-based (plastic/polymer) Electronics</td>
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<td>✓</td>
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<td>Nanoelectrics Nanomagnetics/Spintronics</td>
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<td>Silicon Microsystems and System-on-Chip</td>
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<td>Component and System Design and Software</td>
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<tr>
<td>Non-Semiconductor Components</td>
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Source: Gartner 2004

The EIGT also asked Gartner to consider the prospects for emerging technologies as part of the Opportunity Review\textsuperscript{11}. A fascinating picture of opportunities arose, but it’s worth taking a close look at Fig 4.4, which maps emerging technologies in ‘hype cycle’ of functionality against perception.

\textsuperscript{11} Ibid.
Many electronic products that will emerge over the next few years are likely to be targeted at consumers. Personal music systems and mobile phones are the most popular types of personal electronic product today. But this will change dramatically over the next 10 years. For example, smart clothes made from new fabrics will support changing patterns and colours. Teenagers could be walking around with moving images on their T-shirts or fashion logos that change to suit the occasion. These products will require flexible interconnect technologies that are likely to be manufactured using low-cost polymer-based reel-to-reel production technologies. The same approach will be used for many emerging electronic products, including organic light-emitting diode (OLED) and light-emitting polymer (LEP) displays, electronic paper, intelligent labelling and bank notes. Healthcare and medicine are also likely to experience strong growth, with innovative product introductions. Smart clothes with integral sensors could also enable ongoing health monitoring.

**Personal entertainment** will probably be taken to the next level with small but high-quality images provided by head-mounted and retinal imaging display technologies. Personal area networks will share and route information among users through ad-hoc mesh networking systems.

‘Teenagers could be walking around with moving images on their T-shirts or fashion logos that change to suit the occasion’
Camera technology is advancing rapidly through the development of electronically enhanced lenses. This will allow ultra-thin cameras to be made, for use in many new sensor applications from biometrics to automotive distance sensing. Coupled with a small display, this technology is also likely to find use in smart glasses. In addition to vision correction, these systems will support zooming, night vision and distance measurement. Given the right fashion conditions, this glasses market could be worth over $1bn p.a.

Fuel cells Advances in low-power design will result in improved efficiency, but significant portable energy sources will still be required. Battery energy capacity will improve – though rather slowly. Kinetic and bio-energy sources currently offer very low energy capacity, and are unlikely to be developed within the next 10 years. Micro-fuel cells offer an alternative power source for mobile devices and could provide 10 times the energy capacity of lithium-ion batteries. Working prototypes have been demonstrated and production is expected to start in 2005. Mass roll-out first requires infrastructure issues to be solved. For example, customers must be able to find stockists for fuel cell cartridges. Gartner believes it will take up to 10 years before fuel cells are widely used.

Security fears, terrorism and illegal immigration will drive the slow adoption of smart ID cards containing biometrics and securely encrypted personal data. Such systems, probably based on smart card and RFID technologies, could generate semiconductor revenue of almost $1bn p.a.

Smart pills that can be swallowed or embedded under the skin will be developed. These will facilitate diagnosis through image and chemical analysis. They will also be able to dispense several different medications, making them appropriate for elderly people who forget to take specific types of pill at set times. Later generations of these pills will synthesise drugs from basic chemical components, bringing significant economic benefits to the pharmaceutical industry. Gartner estimates that a market will exist for at least 2bn smart pills per year by 2015.

Home entertainment will undoubtedly increase in popularity. Though music and video distribution systems are changing, the real boom in digital content will not happen until home appliances have been standardised to allow interoperability, especially between PCs and consumer electronics equipment. But content owners will resist this, requiring strong safeguards of their intellectual property. Resulting home entertainment systems will need end-to-end encryption for copyrighted material across the range of media types, e.g. CD, DVD, wired, wireless and hard drive. The algorithms for these future encryption schemes will evolve over time. One thing is clear – they must be able to be corrected quickly if security is cracked. This suggests the need for some form of downloaded functionality that can be updated during the lifetime of the equipment.
Energy saving The under-capacity of many of the developed world’s power systems is well known. Non-renewable energy reserves will continue to be depleted, leading to increasing energy costs. This will drive demand for electronic products that consume less energy. Applications include washing machines that clean at low temperature and without water, and cookers with integral microwave accelerators. New home appliances will monitor health and save valuable time.

The work environment will also be transformed over the next 10 years. More automation of physical labour will occur, requiring instrumentation, sensors and distributed intelligence. But this will not be evenly distributed across all work types because economy of scale will be a main requirement. Technologies that eliminate the need to travel will grow in importance. We expect to see major growth in applications such as advanced videoconferencing (with ‘virtual avatars’ of remote participants), remote field service and telemedicine. Personal productivity will be addressed through speech recognition and possibly through intelligent desktops that connect to PCs and large displays on walls dividing workstations. Employees will also carry more instrumentation for ID purposes and building access, as well as stress-level sensors, for example.

The work environment will also be transformed over the next 10 years

Ubiquitous computing will spur many changes in the wider environment over the next 10 years. Intelligence will be built into our cities, typified by security cameras that are capable of automatically assessing security threats and other crimes. Buildings and bridges equipped with arrays of sensors will be able to detect structural stresses, fire and intruders. Cars and roads will make growing use of processor-based intelligence for safety, entertainment, navigation and traffic control. Buildings and people at large public gatherings will be screened for explosives and chemicals through sophisticated sensors and behaviour analysers.

Intelligence will be built into our cities

The products and environments outlined above will all need semiconductors and related devices that are more advanced than those available now. Many will evolve from today’s devices along the progression laid out in Moore’s Law. Other technologies employed will include micro-electromechanical systems (MEMS), embedded programmable logic, micro-fuel cells, LEPs and OLEDs.

Following recent trends, many new semiconductor/electronic-based products will be purchased by consumers rather than by enterprises or governments. By 2015 (or earlier), 50% of semiconductors will be bought for use in consumer products. This compares with approximately 40% today.

The big opportunities are in complete systems that combine IP and systems knowledge. Most of the emerging product opportunities need considerable
economies of scale to drive cost reductions. Integration beyond semiconductors will play a role in this cost reduction with biochemical, chemical, mechanical and optical integration.

The end of Moore’s Law for bulk silicon may be in sight by 2013. Vendors and immediate users of semiconductors must plan for the use of next-generation semiconductor technologies such as molecular transistors. System design knowledge using these technologies does not yet exist, suggesting large rewards for those organisations that can develop it. Large-scale industry restructuring is likely in view of these changes.

Interconnection and communications are a theme of most of the product scenarios outlined. It is likely that communications and other services will represent a larger market than individual products.

Gartner also produced a ‘hype cycle’ for semiconductor developments for the EIGT (see Fig 4.5).

**Fig 4.5: Emerging semiconductor hype cycle**

The electronics sector must keep an eye on the potential of several exciting technologies that promise to reshape the industry.

**Carbon-based electronic materials** (including polymer electronics) display a range of desirable properties. In particular, they can emit light and act as semiconductors. They could impact on a range of applications, from general low cost circuits to displays and sensors to solar cells. The principal advantages of carbon-based electronics are the potential for ‘printed’ chips and flexible electronics.
Major electronics companies embarked on programmes of research into carbon-based electronics in the late-1980s. However, a range of fundamental problems must be solved before carbon’s electronics potential can be realised. The Engineering & Physical Sciences Research Council (EPSRC) awarded £2.7m to support the creation of a National Carbon-Based Electronics Consortium in 2002 to enable the UK to maintain its lead in this area. Plastic Logic and Cambridge Display Technology (CDT) are two UK-based companies at the forefront of commercial development of carbon-based electronics.

Carbon-based electronics is a disruptive technology that will come to maturity in 5 – 10 years, although some Asia Pacific display manufacturers claim organic light emitting diode (OLED) TVs will be available from 2007. A full-sized manufacturing plant would cost very much less than the billions of pounds needed to build a state-of-art silicon semiconductor or LCD facility, and an investment entry of around £500,000 to £3m would enable development and prototyping activities that could lead to commercial IPR.

A leading printable electronics company maintained that OLEDs and electrophoretics represent a real opportunity for Europe. An SME also saw polymer electronics as a major opportunity in the lighting field. And a leading design house said, “There’s a real opportunity for UK companies to make the base materials for carbon-based products, and this could lead to a new wave of electronics companies with real potential.”

“There’s a real opportunity for UK companies to make the base materials for carbon-based products, and this could lead to a new wave of electronics companies with real potential”

**Compound semiconductors**, made of materials such as gallium arsenide or indium phosphide, exhibit better thermal characteristics than silicon devices, can handle higher frequencies well into the microwave range, and as direct band gap material have useful optoelectronic properties.

The UK has historical strengths in compound semiconductor design, for example, as the RF front-ends in mobile handsets. Newer materials such as gallium nitride are useful for bright displays, as they can be used to prepare superluminescent diodes (SLDs) that emit down to blue wavelengths. A leading semiconductor company said, “The compound semiconductor market is underestimated, due to the growth in integration.” And a major EMS reckoned, “Compound semiconductors have the potential to impact on many more sectors.”

The UK is in the top five nations with compound semiconductor expertise, with companies like Bookham, Filtronic and IQE operating large mass production wafer
fabrication facilities (‘fabs’). Good prototyping work also continues to be done at the smaller UK fabs, and there is a significant business opportunity for UK companies. The market for high brightness LEDs alone is forecast to rise to £2.6bn by 2007

‘Compound semiconductors have the potential to impact on many more sectors’

Nanoelectronics is concerned with exploiting the electronic properties of materials and structures at the molecular level. At this scale materials behave very differently and exhibit useful electronic and magnetic properties. Nanoelectronics is a widely researched topic in the UK and other nations that have the necessary infrastructure, expertise and academic strengths. Studies of semiconductor/magnetic hybrids are underway at Nottingham University, for example. The first applications are starting to appear in memory devices, e.g. hard drives.

The UK may be disadvantaged if it does not develop a manufacturing or a prototyping capability, at least. The ability to fabricate at the nanometre scale will be necessary to master nanoelectronics. The level of current activity does not register in market terms. First predictions for nanotube and nanowire markets start in 2009 at $314m and $164m respectively. These markets are anticipated to grow by about 75% CAGR to 2014, to a total market of about £8.2bn by 2014, including nanoparticles, nanocells, molecular chips and organic transistors.

System-on-a-chip (SoC) technology involves packaging of all the necessary electronic circuits and parts for a ‘system’ (e.g. as a mobile phone or digital camera) on a single integrated circuit. SoC is sometimes viewed as a sophisticated ASIC. SoC technology is used in small, increasingly complex consumer electronic devices. In the future, SoC video devices may be embedded in the brains of blind people allowing them to see, and SoC audio devices may allow deaf people to hear. Handheld computers with small whip antennas could someday be capable of browsing the Internet at megabit-per-second speeds from any point on the surface of the earth.

Silicon micro-systems combine electronics with mechanical features, e.g. as the accelerometers/actuators used in automotive air-bag applications or the micro-mirror arrays used in some larger projector devices. The technology is relatively mature, and the UK shows leadership through the endeavours of companies like Wolfson, Swindon Silicon Systems and TTP Com. As in many other electronics technologies, the UK does not have a manufacturing base. Our success comes from design strengths and the successful exploitation of IP.

The overall market for SoC ICs is expected to experience a CAGR of 20% p.a. and grow from about $13.6bn in 2002 to $34.7bn in 2007.

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Bioelectronics is a variation of silicon micro-systems, focused on the medical sector. The development of medical devices is more onerous than most other electronics sectors given the extent of ethics and governance required. However, the UK environment compares favourably with other territories. Given the strong impetus of the pharmaceutical base, the EIGT expects to see that new UK-developed bioelectronics products will begin to penetrate markets within five years.

’UK-developed bioelectronics products will begin to penetrate markets within five years’

Component design and software Strength in electronics design and software development is key to many emerging product developments, and represents the high value end of the supply chain. The UK has strengths in both these areas, although some EIGT interviewees remarked that this is often a legacy of erstwhile OEMs. The UK has performed well but there are signs that design could migrate with production.

The UK still boasts key players such as ARM, ST Micro and Philips. Our design and software strength has enormous potential, as well as being exploited currently. The Innovation chapter 6 of this report details actions to be taken to maintain the UK’s position in this market.

Flat panel displays The UK has R&D strengths in the basic materials that underpin flat panel displays (FDPs) – particularly liquid crystals and light emitting polymers. There is nascent industrial capability in companies like Plastic Logic and Cambridge Display Technology (CDT). We are also world leaders in the generation of IP, as demonstrated by companies like Qinetiq and CDT. The shipped value of FPDs in 2003 was around $31bn worldwide, and is projected to rise to about $60bn by 2006.\(^\text{15}\)

As with other technologies it is unlikely that the UK will invest the $1bn or so required to establish a volume manufacturing capability, but there is opportunity to extract value from control of the precursors and development of innovative manufacturing techniques.

Imaging High frequency imaging has great potential for security, defence, medical and manufacturing inspection applications. Gallium nitride front-ends provide imaging solutions far superior to existing microwave technology, particularly in the differentiation of flesh and plastics – rather like X-ray vision.

The UK has world-class university-based R&D in imaging, with a number of successful spin-out companies, e.g. Teraview of Cambridge. Commercial offerings can be expected in two to five years. However, the current level of Government

\(^{15}\) DisplaySearch in Flat Panel Display Market, RocSearch, 2004
interest in the UK is far below that of the USA and some European states. The UK is unlikely to maintain its global position without the active backing of UK Government.

**Sensors** There are a plethora of sensor technologies pervading virtually all application sectors. New sensor materials and novel applications are being produced at an increasing rate. Here again, there is no large UK OEM but this is an area where SMEs can thrive.

Unit volumes for CMOS sensors are projected to grow from 18m devices worth $367m in 2001 to 72m units worth more than $1bn by 2005. CMOS image sensors will represent about 47% of all such image sensor devices shipped by 2005, up from 23% in 2001. CCD sensors should continue to dominate the high-end digital still camera market, and other imaging markets like medical instrumentation where precision is required. CCD sensor shipments will expand from 60m units in 2001 to more than 80m units by 2005.\(^\text{16}\)

The sensor market is dynamic and healthy. In order to continue the UK’s success in this field it is necessary to continue to provide generic support for SMEs through the Small Business Service, encouraging collaboration between SMEs and universities, and developing a fast and flexible supply network.

**Vision 2015**

The thriving UK community has a world-class science base, coupled with a wide ranging industry eager to exploit emerging technologies, underpinned by clear, joined-up Government strategies so we can benefit from emerging technologies as opportunities present themselves.

**Recommendations**

**4.3:** A national enthusiasm for new technology should be promoted. The electronics sector must develop genuine capability among the higher educational institutes (HEIs) in the sciences underpinning the emerging technologies.

Industry at all levels should be encouraged to engage in the development of coherent technology strategies that pull through promising emerging technologies across Government departments.

**4.3.1:** Aspirational visions should be set that engender enthusiasm for new technology.

In the course of the EIGT consultations there was discussion of the development of aspirational projects that would push the boundaries of electronic technologies, like a ‘Manned mission to Planet Zog’ or ‘The ultimate robot’. These projects would

\(^{16}\) Silicon Strategies, 2004
challenge thinking and promote truly innovative solutions. It is not clear to the EIGT what would constitute such a project. DTI proposes to hold a competition, in partnership with a leading electronics company and open to schools and trade associations, seeking suitable projects. The competition will open in April 2005.

4.3.2: **OST and the Research Councils should ensure that funding for exploration of new technologies within the science base achieves critical mass.**

There are several acknowledged academic centres of excellence, working in the fields identified above. Many of the basic science issues require concerted intellectual effort, expensive and sophisticated instruments and laboratory facilities. Focus of effort should maximise the chances of the UK maintaining its position at the forefront of materials and device technology.

4.3.3: **There should be greater coherence in Government departments’ technology strategies to underpin and pull through promising emerging technologies.**

The DTI has a lead Technology Strategy, and this should form the basis of a National Technology Strategy. A close dialogue should be maintained with industry to ensure that elements within DTI’s Technology Strategy reflect the potential of emerging technologies. There is no certainty which technologies will actually lead to commercial success, so the DTI must be active and flexible in the management of its Technology Strategy ensuring follow through in the funding of HEIs and R&D support products. OST has a role in auditing other Government departments’ strategies to ensure concerted efforts across all public sector activity.
Supporting a strong environment for innovation and R&D

The EIGT examined how the strength of the UK science base compares to international competitors. What steps could be taken to improve the commercialisation of R&D spend, and whether more tax incentives were needed to help ensure that R&D is performed and exploited in the UK rather than migrating overseas. The EIGT also addressed the issue of fragmentation, knowledge transfer and collaboration in the UK university base, and the level of patent activity in UK companies as a measure of R&D performance.

INNOVATION AND R&D PERFORMANCE

The DTI Innovation Report\(^1\) found that the UK had a strong Science, Engineering and Technology (SET) base, demonstrated by more papers and citations per head of population than any other countries, including the US. However, UK industrial R&D spend (as a percentage of GDP) was lower than many competing nations, including the US, France and Germany.

During the EIGT consultation process we analysed whether the same picture was true for the electronics sector. Though UK universities carry out world-leading research in areas like carbon-based electronics, compound semiconductors and nanoelectronics, foreign competitors seem far better at exploiting our academic research base. Major multinationals like Intel, Hitachi and Toshiba have established facilities beside some leading UK universities.

Despite a few outstanding exceptions, official data showed that the UK electronics industry spends significantly less on R&D (as a percentage of sales) than our major competitors, particularly the US. According to the 2003 DTI R&D Scoreboard, the UK electronic equipment sector spends only about 2.6% of sales revenue on R&D, and over the last five years R&D spend appears to have fallen (see Fig 5.1). The UK lags behind most countries, which typically spend about 6% of sales revenue on R&D in this area. However, the UK figures should be treated with some caution, as the R&D spend in the UK by foreign multinationals tends to be under-recorded in the scoreboard.

UK R&D spending on IT hardware is rising much higher, at about 10% of sales, due to the dynamic nature of the IT business, and possibly due to a sales drop-off in the last two years. This R&D spend compares well with UK competitors. Many of the large IT and electronics companies with bases in the UK are foreign-owned multinationals, and tend to spend more on R&D in the UK than most UK-based companies. However, many foreign-owned companies, but not all, spend less (as a percentage of sales) on R&D in the UK than they do in their home countries. An OECD comparison also shows a falling trend of ITEC R&D spend in the UK compared with our main competitors.

Fortunately, the overall UK innovation story is far from bad. A major European survey\(^2\) of innovation performance (Fig 5.2) showed the UK scoring well in Europe, though well behind the US. The UK’s mediocre R&D performance was masked by good performance in other areas, such as education and venture capital. The UK is also above average in Europe – but well behind the US – in the number of patents per head of population.

\(^2\) http://trendchart.cordis.lu/scoreboard2003/
Fig 5.2: Innovation index for European countries

Source: European Innovation Scoreboard 2003

To remain competitive, UK industry and electronics in particular needs to increase R&D intensity (Fig 5.3).

Fig 5.3: R&D intensity and company size

*Figure omitted since only 15 companies have sales below £50m and all necessarily have R&D over the minimum of £34m.

Source: UK R&D Scoreboard 2003

But as shown in Fig 5.4, the industry has a structural problem – compared to the US, as there is a severe lack of middle-sized, R&D intensive IT and electronics companies.
The statistics appear to show that UK R&D spend lags competitor nations in Europe and the US. Nevertheless, the strong message of the EIGT consultation process was that “the UK has a strong R&D base”. Many companies maintained they were not constrained on R&D spend, and recognised the importance of R&D whether in a defensive or market growth mode.

The EIGT concluded that the official data is flawed for a number of reasons listed below:

- The R&D spend by foreign-owned multinationals is under-reported, partly because reporting is tax driven, and until the recent introduction of R&D tax credits for large companies they had little incentive to report here. For example, despite having large R&D facilities in the UK, IBM was not included in the 2003 DTI Scoreboard.

- A number of high growth but smaller R&D intensive companies did not feature as there was no obligation to report.

- Electronics R&D spend by several large UK-owned defence and aerospace companies was reported under other sectors.

Innovation studies show that the UK is performing well in European terms, though there is a structural problem due to the lack of R&D-intensive medium-sized companies.

A leading independent technology company remarked, “UK companies generally don’t have a problem innovating. However, except in a few cases, we do have a problem turning innovation into market leadership, growth and profit. This issue must be addressed.” Many companies also said that UK R&D efforts don’t fail because of poor innovation or insufficient R&D, “but because of distance from the marketplace, poor knowledge of customer needs and insufficient marketing.”
UK companies generally don’t have a problem innovating. However, except in a few cases, we do have a problem turning innovation into market leadership, growth and profit. This issue must be addressed.

This indicates the importance of improving commercialisation of UK electronics R&D with the emphasis on IP retention and the growth of SMEs to medium-sized companies.

**Vision 2015**

We have accurate measures that demonstrate UK electronics R&D effectiveness compared with international competitors.

UK electronics SMEs are growing successfully into medium-sized companies, with ease of access to R&D funding.

**Recommendations**

5.1: DTI should revise methods of collection of statistics for the R&D Scoreboard to reflect more accurately the level of electronics R&D undertaken in UK, particularly in high R&D SMEs.

5.1.1: The Government should also consider introducing a means of measuring innovation that mirrors the European index.

**SMEs need special attention**

NOTE: If we want to improve the rate of growth of all activities in the UK electronics industry, then any proposals must have equal effectiveness for the SME community as well as for larger companies. SMEs have major problems with access to the academic knowledge base, finding affordable ways to utilise such skills, networking, and particularly for ‘non-electronic’ SMEs (whose products contain electronics as a key part of their performance differentiation) access to good design.

By giving special attention to the SME community, we will help encourage the growth of successful indigenous electronics SMEs, through the IPO phase to successful, high growth, medium-sized companies.

5.2: The Government and industry should encourage growth of successful indigenous UK electronics SMEs, through the IPO-phase, to successful, high growth, medium-sized companies which have the capacity to resource and exploit R&D at an appropriate level.
FINANCE FOR INNOVATION AND R&D

R&D spending is a major driver of industry innovation and will help bridge the UK electronics productivity gap. But as mentioned, UK R&D spend is apparently low compared to some EU countries and the US. Companies need access to sufficient finance to invest in R&D and facilities for the UK electronics industry to grow. The EIGT interviews showed significant dissatisfaction about the availability and effectiveness of venture and risk capital.

Respondents from some of the larger companies thought that the UK had the most sophisticated venture capital community in Europe – though nowhere near as good as the US. Generally, however, SMEs receive a poor reception from institutional investors. VCs were considered to be risk averse about high technology and extremely conservative towards new investment, following low returns on high-tech funds and projects in Europe and the cyclical nature of electronics markets.

‘The main barrier to innovation in the UK is the lack of available financial resource to ‘really push on’. Like many UK innovators, we had to go to the US to raise sufficient funds.’

Over the last decade, institutional investors in the UK have favoured large-scale private deals as they see better returns, especially from management buy-outs (MBOs) over early stage technology investments, as MBOs generate large overall returns at lower risk. By contrast, US technology funds have delivered better returns to their investors, and so have been more successful in maintaining funds.

Obtaining venture capital seems to be more a problem where the risks are high and returns are long-term, e.g. in start-ups. There were a number of cases where innovative companies had little or no success raising funds from UK VCs, but secured substantial sums from US banks and VCs. Such inflows of funds are clearly beneficial and should be encouraged by facilitating interaction between foreign financiers and innovative UK firms.

One technology company claimed, “The main barrier to innovation in the UK is the lack of available financial resource to ‘really push on’. Like many UK innovators, we had to go to the US to raise sufficient funds.”

Many SMEs remarked on the scarcity of seed and early stage funding. They felt that the VCs were too short-term and risk averse in their outlook. Several related this to a conservative culture in the UK where accountants – who
often failed to understand the potential of new technologies – controlled sources of funding and would comment tritely: “It’s far better to say no than yes, as you’re bound to be right 90% of the time!”

Some UK business angels do provide seed funds for high risk ventures. But there are clearly fewer angels than in the US. Though the angel funding community in the UK is fairly strong, it is rather dispersed and there is benefit in aggregating investments to spread the risk. For example, the Scottish Co-investment Fund brings angels together and matches their investment with public funding.

Other sources of funding include the banks (for mid-range capital) and the Alternative Investment Market (AIM). AIM was considered to be good for some companies but a backwater compared to NASDAQ.

Most finance for innovation in the UK comes from private sources. Government support (discussed in Chapter 3) was another area where the opinions of the interviewees varied widely. A number of companies acknowledged the importance of securing grant support under schemes like SMART (now renamed the Grant for R&D), which enabled fledgling companies to progress their ideas to a stage when further finance could be secured from VCs or similar investors.

The need for Government grants to support R&D remains a contentious issue. Many companies felt that grants should not be provided as they distort the market, but they are necessary to level the playing field with our overseas competitors.

A number of interviewees felt there was an absence of any discernable national strategy. A major venture capital company suggested, “The UK needs to produce a Grand Strategy or Roadmap for Electronics, similar to the International Technology Roadmap for Semiconductors.” The new DTI Technology Strategy should address this issue, and the Electronics Leadership Council should find an effective way to influence development of the strategy.

Several SMEs acknowledged the benefit of schemes like LINK and SMART. Support under SMART, for example, helped companies secure further support from the banks, as it acted as a form of reassurance to the lender that the company had been ‘vetted and approved’ and was financially and technically viable. Support under LINK, a mechanism aimed at encouraging collaborative working, acted as a spur to companies to seek out high quality university research groups. Such relationships frequently proved beneficial to industrial and academic parties, by introducing leading edge research to companies and improving the prospects for exploitation in the UK of Government-funded research.

There was some evidence that industry remains confused about what Government support is available to help business. There was only limited awareness of the simplified DTI business support products and what might be available regionally. The Business Links, which help signpost firms, were regarded to be of variable quality.
Vision 2015

The UK environment is more favourable to investment in electronics. All areas of the UK have good access to useful sources of risk capital. Best practice is transferred from successful schemes (e.g. the Rainbow Seed Fund and Scottish Equity Partners) operated in some parts of the UK to other areas. Plentiful seed funding is available for good projects, over a relevant time period. Many projects lead to successful exploitation.

High-tech companies are able to raise substantial funds on AIM, and the stature of AIM is closer to NASDAQ. The financial community is aware of the benefits of establishing a vibrant SME community in electronics in the UK, and the role VCs can play. Innovative founders are not frozen out in financing rounds but are reflected in the equity.

Foreign investment in early-stage UK electronics companies increases substantially as overseas financiers become aware of their long-term potential.

Access to Government support for innovation is quick and simple.

R&D (as a percentage of sales) and capital spend by UK electronics companies rises to US/Asia levels

Recommendations

5.3: DTI and industry should encourage the finance sector to work closer with the electronics industry to improve business plans for raising funding, and in particular their marketing and commercial content.

5.3.1: DTI and UKTI should encourage foreign financiers to invest in UK electronics firms by raising the profile and increasing awareness of opportunities. Tasks should include the provision of good marketing material and organising targeted investment missions to and from the US and Asia.

5.3.2: DTI should draw up a simple guide to grants and other Government assistance for technology projects.

5.3.3: DTI and RDAs should encourage business angels to get together for co-investment in certain initiatives, to spread the risk and aggregate money.

5.3.4: DTI and Treasury should work with the London Stock Exchange to improve the stature of AIM and give it a profile nearer to NASDAQ.

TAXATION AND FISCAL ENVIRONMENT

The UK has a relatively large ITEC sector, but it needs more incentives to help ensure that R&D is performed and exploited in the UK, rather than migrating overseas due to globalisation. UK R&D tax credits have helped electronics engineering and ITEC R&D, but more support is needed for these sectors to thrive.
Overall, the EIGT found that R&D tax credits were well received, but there was a wide range of opinion on their effectiveness. Leading edge, R&D intensive SMEs thought R&D tax credits were an excellent mechanism, particularly where they had worked locally with the Inland Revenue to get an understanding of what qualifies. Some felt R&D tax credits were good but too restrictive, while others suggested they should be better targeted. Several respondents suggested larger tax breaks for companies investing in university research or a ‘voucher type’ system to place R&D with universities.

A high-tech venture investor remarked, “R&D tax credits are arguably the best initiative taken by the Government to help innovation by start-ups. R&D tax credits are a big help to companies that are up against a wall, by taking off some of the pressure.”

A few large companies felt that R&D tax credits hadn’t actually increased the volume of R&D in the UK, because the rules were applied too restrictively and the benefits were “in the noise”. Problems remain defining the extent to which developmental work applies and which costs are eligible.

‘R&D tax credits are arguably the best initiative taken by the Government to help innovation by start-ups’

Some other fiscal changes over the past few years had also helped create an environment more conducive to innovation. In particular, the capital gains tax (CGT) taper relief encouraged entrepreneurs to develop businesses in the UK. The UK CGT regime was now more advantageous in some respects than in the US. The CGT system gives differential benefit to investors in unquoted companies and to employees in companies of all types. This measure is designed to encourage successful investors to recycle more of their gains into reinvestment in smaller unquoted companies with potential for growth. Unfortunately, investors in unquoted companies seemed to lose this benefit in the event of the company being acquired by a quoted company. Some respondents felt that if the relief was extended to cover this eventuality, it would have an even bigger impact on the amount of finance available for innovative businesses.

The EIGT also noted that the application of Schedule 22 of the 2003 Finance Act has reduced the number of university spin-outs. There were mixed views about this as some felt that licensing was a better way of exploiting university research.
Vision 2015

The UK has the best fiscal environment in the western world for stimulating innovation. This environment encourages more multinational companies to establish R&D centres in the UK.

UK electronics companies spend more on R&D.

The UK electronics industry is widely aware of the benefits and what expenditure is eligible for R&D tax credits.

Recommendations

5.4: The Treasury should simplify and broaden the scope and applicability of the R&D tax credit to a level where it makes a difference to both SMEs and large companies’ investment decisions, and helps strengthen the commercialisation process.

5.4.1: The Treasury should make amendments to the capital gains tax taper to encourage more recycling of money into further initiatives and to encourage ‘serial entrepreneurs’.

KNOWLEDGE TRANSFER AND COLLABORATION

Science, Engineering and Technology Base

The UK has a strong science and engineering base as evidenced by the number of papers we produce (over 9% of world) and citations (over 12%). The EPSRC spend on electronics research amounts to £40m p.a., added to which the universities receive funds through the Higher Education Funding Council (HEFC) and other mechanisms like the Science Research Investment Fund. The EPSRC currently funds over 650 research projects that are relevant to the electronics sector, amounting to support of over £125m. The Research Council has done well in this regard, with some 350 companies collaborating in nearly 50% of these projects. However, most of these are larger companies. There should be greater effort, in concert with the business-facing parts of the DTI, to widen the range of companies participating in projects – particularly SMEs.

Many companies felt that the university base in electronics was too fragmented, though the science base was strong overall. They considered that other countries, particularly the US, coordinate and concentrate activities better. A small number of respondents considered that the diversity of the UK university base was a strength and an aid to creativity.

Several companies suggested that university research should be better aligned to industry’s needs. Companies in general found the university research base difficult to understand and access. According to a major semiconductor manufacturer, "Universities are not good at selling what they have. How they are funded is a big issue. There should be better alignment on what industry wants and what the
universities can provide. The universities should be able to do some blue skies work but there should be better market focus.”

A leading electronics company remarked, “The purpose of R&D is to disrupt business models and cause discontinuities. Discontinuities never come from the industries they disrupt; therefore companies must behave disruptively or be disrupted. Discontinuity doesn’t usually come from within an organisation. This is why links with universities are so important, as companies can’t normally do the sort of R&D that universities undertake.”

The company continued, “The science base is only a strength if the universities are better integrated. Everything is too fragmented at present. The UK science base is in disciplinary silos, and needs to look at the gaps and become more interdisciplinary. Government needs to align the science base with where it believes the information flows will be. This means planning ahead around the boundaries as they currently exist. An example is in quantum computing – all of the UK university activity is sub-optimal – in the US there is only one university carrying out research in this area. There are big opportunities for the UK in areas such as information engineering and organic electronics — not things like grid computing, which is really just catch up.”

‘The purpose of R&D is to disrupt business models and cause discontinuities. Discontinuities never come from the industries they disrupt’

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4 However, early in 2004 the EPSRC established an inter-disciplinary research collaboration in quantum information processing lead by Oxford University and involving other universities.
The role of universities as a source of trained graduates was acknowledged, though not all interviewees believed that the quality of their output was being maintained in a way that fully met the needs of industry (See chapter 7 on Skills).

**University spin-outs**

University spin-outs are playing an important part in the regeneration of the UK electronics sector, with long-term research supporting development of new commercial opportunities.

Long-term funding for the Optoelectronics Research Centre (ORC) at the University of Southampton has led to a number of world firsts in the development and application of optical fibre technologies for telecommunications and other sectors. This long-term support has established the centre as one of the leading research establishments worldwide, and a steady flow of high quality graduates and post-graduates for both the science base and industry. In recent years, Southampton University has spun out a number of companies, including Southampton Photonics Incorporated (SPI) and Mesophotonics.

SPI was formed as a start-up in June 2000 with an initial investment of £37m, and two years later established a state-of-the-art speciality fibre manufacturing facility in Southampton to supply products to the industrial, aerospace and analytical markets.

Mesophotonics builds on previous work by the ORC and Southampton University’s microelectronics group, with assistance from the British Technology Group (BTG) to develop and commercialise novel photonic crystal technologies. In September 2003 the company announced a new method of generating white light continuum, and in January 2004 secured £5.5m of second round funding from investors. Both companies retain strong links with research groups in the university.

**Exploitation of academic research**

There was general acknowledgement that the UK in general and UK universities in particular are good at innovation. However, several interviewees questioned the ability of universities to create spin-out companies, suggesting that an alternative and preferable strategy would be to give more consideration to exploiting their IP through licensing.
While the UK science and engineering base appears to be fairly strong, exploitation by UK firms is often inadequate. This is a long recognised but outstanding problem, as mechanisms to encourage knowledge transfer and industry-academic collaboration have been in operation for over two decades, e.g. the LINK scheme in particular. However, coverage has been patchy and funding was often insufficient to have a big impact. In addition to the LINK scheme, a number of Faraday Centres have been established over the past six years to encourage knowledge transfer. But there has been little strategic direction, and no centres directly address the needs of the electronics industry.

A major electronics supplier suggested, “The Faraday Partnerships were good, but we should be saying, ‘They work, so let’s ramp them up and do more.’ Generally the UK picks its technology winners too early. We should be putting more money into technology incubators that may not fit the current funding programmes. We should develop some mechanism for an ideas incubator.”

Some companies considered that networking was poor between UK industry and universities compared with other countries, particularly the US and China. They suggested that the lack of close relationships between

A shining example of academic and industry relationship

University spin-outs seem to stand the best chance of success where there is a continuing relationship with the university. Take the example of Cambridge Display Technology (CDT). The phenomenon of light emitting polymers was discovered at the Cavendish Laboratory, Cambridge, in 1989. The university filed a patent and seed-funding of about £100,000 was provided by Cambridge Research and Engineering Ltd (CREL).

CDT was created with equity shared between the inventors, the university and CREL. The technology was so exciting it attracted some unlikely business angels, like Phil Collins of Genesis to invest about £400,000, while the university provided matching funds. Funding rounds and investment by two New York Funds brought in tens of millions of pounds, enabling the company to invest in pilot production and engage in joint development ventures with world-leading companies like Philips and Seiko-Epson. The funding enabled CDT to concentrate on its core polymer device technology, whilst gaining access to materials and printing know-how. CDT now employs 120 people and leads the world in the development of polymer OLED displays, which have the potential to displace current generations of flat panel displays based on liquid crystals.
‘town and gown’ was due to cultural differences between SMEs and universities. And also considered that companies often lacked awareness of academic activities in their fields, and had difficulty determining who does what.

A semiconductor company remarked, “The universities’ desire to make money is a constraint on innovative partnering. They looked at us just as a manufacturing facility rather than an opportunity for collaboration on wider business issues.”

A leading electronics manufacturer also criticised the lack of collaboration between UK universities themselves. “When we wanted to collaborate with UK universities on containing online viruses in car systems, we found four, each with part of the answer. But they wouldn’t work together, so we had to put considerable effort into making them collaborate. Overseas they would have used the grant structure to force the universities to form a critical mass.”

‘The universities’ desire to make money is a constraint on innovative partnering. They looked at us just as a manufacturing facility rather than an opportunity for collaboration’

Regional networks

Some interviewees felt that better use could be made of regional networks, provided their activities could be coordinated for national benefit. The prospect for creating and linking a number of RDA forums into a national network was proposed as a way of bringing better coherence to the UK’s activities and improving global perceptions of the UK’s capabilities.

A number of electronics-related network activities are currently underway, including the NMI, the EPSRC-funded Electronics IMRC at Loughborough, the new ‘Silicon research and exploitation for the nanotechnology era’ academic network, DTI-funded PRIME, EPPIC and INTERSECT Faraday Partnerships. Though each organisation is doing something useful for respective members in specific areas, the EIGT interviewees suggested there would be significant benefit ‘joining them up more effectively’.

New collaborative R&D partnership in North Wales

A new form of collaborative R&D partnership was set up in June 2004 in North Wales. Optic Technium is based at St Asaph Business Park, Denbighshire, and was established with £14m of funding provided by the Welsh Development Agency (WDA), EU funding and stakeholder funding via interested companies, and is a Technology Business Support and Incubation Centre for Opto-electronics. The centre works closely with a number of leading companies such as Phoenix Optical, Pilkington, Thales and Tyco and universities such as Cranfield and University College London.
Many interviewees felt that key areas of UK academic research excellence should be used to attract foreign investors. Government must also do more to bring this national asset to the attention of overseas investors, and those seeking opportunities for joint ventures or other forms of collaboration.

There was lack of consensus regarding how universities and industry should be encouraged to interface for research provision or collaboration. In particular, universities were criticised for their inability to respond to industrial timescales and pressures. “Knowledge of academic activity can be a problem for all companies. And academics do not have a good sense of our time pressures,” commented an EMS.

Many companies expressed concern about the difficulties of identifying where the best research groups were located and, more fundamentally, what research was being undertaken in universities. Some said that even when an appropriate research group was identified, it often proved difficult to establish working relationships because universities sometimes had conflicts of interest through their own spin-outs, or unrealistic expectations about the ownership of jointly generated intellectual property.

Though creation of successful relationships between universities and industry could be difficult, there were some notable successes, such as Plastic Logic, which has a pipeline agreement with Cambridge University, and an exclusive licence to any IP generated by them in the area of plastic electronics.

Knowledge of academic activity can be a problem for all companies. And academics do not have a good sense of our time pressures’

Vision 2015

A smaller number of well-resourced universities carry out world leading electronics research, in order to focus funding and bring related research together.

A user-friendly directory of university research and network of technology advisors helps companies, particularly SMEs, access relevant research groups.

Centres (with real or virtual clusters) are established to encourage exploitation and knowledge transfer in new and existing opportunity areas, e.g. plastic electronics and nanoelectronics.

Electronics is seen as a priority area within the DTI Technology Strategy, and part of an integrated National Technology Strategy involving all Government departments.
**Recommendations**

5.5: The Technology Working Group of the Electronics Leadership Council should work with the RDAs to identify and develop core competencies, creating incubators and clusters (including virtual clusters) in support of them.

5.6: The DTI Technology Strategy Board should consider disruptive electronics as a priority technology area, and encourage collaborative R&D and the formation of a Knowledge Transfer Network in Electronics Design. The network should also give access to people who are not directly involved in electronics design.

5.6.1: DTI should commit a much higher proportion of UK science and innovation budget to knowledge transfer and collaborative R&D.

5.6.2: EPSRC should continue to encourage the acceleration of critical mass in research by judicious deployment of its funding. It should also encourage more collaborative projects between universities and across disciplines.

5.6.3: DTI and EPSRC should work together to produce a database of business and academic research capabilities in a national framework, improving signposting for collaboration between industry and universities.

5.6.4: OST and Research Councils should encourage wider industry participation, particularly SMEs, in academic research.

**INTELLECTUAL PROPERTY**

EIGT interviewees commonly expressed concern about the cost and complexity of securing IP protection. The high cost is anti-competitive and not SME-friendly. A number of companies thought there should be an initiative to drive down the costs, particularly of EU patents. A major venture capitalist remarked, “IP rights need to be better understood and appreciated with respect to their intrinsic value.”

There was significant criticism about the way universities handle IP-related issues. This was seen as a significant barrier to exploiting university research. Universities were often felt to be too protective, inconsistent and unrealistic about the value of their IP.

‘IP rights need to be better understood and appreciated with respect to their intrinsic value’

A venture capitalist highlighted the problems of ‘politics’ in university spin-outs. “Many start-ups are spun-out of universities, but we can’t bear the politics of academia. Too many people are involved in wrangles over ownership of equity and IP. Universities often refuse to assign IP, and are only prepared to licence IP – so they can get it back if the company fails. The university commercialisation officer is often too greedy and VCs don’t have the time to get roped into their machinations.”
The main issue for the UK electronics industry is retention of IP, given the regulatory and market trends. The venture capitalist emphasised, “The higher cost of capital in the UK (compared to the US), given the pressures on the IPO market, combined with the smaller market size, means retention of IP, and by extension jobs, will continue to be a function of attracting investment around these areas of competence. The challenge will be focusing limited resources around chosen areas of intellectual distinction. This means encouraging the support of Government, multinational corporates, SMEs and universities to work together around selected areas where the UK can demonstrate global leadership.”

The challenge will be focusing limited resources around chosen areas of intellectual distinction

Faced with potentially disruptive technologies, SMEs also maintained that the IP protection period should be extended, as the time from invention to mass production is usually longer. An SME emphasised, “20 years is too short, given that the time it takes from invention to exploitation is often longer”.

Vision 2015

IP protection costs are reduced significantly.
Universities have consistent IP policies that help to generate new business initiatives.

Recommendations

5.7: DTI should commission a study, working with the Patent Office and the European Commission, on measures to reduce the cost of EU patents.

5.7.1: The electronics industry should work closer with universities to develop best practice in exploitation of their IP.

5.7.2: Universities should be benchmarked on the success of their IP exploitation.

INDUSTRY STRUCTURE

A key concern of EIGT consultations is the lack of growth in the electronics sector. Despite the large numbers of innovative electronics SMEs in the UK, very few grow to become medium-sized companies. There are a number of reasons, including the dearth of risk capital, the risk-averse culture in the UK, and foreign acquisitions. Most SMEs seem happy to address a niche and stay small.

The EIGT suggests that the model for the UK should be the same as the US, where the engine of company growth is investment in R&D.

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4 A joint industry-university group under chairmanship of Richard Lambert, supported by the Patent Office, is currently developing model contracts and protocols for IP exploitation.
The UK was disadvantaged because it does not have any major corporations any more, i.e. those that would typically spend 15-20% of revenue on R&D.

The terms ‘Made in the UK’ and/or ‘Designed in the UK’ still seem to mean something to overseas buyers, implying that UK electronics designers and manufacturers still have a strong reputation for quality. This perception was considered to be a valuable differentiator and worth developing.

There are very few large indigenous OEMs in the UK. This is a significant problem because companies tend to establish higher value activities, like R&D, in their home country. A major institutional investor remarked, “The UK was disadvantaged because it does not have any major corporations any more, i.e. those that would typically spend 15-20% of revenue on R&D. Though the UK has a good academic base, most spin-outs tend to lose focus on R&D, because they need to concentrate on getting a product to market, and have resource restraints.”

Generally, large corporations generate spin-outs so the lack of this type of company is a major disadvantage for the UK. The institutional investor said, “Most companies that grow successfully from start-ups in the UK tend to get bought, particularly by US companies. VCs generally prefer the IPO route because the valuations tend to be higher. However, there are quicker returns and more certainty from selling up. Most companies tend to get bought before they are ready for an IPO. If a company is acquired by a foreign company, then this makes them vulnerable to relocation offshore.”

A leading electronic component distributor commented, “The UK still retains some OEM’s and CEM’s and is no different to the remainder of the EU in this respect. The large SME infrastructure is a UK strength. The real skill is not manufacturing but in the idea. The UK should concentrate on its design skills and much improved service-based society.”

The UK is seriously disadvantaged as some activities, like silicon semiconductor production, can only be addressed by large companies. A number of interviewees felt that recent loss of certain OEM companies, coupled with the change in status of some of the UK’s major electronics R&D activities (e.g. BT Labs at Martlesham Heath and ex-MoD research facilities), meant that innovation was no longer cascading through the sector and supply chain as well as in some other countries.

The UK could be a global design house, while manufacturing moves elsewhere. But we have to be careful not to lose our design position.”
Despite this, the UK is still considered to be strong in areas like electronics design and electronics systems integration. A component maker suggested, “The UK could be a global design house, while manufacturing moves elsewhere. But we have to be careful not to lose our design position.” However, the small scale and fragmented nature of the industry created a fragile structural impression. And we can’t be complacent, as more than one technology developer pointed out, “Design jobs could easily follow manufacturing jobs to take advantage of local knowledge of the supply chain, and access to preferentially priced, locally sourced components.”

Several respondents suggested the need for an effective voice for the electronics industry in the UK (see Chapter 3), which would help to foster an environment where companies can grow.

A number of interviewees stressed the value of foreign organisations, such as the Fraunhoffers in Germany and ITRI in Taiwan, as useful bridges between universities and industry, supported with significant Government funding. “These organisations assist with the process of commercialising ideas emerging from academic institutions. They can play a useful role in shaping national industrial polices and can facilitate progress of good ideas into the marketplace. The UK Government appears to lack the will to establish such an organisation in the UK, and I’m not wholly supportive of the current DTI plans to establish a virtual network of micro/nano-facilities,” said a leading UK technology provider.

**Vision**

A significant number of SMEs grow to become medium to large-sized global companies, achieving greater value-added and wealth creation in the UK.

Electronics OEMs are encouraged to place their European and/or global HQs and R&D centres in the UK.

The commercialisation of R&D is improved with better IP retention.

**Recommendations**

5.8: The DTI and UKTI must step up efforts to encourage global electronics companies to establish R&D centres in the UK, through missions, better marketing of UK excellence and targeted financial assistance.

5.8.1: DTI and ELC should look for measures of fiscal encouragement and de-regulation to encourage SMEs to grow to mid-range companies and stay in the UK.

5.9: DTI and ELC must explore ways to protect our UK design base, via integration with related activities into core-competency clusters, and also increase electronic design support for non-electronic companies.
CHAPTER 6

Operating effectively in a global supply chain

The electronics supply chain is highly dynamic, complex and disaggregated, following significant changes in recent years, including offshoring to lower cost economies, and increased product complexity. These changes bring new challenges for UK-based electronics companies in terms of managing the extended supply chain, strategic decision-making, and e-business. There are also challenges associated with new environmental regulations, especially in design and end-of-life management. New skills are required, particularly for SMEs, if the vision of establishing a global presence and global best practice in supply chain management is to be fulfilled. These issues are important given that the supply chain can represent up to 95% of a product’s manufacturing costs.

NEW SUPPLY CHAIN CHALLENGES

The electronics industry is a global industry characterised by intense competition, rapidly declining prices, fast technology development, unpredictable customer demand and constrained material supplies. The pursuit of higher prices and improved margins leads to a continuous stream of new products, each able to command a premium price for a short period before becoming commoditised. This challenging cycle requires firms to be continually innovative, more flexible and efficient in order to compete effectively globally.

Many original equipment manufacturers (OEMs) have outsourced elements of their manufacturing to Electronics Manufacturing Services (EMS) providers in order to gain economies of scale, and share R&D costs across product lines. These EMS providers themselves have moved manufacturing activity to low cost geographies. A similar trend has occurred in semiconductor manufacture. Distributors currently source most of their component purchases from outside the UK and Europe. This increase in globalisation and off-shoring over the past few years has led to disaggregation of the electronics supply chain, and put significant pressure on the UK industry and the SME community in particular. The UK electronics sector has a high proportion of SMEs, which exacerbates the problem.

Major parts of the supply chain no longer reside in the UK and, unless a disruptive technology emerges which makes it commercially viable to bring these elements of production back, they will continue to remain outside the UK. As well as implications for pricing policy and practice, this trend is leading to a migration of key design capability. Therefore, it is imperative that UK companies optimise those elements of the supply chain that they currently control, in order to protect their
existing competitive position and enable them to exploit future global opportunities (See Annex 1 for further analysis of the electronics supply chain).

The EIGT identified a number of areas of world-class best practice in supply chain management where UK companies should focus in order to improve their competitive position on a global basis. These are:

- Strategic supply chain decision-making;
- Supply chain management skills;
- e-business uptake.

In addition, there are supply chain challenges from new environmental regulations associated with design and end-of-life management that could present significant opportunities for UK industry.

The EIGT considered potential mechanisms to exploit the strengths and address the weaknesses of the UK electronics in the above areas.

**STRATEGIC SUPPLY CHAIN DECISION-MAKING**

**Access to Information**

The highly dynamic, complex and disaggregated nature of the electronics supply chain demands up-to-date cost and associated information to aid strategic ‘make or buy’ decisions. Getting access to this information can be a major challenge. The rapidly changing, cyclical nature of the industry also complicates the decision-making process – as new products quickly reach a level of maturity and volume production, followed by obsolescence problems. Unless electronics companies are able to make informed strategic decisions, they run the risk of making decisions that could ultimately damage their competitiveness and capability.

Many multinational OEMs and large EMS companies, but only a few SMEs, use sophisticated landed cost models to consider the total supply chain (e.g. the geography of sources, landed cost, pipeline flexibility and inventory implications) to support their decision-making. The EIGT found that many companies are paying increased attention to purchasing and supply chain management, because of the increased percentage of their production being outsourced.

Electronics SMEs are often disadvantaged in the strategic decision-making process as they lack the tools and resources to address the supply chain as a whole. They operate with significant information gaps. SMEs are usually driven by customer specifications, designer preferences, and the knowledge of their procurement groups (which are often home-grown and trained). Their decisions tend to be part cost-driven rather than landed cost-driven, and often respond reactively to issues, such as flexibility, inventory, geography implications, transport, service and repair.

During the EIGT consultation process an electronics retailer remarked, “As labour content is only 3-4%, it is the component supply and the supply chain, e.g. hourly deliveries, that dictates where volume manufacturing is located.” An SME admitted “We made the wrong decision on make/buy for a particular product, and had to
bring production back to the UK.” According to a large distributor, “SMEs always buy on unit price, but larger companies buy on life-cycle costs.”

Using supply change management as a key skill

Erskine Systems, a 130-strong company in the TT Electronics Group, manufactures uninterruptible power supplies, and has reaped the benefit of adopting supply chain management as a key skill for the company. The firm established a process for measuring the relevant costs, including internal management effort, and justified bringing back in-house some manufacturing operations which were previously outsourced, including PCB assembly. As a result, the company gained better control of its supply chain, improved security and its ability to meet tight delivery schedules. The judicious use of IT systems has also delivered significant cost savings.

There was general agreement that it would be helpful to have a ‘toolkit’ containing information for companies, particularly SMEs, to make strategic outsourcing decisions. This would only be of value if the information provided was accurate and up-to-date, reflecting the dynamic nature of the business and external factors.

Companies suggested that the following information would be useful: continuity of supply and flexibility, lead-times, quality issues (to avoid over specification), overall costs involved, import costs and tariffs, IPR protection, reliability of electricity provision, fuel prices, practical issues regarding off-shoring across time-zones, details on how to undertake quality audits and vendor evaluations, hedging processes, how to handle logistics challenges, and cultural issues, e.g. public holidays.

Vision 2015

UK electronics companies have a full understanding of all the cost elements of their supply chains and access to up-to-date information to make both strategic and tactical decisions.

Recommendations

6.1: A ‘toolkit’ should be created which could provide a single access-point to source all necessary information on which to base strategic supply chain management decisions.

Outsourcing tools, for example, already exist, but there is a need for a low-cost and wide-ranging toolkit that could be focused on SMEs. SBS/Business Links should consider extending their current business diagnostic tool to address make/buy decisions. Promotion and awareness of the toolkit should be reinforced by the UK Electronics Alliance and Business Links (see chapter 3).
SUPPLY CHAIN MANAGEMENT SKILLS

Emerging supply chain challenges require new ways of networking. The UK electronics industry lacks effective supply chain management skills, particularly within the SME community. This hinders the efficient operation of their supply chains and ultimately affects competitiveness of the whole industry and its customers.

‘Our biggest current challenge is how to upgrade the supply chain management’

The consultation highlighted a widespread belief that some UK electronics businesses can achieve is broadly comparable pricing with the US and Western Europe for components, but less so with Eastern Europe and Asia. However, many UK companies fail to achieve optimum pricing, reflecting a weakness in purchasing and supply chain management skills.

Multinational OEMs and large EMS companies are well aware of the importance of supply chain management and have supply chain organisations at global, regional and customer levels. These groups contain skilled specialists in all aspects of the supply chain from design, raw material, through building blocks, to distribution of finished products and reverse logistics. However, these larger organisations found it difficult to recruit staff who were specifically skilled in supply chain management.

The EIGT found that many of the smaller companies recognised the increasing importance of supply chain management, but claimed they did not have the resource to be able to manage and optimise their supply chains. Many SMEs lacked qualified and experienced supply chain managers. Even those that recognised the importance of the supply chain saw it as a purchasing function only.

An SME remarked, “Our biggest current challenge is how to upgrade the supply chain management.” Another small firm recognised the importance of supply chain skills and said, “We are giving increasing attention to cost of supply and procurement, and design for manufacturing in particular. The buyers and engineers within the company now actively interact.”

‘We are giving increasing attention to cost of supply and procurement, and design for manufacturing in particular. The buyers and engineers within the company now actively interact.’
A fabless semiconductor company said, “We need to have closer links to the wafer fabrication assembly and test providers, given the complexity of the devices now being designed. This is a real challenge given that most of the supply chain players are not located in the UK. We are disadvantaged against local fabless companies in Taiwan and China, as they seem to use their relationship with local fabs to their advantage to access technology, obtain a lead in time-to-market, and also get better pricing.”

Some took a more sanguine approach to the issue. A PCB manufacturer commented, “We recognise supply chain management as a skill, informally rather than as a separate qualification. It is important but not critical.” However, one small electronics supplier told the EIGT, “These are not concerns for SMEs because of the resource restrictions. We don’t regard supply chain management as a discipline in its own right.”

The larger companies stressed the importance of maintaining global links and supply chain management skills. An EMS remarked that it had a supply chain director and “all our procurement staff are Institute of Procurement trained.”

Interviewees expressed concern that the education and skills suppliers do not cater for supply chain specialists, and where they do the course material needs to be improved. There are notable exceptions, particularly the Scottish Enterprise initiative for locally based electronics companies.

Supply chain management courses in action

Scottish Enterprise has recognised the importance of supply chain management to Scottish electronics companies, and has created a number of courses in a ‘continual professional development map’ to help electronics companies develop skills in this area. Scottish Enterprise is part-funding some of the courses.

The supply chain skills map includes: a short on-line training course entitled the ‘supply chain passport’, aimed at embedding a core knowledge of supply chain management principles for electronics companies; a modern apprenticeship in supply chain management which will include formal education in the form of an HNC (which can be followed by an HND); and a Masters degree in supply chain management in a joint project with Strathclyde, Heriot-Watt and Glasgow Universities.
According to the Eigt interviews, few SMEs actually benchmarked their supply chains, and fewer still undertook process benchmarking with those outside the sector. Generally, only large companies engaged in benchmarking. One large electronics distributor mentioned that it benchmarked supply chain operations with companies operating in the retail and automotive sectors.

The DTI’s Benchmarking Index (involving a sample of electronics SMEs and analysed in 2003) demonstrated that the electronics sector is one of the worst performing sectors in the index in terms of supply chain management. Significant performance gaps were identified in terms of sub-standard supplies, turnover per supplier, and low stock turns.

Vision 2015

The UK electronics sector operates the most efficient supply chain management system in the world, bringing about a step change in productivity for both the UK electronics industry and its customers. UK universities are globally acknowledged experts in supply chain management research, and training providers teach best practice. Companies continually refresh their skills in this area.

Recommendations

6.2: The RDAs and other devolved administrations, working with SEMTA, should ensure that appropriate training provision of global supply chain management skills is provided in their regions, and that universities and business schools also capture best practice in supply chain skills in their courses.

6.2.1: The industry should urgently strengthen its supply chain management and should benchmark its supply chain management both internally within the sector and against other sectors to identify and address weaknesses.

6.2.2: Trade Associations and RDAs (via the Electronics Leadership Council) should run regional initiatives, such as seminars, on the issue of supply chain management to raise awareness of the importance of the activity, and to learn from other sectors about best-in-class practice.

Lack of e-Business Uptake

It is widely accepted that a pragmatic deployment of e-business in an organisation can deliver significant improvements in productivity and margin by enabling cost reduction, optimising the supply chain, improving responsiveness to customer requirements and maintaining closer links with suppliers.

The NERA report\(^1\) suggests that the major divergence in terms of productivity in the electronics sector between the USA and its European competitors (including the

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\(^1\) ‘Competitiveness in the UK electronics sector’, eSCA report, November 2003
UK) occurred in 1994. This was the time when US companies began to embrace e-business. This divergence has increased as Europe still lags behind the US in leveraging efficiencies via the deployment of e-business.

‘We see e-business as essential, and could not achieve margins in this kind of business without it’

A Booz Allen report\(^2\) shows that UK is more or less on a par with its main European competitors in terms of e-business uptake, and that the UK electronics sector performs better than many other sectors in the UK. Elements of the UK electronics sector recognise the importance of IT to its business and some organisations clearly derive benefit. Some organisations claim they could not deliver the profits they do without the use of a completely integrated supply chain.

A major distributor said, “We see e-business as essential, and could not achieve margins in this kind of business without it.” A global EMS concurred, “Running a global complex supply chain that delivers the level of service to the customer and margins to the organisation would not be possible without e-business.” And a large aerospace OEM maintained, “e-business is marginal as a differentiator but we see it as a ‘must have’ at this level of business.”

However, there still remains a section of the UK electronics SME community that is reluctant to adopt e-business in order to improve productivity and margin (see ‘The UK electronics industry e-commerce initiative’\(^3\), and studies undertaken by the European Commission\(^4\)). This opinion was reinforced in the EIGT consultation exercise where the majority of SMEs interviewed placed themselves no higher than in stage 2 – 3 of the Cisco e-business triangle (see Annex 2).

Whilst there was, in general, an intent to adopt a higher degree of e-business, many companies cited the following barriers to further e-business adoption:

- Previous unsuccessful and costly experiences like implementing EDI;
- Lack of belief in the business benefits that could be delivered;
- Costs associated with implementation and support of e-business.

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\(^2\) ‘The Competitiveness of Europe’s ICT Markets,’ Booz Allen 2000

\(^3\) ‘The UK electronics industry e-commerce initiative – a study of the adoption of e-commerce’, 2002

\(^4\) ‘e-business Watch. Sector report: No 03-I, May 2004’
An electronic SME told the EIGT, “e-business is a huge issue for us. We deal with a number of supermarkets and are linked to all of them, but we don’t currently undertake electronic invoicing.” Another small firm said, “We are unable to progress further with e-business as we produce specialist products and credit card companies refuse to insure the products, effectively denying us the ability to sell directly from the website.”

“I try to encourage my SME customers to adopt e-business as a mechanism for conducting business with us. However, this has been frustrating as they are reluctant to make the investment.”

Some SMEs faced considerable cost pressure from larger organisations who would only do business with those who could interface electronically with their systems, for online order management, advanced planning, payments and other administrative operations. Typically, SMEs do not have the skills or resources to make this type of investment.

A large distributor explained, “I try to encourage my SME customers to adopt e-business as a mechanism for conducting business with us. However, this has been frustrating as they are reluctant to make the investment. They lack the experience to drive through business benefit from it.” A major consumer electronics OEM suggested, “If e-business were pushed forward this would greatly assist the electronics industry. In the case of B2B there remains difficulty in encouraging SMEs to fully embrace e-commerce.”

**Vision 2015**

The industry adopts common open standards that encourage appropriate e-business adoption. This is similar to the automotive sector, where OEMs, via their trade body the Society of Motor Manufacturers & Traders (SMMT), have developed an e-based interface standard for use by their suppliers.

The electronics industry works closer with software suppliers to adopt low-cost, effective e-business options (e.g. outsourcing IT implementations and on-demand computing) that enable organisations, including SMEs, to retain their competitive edge.

Through the use of e-business, the UK industry achieves more tightly integrated global supply chains, minimising ‘information latency’ and optimising supply chain efficiency. This results in world-class performance in customer service, payments, stock control, timely
delivery to specification, and can eliminate obsolete stock when cyclical downturns occur.

The above level of integration delivers high quality management information so senior management of electronics firms can make strategic decisions to maintain or increase their competitive edge.

The electronics industry has a vital source of information for understanding what opportunities are delivered by a number of converging areas of new and emerging technologies, services and software. The type of topic covered in this mechanism includes leveraging broadband and wireless connectivity applications to enable a mobile workforce, and thus reduces costs.

**Recommendation**

6.3: The Electronics Alliance should promote the cost effective adoption of common open standards to facilitate greater uptake of e-business.

6.3.1: The Electronics Alliance should develop a communication programme to inform the SMEs of the low cost, low resource intensive options associated with e-business, such as outsourcing, hosting and on-demand computing.

These options will enable an organisation to deliver the efficiencies and cost reduction required to both compete and collaborate with larger organisations as appropriate.

6.3.2: The Electronics Alliance should forge relationships with related sectors to ensure that UK electronics companies are well placed to take advantage of sectoral convergence.

**ENVIRONMENTAL LEGISLATION IMPACT**

**End-of-Life Management**

Recent environmental legislation has a significant impact on the electronics supply chain. This highlights the need for business to influence the legislative process more effectively (see chapter 3 where this issue is addressed more fully) and the need for business to consider the implications at a strategic level.

The most significant regulatory developments currently affecting the sector are the Waste, Electrical and Electronic Equipment (WEEE) Directive and the Restriction of the use of Hazardous Substances (RoHS) directive. Following soon are the Registration, Evaluation, Authorisation and Restriction of Chemical Hazards (REACH) and Energy-using Products (EuP) directives.
Some of these directives will require investment for compliance but will also provide new opportunities. End-of-life management systems will need to be established. Markets for recycled materials will have to be found or new business models developed for leasing and upgrading products to eliminate environmental burdens. Manufacturing processes will have to be reviewed and modified, as well as make-or-buy decisions. Companies will also have to consider their reputations in terms of Corporate Social Responsibility for supply chain decisions. There are opportunities which include:

- Supply of RoHS-compliant equipment and processes;
- Training in sustainability issues such as eco-design and conformance;
- Increased demand for repair and recycling; and
- Collaboration to provide an overall strength in environmental business awareness for electronics.

These changes require serious engagement across the electronics supply chain.

Public procurement decisions also impact on the supply chain. Increasingly Government purchasers are moving towards a more standard regime for both content and platform, to meet IT and communications needs. If Government is to gain full economic value from standardisation, it will need to address the current derogations for health and defence under WEEE and RoHS. The use of generic standards would not only improve value for money from public spending, but also help drive out the costs incurred by current suppliers in running separate lines and processes.
Industry impact

According to EIGT interviews, there is a lack of awareness, particularly amongst SMEs, about some existing and future regulations that will impact on the supply chain. Where there is awareness, WEEE and RoHS are seen primarily as cost generators, particularly for SMEs. In general, only the large organisations appear to be taking a strategic approach to the opportunities that may arise.

But knowledge is not the only problem. Lack of industry networking is inhibiting solutions. There are fragmented pockets of work within the UK supply chain which address the challenges and opportunities associated with WEEE and RoHS, but these do not cover the whole supply chain. For example, there are several consortia which address the challenges of recycling, and trade associations have undertaken awareness seminars. But PCB manufacturers are unable to forecast, and thus make production capacity investment decisions concerning lead-free finishes, as OEMs cannot define their needs. Designers need to be thinking of end-of-life requirements for repair and recycling.

Lead-free solder legislation proposal and impact

The lead-free solder proposal was introduced at short notice by the EU in 1998 as a revision to the WEEE Directive under Article 175 (environment), and is the subject of qualified majority voting, so the UK has no power of veto. The UK was the only member state represented by its industry ministry, and other member states were represented by environmental ministries. No rigorous fiche d’impact was undertaken. The proposals take effect from 1 July 2006.

Subsequently, the Removal of Hazardous Substances (RoHS) provisions, which deal with other hazardous substances, were made under Article 95 (single market). So interdependent legislation will be introduced under different agreement arrangements.

Unintended consequences include:

- Increased material and component costs because some PCB material and some components cannot be used with higher temperature solder;
- Re-certification costs for safety critical products;
- Damage to soldering equipment from electrochemical corrosion, following use of tin-rich solder in machines previously used with lead-based solder;
- Increased capital equipment cost as equipment life shortens;
- Increased costs associated with inspection, testing and tracking to demonstrate compliance;
- Training and retraining costs for staff working with new materials;
- Increased capital and inventory costs as manufacturers keep separate lines and stocks for defence and exempt products.
The ban on lead-based solder has had a significant impact on the industry, as shown in the Box on page 127. The need to change manufacturing processes in order to comply with the regulations has necessitated a major worldwide development programme, some of which is not yet complete. There is still a lack of clarity concerning the scope, implementation and application of RoHS and WEEE. This has resulted in much uncertainty within the industry, exacerbated by the current derogations for health and defence. However, industry cannot afford to wait before addressing those issues which have been decided upon.

Much equipment manufactured before the application of RoHS will suffer premature obsolescence, as component parts which have been modified to meet the RoHS requirement may not be compatible. Businesses supplying sectors such as defence, medical, instrumentation and control, currently have a derogation from the regulation in Europe. But this poses problems for the future availability of lead-free components. This issue has product lifetime implications for public sector purchases as well as business implications to those supplying export markets where RoHS standards do not yet apply.

During the EIGT consultation exercise an electronics distributor commented, “The industry has enough time to prepare, but as the actual legislation is still undecided, time for preparation is immaterial, as what is being prepared for is undefined.” Another distributor considered that the WEEE and RoHS directives will be significant cost contributors. “Dual inventory requirements are only one part of the problem that will become a logistical nightmare.”

Some SMEs consider regulation an opportunity, and remarked, “Regulation presents a major innovation opportunity for start-ups. The regulatory burden for start-ups tends not to be large.” Another firm said, “We want to meet the regulations and will use them as a marketing advantage with our customers.”

However an SME saw some opportunities in the short-term “but in the long-term it brings costs. So we intend to maintain two lines to manufacture for leaded and lead-free products.”

‘Regulation presents a major innovation opportunity for start-ups. The regulatory burden for start-ups tends not to be large.’

A recycler of electronics products thought not enough attention had been given to the recycling industry itself. “The WEEE Directive consultation has focused too much on the manufacturers (who lack competence in end-of-life management skills), and too little on the recyclers who have the necessary knowledge and expertise to assist. It has also focused too much on detailed practical issues rather than on process. The industry is thus not as prepared as it would have been. There needs to be a pragmatic view for business whilst retaining focus on delivering for the environment.”
Industry embraces the new regulations as opportunities rather than cost contributors and explores market advantages. They consider carefully the environmental impact of their entire supply chain for both current and new products. Companies take legislation into account when designing new products, and work more closely with suppliers and customers to eliminate environmental risks, not just for manufacture, but also with regard to end-of-life management.

Industry and Government plays a full role in the Electronics Regulatory Group (ERG) to ensure:

- Effective influence on the legislative process for forthcoming environmental regulation both in the UK and in Europe.
- Effective influence on the EU Technical Adaptation Committee (TAC) and other legislative processes associated with implementing WEEE, RoHS and subsequent legislation.
- A consistent and effective approach to implementation and policing across Europe.
- The UK electronics supply chain works together, rather than just in pockets, to address the challenges and opportunities associated with regulation.
- Public procurement decisions impact positively on the supply chain, with the derogations in legislation (re: WEEE and RoHS) addressed pragmatically, minimising the costs incurred by suppliers in running separate lines.
- UK businesses have ready access to training and technical support on lead-free soldering, and to lead-free soldering capacity.

See chapter 3 re: ERG
Recommendations

6.4: Government and industry should participate fully in the Electronic Regulatory Group (ERG) in order to influence the detail of regulation more effectively, and to stimulate industry networking for developing and sharing best practice on implementation.

6.4.1: Industry should re-assess how it will adapt its management of reverse logistics in line with compliance of new regulations.

6.4.2: Government should ensure uniform interpretation and application of regulations across Europe, and ensure that imported goods are compliant.

6.4.3: The Electronic Leadership Council’s supply chain group should work with Government and the RDAs to ensure that Business Support best practice products address supply chain issues and technology development associated with regulatory best practice, and the setting up of infrastructure for recycling.

6.4.4: Design for the environment and eco-design principles should be built into education and training programmes in both academic and business organisations. This could be achieved in similar fashion to the delivery mechanisms identified in the supply chain management skills recommendation.
Growing skills to meet the challenge

UK electronics companies need to be more strategic in addressing skills if they are to raise productivity and compete effectively. This means a step change in management and leadership skills, technical and engineering skills, general business skills, procurement and supply chain management skills, all of which are essential for the future survival and success of the industry. Government also needs to target the available resources better to stimulate the take-up of people development activity.

The employee image of the sector has deteriorated substantially since the late-1990s. UK electronics companies have reduced work placements and connections with education establishments. The lack of diversity and the increasingly aged workforce pose significant future challenges to the sector.

There is a cyclical disconnect between the skills and labour needs of the UK electronics industry, the business cycle, and the provision from the education sector, which need to be addressed. We also need much better alignment and industry responsiveness for the UK’s electronics workforce to thrive. Business also needs to take a more strategic approach to its skills needs and engage better with key skills stakeholders both nationally and regionally.

**SKILLS CHALLENGES**

The electronics manufacturing workforce is forecast\(^1\) to reduce slightly overall but with demand for professional and associate professional staff rising (see Table 7.1). The data has been supplied by SEMTA, and the figures are based on collating existing forecasts from the Institute of Employment Research and the Manufacturing 2020 Report, the results of which were discussed with industry.

(Note: The figures in Table 7.1 exclude the electronics distribution workforce).

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\(^1\) Forecasts for 2014 assume stable of falling numbers of employees for most occupations except Professionals and Associate Professionals.
Table 7.1: Electronics occupation distribution (2002 and SEMTA forecast)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>2002</th>
<th>%</th>
<th>Employees</th>
<th>%</th>
<th>2014*</th>
<th>%</th>
<th>% Net change from 2002-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>45,600</td>
<td>18</td>
<td>42,900</td>
<td>18</td>
<td>-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professionals</td>
<td>35,100</td>
<td>14</td>
<td>35,500</td>
<td>15</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate Professionals</td>
<td>36,700</td>
<td>15</td>
<td>38,900</td>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admin/Clerical</td>
<td>26,500</td>
<td>11</td>
<td>23,800</td>
<td>10</td>
<td>-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled trades</td>
<td>46,500</td>
<td>19</td>
<td>43,700</td>
<td>18</td>
<td>-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal service staff</td>
<td>2,900</td>
<td>1</td>
<td>2,900</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales/Customer Service</td>
<td>4,000</td>
<td>2</td>
<td>3,800</td>
<td>2</td>
<td>-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine Operatives</td>
<td>32,500</td>
<td>13</td>
<td>29,300</td>
<td>12</td>
<td>-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary staff</td>
<td>19,800</td>
<td>8</td>
<td>19,200</td>
<td>8</td>
<td>-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All occupations</strong></td>
<td><strong>249,600</strong></td>
<td><strong>100</strong></td>
<td><strong>240,000</strong></td>
<td><strong>100</strong></td>
<td><strong>-4</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: *SEMTA

Within these figures some skills will have different renewal rates. For example, the productive life of an electronics designer is about 10 years. But other skills challenges are growing. Technical, regulatory, structural and extended supply chain changes have brought new challenges to the skills requirements of the electronics industry. New products are introduced every six months or so, requiring flexibility in manufacturing and marketing skills.

Regulations are challenging the use of traditional materials and require new supply chain management, process and testing skills. Customers demand the availability of e-business from their suppliers. Whilst environmental pressures to reduce energy use, encourage re-cycling and re-use, bring new demands on design skills and end-of-life management. This creates new market demands, as well as new networking and business culture skills. Unless the electronics sector has the skills to embrace these challenges it will not be able to compete successfully.

**MANAGEMENT AND LEADERSHIP SKILLS**

With only a few exceptions, the EIGT interviews confirmed a pattern of management and leadership behaviour that was generally short-term, risk averse and tactical rather than strategic. A large electronics manufacturer called for a healthy balance between vision and drive in senior managers and leaders. “**UK companies are driven by the profit and loss account and boards are broadly stuffed with accountants. This makes them short-termist and risk averse, so companies eventually run out of steam. In the US, a success rate of one in three is good, whereas UK companies will only attempt something if they think they can get it 100% right.**”
An SME claimed, “The rest of the EU is no better at management than the UK. Lack of leadership is the main issue, and the UK is at best average. A key problem is the shortage of entrepreneurs not PhDs, and the right climate to operate in. We need a climate that enables new business to race away rather than one that protects the old.” Another SME was of the opinion: “UK electronics managers are tactical and are driven to this by the climate. For example, the banks force entrepreneurs to mortgage their houses. US guys are more driven upfront. We’ve also got poor industry leaders. They knew how to manage PCB businesses when there was a rising market but lack the management skills to make money now.”

Currently much of UK industry lacks the world-class management and leadership skills to cope with all the new challenges. The EIGT’s findings suggest that management and leadership challenges have increased significantly in recent years, as the business environment grows more competitive, and markets and supply chains become more global and complex. Evidence from other sections of this report (e.g. the lack of strategic approach to networking, regulation and investment) suggests that leadership is weak. The EIGT was unable to identify even a handful of individuals who were seen as visionary champions by their contemporaries.

The rest of the EU is no better at management than the UK. Lack of leadership is the main issue, and the UK is at best average. A key problem is the shortage of entrepreneurs not PhDs, and the right climate to operate in."

The electronics sector is not atypical in this respect. A recent Engineering Employers Federation (EEF) report\(^2\) suggests that UK managers are more tactical than strategic when making investment decisions. The Skills Strategy white paper\(^3\) also highlighted the need to enhance management and leadership skills for improved business performance. It is generally recognised that organisations achieve world-class performance when innovation, communication and rewards are aligned to business strategy.

According to a recent study commissioned for the Dutch Ministry of Economic Affairs\(^4\): “Top managers of UK-owned firms have rarely trained as scientists, in contrast with US and French executives, which often have both PhD and MBA diplomas. There seems to be a gap between the research community and senior management in firms. Firms tend to have insufficient capability to absorb science, reflecting the low level of R&D carried out in most companies. Foreign subsidiaries also show a greater propensity than domestic firms to collaborate with universities. Senior management often shows little interest in R&D activities.”

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\(^2\) EEF Report ‘Catching up with the Continent – EU/UK manufacturing productivity’ http://www.eef.org.uk/
\(^3\) www.dfes.gov.uk/skillsstrategy/pdfs/whitepaper
\(^4\) Draft study, www.apps.ez.nl/bestel
'There seems to be a gap between the research community and senior management in firms'

Trade associations were (unsurprisingly) reluctant to criticise the management and leadership qualities of members. Indeed, some companies have taken management and leadership development seriously, and can match the best anywhere in the world. But most EIGT interviewees were openly self-critical of the sector’s leadership capability. The absence of any electronics company from the list of ‘UK Top Companies To Work For’ also suggests weakness extends to people management.

Venture capital companies emphasised a preference for recruiting CEOs from the US, because UK CEOs do not have the experience and capabilities necessary.

“Managers in the US are hungrier and more ambitious than those in Europe who are content to stop at their first million dollars,” remarked a venture capitalist. “UK managers often lack the impetus to want to grow from a small to medium or medium to large company. We are very cautious about hiring UK CEOs for our companies. For six out of eight of our last investments we brought in American CEOs. Things like the ‘fat cats’ campaigns have discouraged entrepreneurs, but the climate seems to be improving and some of the university entrepreneurship initiatives are beginning to help.”

‘Managers in the US are hungrier and more ambitious than those in Europe who are content to stop at their first million dollars’

The right balance

One of the key issues is to get the right balance between technical skills and business skills at board level. Too much of one to the exclusion of the other is a problem, so the education system needs to train PhDs for business and not just academic research. Companies like ARM are taking this challenge seriously but many are not.

A large company remarked, “We don’t value PhD or MBAs in the UK. In the US, PhDs are geared to business start-ups. In the UK they are geared to academia, so research stays in the universities. Look at what has come out of the US PhD venture capital start-up route – Sun Microsystems from Stamford, Cadence from MIT, and Synopsis from Carnegie Mellon.”

The EIGT found it difficult to obtain up-to-date international comparisons of the skills mix in the electronics industry, but NIESR productivity data\textsuperscript{5} for 1993 and 1995

\textsuperscript{5} NIESR productivity data, \url{http://www.niesr.ac.uk/research/nisec.htm}
shows that the UK electronics skills mix appears to be a hybrid between that of the US and Germany. In the UK and US, electronics workforces have around 50% low skilled employees. The US tends to have a significantly higher proportion, with about 25 – 40% higher skilled workers than the UK. Germany, on the other hand, has a high proportion of intermediate skills workers 55 – 70%, with far fewer low or high skilled workers. The EIGT views these figures with some caution because of the age of the data. Other data, including DTI benchmarking data, suggests that the UK has a more hierarchical management structure than its competitors, featuring a high proportion of middle managers.

Recruitment into the sector comes largely from other electronics companies. Therefore, experience from other business areas tends to be limited. This contributes to a proliferation of traditional management practices and excludes much learning from outside the industry.

Vision 2015

The UK has electronics leaders with vision and the ability to communicate it, as well as technologists with strong business skills, academics who understand business, and an education system that delivers this vision.

The electronics sector gains new business insights and raises its innovation and productivity by embracing diversity, and adopting best practice from other sectors. The sector recognises and continually responds to the challenge of re-skilling and growth.

Recommendation

The Government’s skills strategy has already placed emphasis on management and leadership skills. The EIGT recognises that most of the responsibility for addressing this problem rests with business itself, and recommends:

7.1: Members of the Electronics Leadership Council should be exemplars in management and leadership and should create a mechanism for recognising outstanding leadership. Working through both its skills working group and the Electronic Alliance, it should promote a leadership challenge to senior managers in the sector.

7.1.1: RDAs and Business Links should help to promote management and leadership training opportunities to electronics companies in their regions.
Diversity

The sector also faces demographic challenges. The electronics workforce is ageing, and more than 45% are due to reach current retirement age in the next 10 -15 years (see Fig 7.2). The sector has failed to attract and retain new blood in sufficient quantities over the last 10 -15 years. Many companies expressed the following concern: “We have an ageing workforce in key areas such as technicians and skilled diagnostic engineers. We are finding it very hard to fill good shop technician positions. School leavers are not interested, trained or motivated in a manufacturing environment.”

‘We have an ageing workforce in key areas such as technicians and skilled diagnostic engineers’
The sector is over 70% male. Notably, the sector has failed to attract and retain women into the workforce, partly because of the gender mix in supply subjects from which it recruits, but also due to the low provision of flexible work arrangements that are likely to attract both men and women. In addition, many employees in the sector come from sectors where traditionally there have been regulatory barriers to employing women. The sector has tended to recruit in its own image.

These factors combine to threaten the sustainability of the electronics industry. The lack of diversity in the industry has wider implications for productivity and innovation. The 2002 census showed that by 2014 there will be more people over-65 in the UK than under-16. In just seven years, only a third of the workforce will be male and under-45. Women now make up nearly half the workforce, double the numbers of 25 years ago. Projections show that in less than 10 years’ time there will be two million more jobs in the economy – 80% of which will be filled by women.

The workforce is also changing in other significant ways. A recent Government report estimated that the working age population will increase by a million in the next 10 years, and that minority ethnic communities will account for more than half that increase. Generally it will become a seller’s labour market, and unless the electronics industry positions itself to attract from this diverse labour pool, it will not survive.

This poses challenges at all levels, including the boardroom. The more diverse the vision, the more companies are likely to be able to recognise potential new markets, attract a much wider customer base, and gain a competitive edge. Research shows that organisations with high quality human resource/personnel systems – in which equality plays its part – deliver better products and services and ultimately better
shareholder value. Such companies have a wider portfolio of skills at the top of the organisation. They also have a better feel for customers and are able to provide a more responsive service to meet their needs. They provide role models for younger people in the organisation, encouraging them to stay and become the leaders of tomorrow.

Most electronics businesses are not rising to the challenge. Research undertaken for the DTI showed that the electronics sector had been slower to embrace part-time and flexible working than other manufacturing sectors. The EIGT can see no valid reason why this should be the case. The recent DTI Best Practice\textsuperscript{7} publication describes several case studies where companies have improved performance through more flexible working. Other exceptions include National Semiconductors, for example, where the introduction of more flexible working has increased both the age and gender diversity of its workforce. The outcome has been a 15\% increase in productivity.

**Vision 2015**

Electronics companies have workforces that are more representative of the UK working population at all levels. Electronics companies are recognised as among the best employers in the country and so are able to retain talent. As a consequence, they get higher returns from training costs and reduce recruitment costs. This means the sector can attract a higher proportion of the best talent and gain a more diverse outlook, driving innovation, growth and improved customer satisfaction.

**Recommendation**

Changing culture is a significant task and the EIGT does not underestimate the challenge. The past has been littered with well-intentioned attempts to raise this issue, but it has been difficult to secure business engagement. There is currently an impasse. Women will not be attracted to the sector unless the culture and working arrangements are right, and the sector will not make an effort to change unless it recognises the need to recruit suitably qualified women. Advice and best practice case studies already exist. The EIGT recommends:

7.2: Businesses should review their recruitment and employment patterns and practices in order to attract and retain a more diverse workforce.

7.2.1: The Electronics Alliance should establish a high profile and challenging diversity award for companies in the sector to reflect effort and progress in achieving diversity.

\textsuperscript{7} www.dti.gov.uk/work-lifebalance/publications
Specific skills weaknesses

The EIGT study highlighted some specific skills challenges for the electronics industry. In the long-term, new technologies will present new skills challenges and attention needs to be given to helping employees become proficient. The advent of carbon electronics, for example, could bring about more distributed and local manufacturing, making maintenance of small-scale printing equipment a priority.

Currently, the most pressing current gaps are in:

- Top level commercial leadership;
- Procurement, supply chain management, logistics and e-business skills (as explained in chapter 6);
- Global marketing and sales; and
- High-level technician skills.

BUSINESS RESPONSE TO THE CHALLENGES

Training and development

The EIGT consultations revealed that training is often seen as a non-strategic activity. Many electronics companies claimed they did not have a skills problem because they were not recruiting at the moment! This seems to reflect confusion between labour supply and skills development. A typical response was: “We are too busy getting products out of the door to get involved with training.”

According to SEMTA’s Electronics Sector Strategy Group, training budgets (particularly for soft skills) were the first to be cut when business conditions toughened. Some senior managers claimed that training remained a priority, and did not support this view. There is clearly a difference in perception at senior level compared to experience at lower levels. The trade unions pointed out that senior staff generally receive a higher proportion of training budgets. Particular concerns were expressed about the failure to train employees as they reach new responsibility levels. It is often assumed that the best operator makes the best supervisor or the best first-line manager.

“We are too busy getting products out of the door to get involved with training’
Skills strategy

The Skills Strategy White Paper ‘21st Century Skills: Realising Our Potential’ aims to strengthen the UK’s position as one of the world’s leading economies by ensuring that employers have the skills to support the success of their business, and that employees have the necessary skills to be both employable and personally fulfilled. SEMTA, the Sector Skills Council, has been charged with developing a Sector Skills Agreement for the electronics industry. This agreement should reflect the demand-side requirements of the sector, and in turn influence the Regional Skills Partnerships and the Learning and Skills Councils in their provision of skills support to the sector.

Despite this important opportunity, engagement by senior level leaders from the electronics industry has been weak. In contrast with the advisory board for the IT sector, which was represented by the CEOs of all major IT companies, the electronics industry mostly fielded HR specialists. Electronics trade associations have also been absent from this work. The absence of senior level strategic input reinforces the reactive approach to skills in the sector, and the focus on recruiting to solve problems rather than developing the workforce.

Vision 2015

All UK electronics companies aspire to be learning companies and are listed among the best employers for continuous up-skilling of their workforce. Skills are a strategic priority at board level, and senior industrialists engage in helping to define the Sector Skills Agreement. Training budgets reflect this priority.

Recommendation

7.3: The Electronics Leadership Council should establish a skills working group, which should be led by SEMTA.

The skills working group should be an evolution of, and not a substitute for, SEMTA’s existing Skills Strategy Group. Enhanced senior executive membership will ensure that long-term strategic challenges are addressed effectively, and that the ongoing skills implications of all of the ELC’s workstreams are also addressed.

ACCESS TO GOVERNMENT FUNDING

Funding for training is available from various Government and agency sources. But take-up of such support is very sparse. Businesses consulted consistently reported confusion about what is available and who to contact. “There are many conflicting training programmes and too many different initiatives from Government”, was a common comment.
There are many conflicting training programmes and too many different initiatives from Government’

SEMTA’s Electronics Sector Strategy Group attempted to contact various agencies in the regions and were misdirected or given confusing advice. As a result, few electronics companies are taking up existing Government support for training and skills. Therefore, there is a pressing need to develop relationships between the industry and the regional skills network in order to tackle the most pressing skills challenges. The greatest challenge is to address the needs of the SMEs in this sector who are outside the trade association networks, and need technically competent advisers. The EIGT recommendations on access to Government support in chapter 3 are relevant to this issue.

Recruitment and image

The electronics sector has a weak reputation among young people as an employer. In addition to its lack of diversity, employment practices tended to be short-termist. Organisations tend to recruit to fill skills gaps, rather than developing the existing workforce, and short-term employment contracts are used to meet cyclical trends. This reputation has been particularly strong since the downturn in the late-1990s, and concern is shared by parents at careers exhibitions, who regularly question whether there is any future in electronics engineering. These views are fuelled by ‘bad news’ stories in the media, whereas ‘good news’ rarely makes the headlines.

The sector also shares some of the problems generally associated with manufacturing and engineering. “Engineering is more respected in France and Germany as a profession than it is in the UK”, was typical of comments from a wide range of companies and stakeholders. The problem is made more acute by headlines that often highlight high-tech companies’ collapse and closure.

Recommendation

The invisibility of the industry means the failure to attract much career interest is not really surprising. The EIGT recommends:

7.4: The Electronics Alliance, SEMTA and the professional institutions should work closer together to represent the exciting career opportunities in the sector for both women and men.

This cooperation should not just focus on the engineering opportunities. As a driver for change across all sectors, and operating in global markets, the range of jobs and opportunities offered by the electronics sector should be a unique selling point. The sector needs to gain a better understanding of the target market and re-evaluate the impact of existing recruitment methods.
ENGAGING WITH FURTHER EDUCATION

The EIGT consultation exercise showed that outside R&D collaboration, the sector is poorly engaged with further and higher education establishments. The NEISR report\(^9\) found that the most successful way of reducing skills gaps is to engage with local education establishments. Research\(^10\) undertaken for the DTI to track graduate destinations shows a clear link between the availability of work placements, degree results and the likelihood of graduates taking up employment in the sector after graduation. Despite this, colleges and universities report a continuing gap between work placement opportunities and demand for such places.

During the EIGT interviews we encountered many companies who saw such placements as a cost. Few appreciated the wider benefits that such experience gave in marketing the sector to the wider student population. Similar problems were encountered by the Shell Technology Enterprise Programme (STEP) programme which helps SMEs by screening potential students. Evaluation\(^11\) suggests that companies who do engage more than cover their costs from the business contribution made by students.

There is also concern about the long-term provision of skilled electronics and embedded software engineers both at graduate and technician level. Many companies expressed concern about basic skills levels of numeracy and literacy, as well as softer skills like communication and team working. The number of students taking the feeder subjects (maths, physics, and computer science) has declined significantly. In 2004\(^12\) there were only 28,000 A-level physics entries and just 8,000 computer science entries.

Between 1996 and 2003 there was a steep decline in the number of students taking A-level maths from 67,022 to 55,917, a 16.5% decline in just over eight years\(^\text{13}\). These figures include students taking both pure and applied maths. To add to the concern, over 60% of current maths teachers are due to retire in the next 10 years. The take-up for initial teacher training placements in maths and science is still low compared to other subjects. Although recruitment to courses increased between 1998 and 2002, it has since fallen back to the same level at 1995\(^\text{14}\).

These factors all contribute to the decline of UK students studying electronics and related subjects at university. As demand has fallen, courses have been cut in an uncoordinated way, and without any apparent regard for the wider economic impacts on business.

The EIGT’s consultation also exposed extensive concern about the methodology of science and maths teaching in school. Some observations were commonly voiced. There was a belief that current teaching no longer produces students with rigorous intellectual skills, especially the ability to think and apply logic. These are skills

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9 NIESR productivity data www.niesr.ac.uk/research/niscc.htm
10 www.engc.org.uk/publications/pdf/graduate_experiences_-_2002
11 Shell Technology Enterprise programme (STEP) www.step.org.uk
12 Joint Council for Qualifications www.jcgg.org.uk
13 www.jcgg.org.uk
which industry considers have been the past drivers for success of the UK science and technology base. Instead, too much emphasis is placed on learning techniques for passing exams or opting for less intellectually stretching subjects in order to boost league tables.

Creativity has also been stifled by providing too many computers and not enough computing teachers; and too much standard software that drives students into application mode rather than original thought. “Teachers need to understand that they are preparing people to work – not just to pass exams”, said an SME. “We don’t specialise our school children too quickly. Sixth formers are not coming out with maths and science at the appropriate standards. Secondary schools are not serving the electronics sector well”, echoed a large multinational.

There has also been a failure to capture the enthusiasm generated in primary school science teaching, and translate it into secondary schools. Many interviewees attributed loss of interest to the decline in practical teaching of science. Many schools and school governors are seen as risk averse to practical experiments (and are said to have been restrained by health & safety issues), with the result that the fun and excitement has been taken out of science.

Electronics teaching has also declined in the technology syllabus, largely due to the shortage of teachers with the necessary skills, and the non-competitive salaries offered for these teachers. It is not unusual for the technology A-level to have no electronics content.

‘Teachers need to understand that they are preparing people to work – not just to pass exams’

Electronics in Schools (EiS)\textsuperscript{15}, a programme originally supported by the DTI under the umbrella of the Sector Skills Council SEMTA, is already stimulating interest in schools, which the EIGT strongly endorses (Table 7.3). But supporting electronics itself is insufficient by itself unless maths and science teaching is also stimulated and enlivened.
### Table 7.3: Electronics in Schools 2002/3

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>New EiS teachers trained</td>
<td>248</td>
</tr>
<tr>
<td>Phase 1 teachers that received further training</td>
<td>42</td>
</tr>
<tr>
<td>Number of new schools involved</td>
<td>129</td>
</tr>
<tr>
<td>Phase 1 schools involved in Phase 2</td>
<td>97</td>
</tr>
<tr>
<td>Key stage 3&amp;4 pupils that received electronics training</td>
<td>39,586</td>
</tr>
<tr>
<td>Primary School pupils that received electronics training</td>
<td>2,770</td>
</tr>
<tr>
<td>EiS schools that now offer electronics qualifications</td>
<td>105</td>
</tr>
</tbody>
</table>

Source: EiS

The Science, Engineering, Technology and Mathematics Network (SETNET)\(^{16}\) promotes Science Technology Engineering and Mathematics (STEM) awareness, especially among young people. SETNET aims to help ensure there is a flow of well-motivated, high quality people going from schools into Science Technology Engineering and maths careers, and prepares young people for the technological world they live in.

Through its regional organisation SETPOINT serves as single, authoritative source of information for teachers about what local and national STEM materials and activities are available. In particular, using Science and Engineering Ambassadors (SEAs) as the interface with young people. However, neither the electronics supply chain nor its trade associations are well represented among SETNET’s membership.

The universities and further education colleges also play an important role in the provision of trained people at vocational, graduate and post-graduate level for the electronics sector. There is concern that insufficient students are following the vocational route. The decline in school children studying the appropriate feeder subjects has resulted in declining numbers studying physics, electronics engineering and related subjects. Such has been the decline that only 25% of undergraduate places are now filled by UK students, and in some universities no post-graduate students come from the UK.

EPSRC provides a range of flexible funding opportunities at Masters and Doctoral level, both full-time and part-time and for continuous professional development (CPD) of those already employed in the industry. These include:

- Engineering Doctorate Programmes in system-on-chip technologies.
- Collaborative training awards linked to industrial needs, and industrial CASE awards for PhD students to work on specific projects identified by companies.
- Masters level training, e.g. Continuing Education in Electronics Systems (CEESI)\(^{17}\).

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\(^{16}\) [http://www.setnet.org.uk/](http://www.setnet.org.uk/)

\(^{17}\) CEESI, [www.ceesi.ac.uk](http://www.ceesi.ac.uk)
In October 2004, EPSRC identified electronics design research and training as priority for the new Science and Innovation Awards. These will lead to significant long-term funding (typically £3-5m) to enable the appointment of new academics, post-doctoral research assistants and students.

Vision 2015

The UK education system produces students in sufficient quantity and quality to sustain an innovative and growing electronics sector. School students are enthused in key feeder subjects of maths and science by inspirational teachers who have a good understanding of what industry needs. Electronics grows to be a popular part of the Craft Design Technology (CDT) syllabus. The learning experience includes hands-on experience, and is put in the context that makes electronics relevant for today and stimulating for young people.

Demand from UK students wishing to study electronics-related subjects increases, so that by 2015 they form the majority of undergraduates and post-graduates studying in UK universities.

Recommendations

7.5: DfES, HSE and teacher representatives should address the barriers to practical science teaching, and produce guidance for teachers and school governors that encourages more practical work to be undertaken in schools.

7.5.1: More electronics companies and trade associations should engage with SETNET activities.

CONNECTING INDUSTRY AND EDUCATION

There is a lack of engagement between the sector and the further and higher education community on skills issues, and particularly business skills. SMEs have found it particularly difficult to engage, and several commented that universities seem only to be interested in talking to companies with budgets for collaborative research rather than for their output of skilled people. “When people leave university they generally have few business skills, or even an understanding of business, and it can take between six months and two years for them to acquire these,” is typical of SME experience.

‘When people leave university they generally have few business skills, or even an understanding of business, and it can take between six months and two years for them to acquire these’
School teachers need to improve their understanding of the electronics sector, in order to make their teaching relevant and offer better careers advice. But this will not happen without industry help. From September 2004, there is a requirement that all young people should experience some work-related learning at Key Stage 4. This activity is designed to use the context of work to develop knowledge, skills and understanding that will be useful in working life. This is a real opportunity for the electronics industry to showcase itself to prospective employees. Therefore, the sector needs to grasp the opportunity by working closely with local schools to offer work placements and to resurrect activities like open days (which were curtailed in the 1990s), and inspire children by demonstrating how the tools of everyday life (e.g. mobile phones and computers) depend on electronics and embedded software.

**Education targets**

The EIGT considers it is vital to get the balance between academic and vocational qualifications right. There is widespread agreement among those consulted that the balance is not right at the moment. Many students are unwisely advised to pursue an academic route, when the opportunities from the vocational route are greater and more suited to their potential. Modern apprenticeships and foundation degrees could provide a better level of training and should be promoted and encouraged.

The problem, however, is that opportunities in electronics are largely invisible to students, teachers, parents and other peer pressure groups. The sector has mostly lost the large UK-owned companies that provided a major resource of trained technicians, and ultimately supplied the rest of the industry. Therefore, there is a critical need for the various stakeholders in the sector to cooperate to provide a highly visible picture of career opportunities.

“There is scope for the re-introduction of apprenticeships as these schemes are beneficial to all concerned with them”

During the EIGT consultation exercise some policy decisions were also criticised. For example, the capping of modern apprenticeship programmes at Level 3 by the Learning and Skills Council has meant a reduction in the training at Level 4 leading to a shortage of Level 4 technicians. “There is scope for the re-introduction of apprenticeships as these schemes are beneficial to all concerned with them. A variety of roles within the company would suit apprentices and this could also reinforce links into local further higher education colleges”, said a medium-sized manufacturer.
**Disconnect in skills demand and supply**

The electronics industry is subject to considerable cyclical trends. Electronic products often come and go in a six-month period. The timetable from innovation to commoditisation continues to shorten, so businesses can swing quickly from skills feast to skills famine. Various initiatives have been taken to address skills crises in the late-1990s. For example, the DTI-funded course on Electronic Design Realisation (EDR)\(^\text{18}\) was developed to provide skilled professionals capable of creating optimum designs for electronic products. But demand had fallen by the time appropriate courses came on stream. This was largely because the time taken to develop training material is up to two years. Consequently, investment in course material is often wasted because it needs a complete refresh by the time that demand returns.

There is an inherent disconnect between the short-term business cycle and the long-term education cycle. The EIGT also encountered academics that claimed they couldn’t alter a syllabus once advertised. This means students could have seriously out-of-date skills by the time they graduate. This approach seems a ludicrous way to respond to a fast-moving technical sector.

The EIGT does not underestimate the challenge of trying to bring about more responsive curricula provision. Unless supply chain management skills in the industry improve, sudden changes in demand will continue to come as a surprise, and such is the severity of commercial pressure that these changes can occur practically overnight. But business must act more strategically, identifying long-term skill demands. This requires almost counter-cyclical attention to training, and requires a training supply-side that is more responsive to the rapidly changing pace of the sector.

If skills provision is to become truly demand-led, training provision must break away from traditional academic timetables and qualification-based approaches. Funding provision also needs to follow demand rather than qualifications. And professional institutions must acknowledge the value of having more diverse and flexible routes to address the requirements for professional status. In addition, more flexible teaching methods need to be deployed, including distance learning.

In theory, the student market responds to market opportunities for skills when they can see clear career opportunities. This should send signals to training providers to step up appropriate courses. The market for electronics skills fails to respond in this way largely because of the invisibility of the sector and its cyclical nature.

**Vision 2015**

Training provision is in step with the business cycle and the strategic direction of the electronics sector. Business and training providers understand each other’s requirements and work together to secure the best economic outcome. Training material reflects global best practice. Training is undertaken before demand takes off, rather than afterwards. Reliance on unskilled temporary staff reduces.

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\(^{18}\) www.edrcentre.org.uk
Recommendations

The market failure to match skills supply to demand in the electronics industry calls for intervention. There is a need for some self-help measures that could start to address this mis-match. Improved supply chain management and the use of e-business should improve business understanding of labour market trends. Steps to improve the visibility of the sector will help, but in themselves will be insufficient – at least in the short-term.

The EIGT believes there would be merit in exploring fiscal and other mechanisms to address counter-cyclicality so that the downturns in business cycles are used for up-skilling rather than lay-offs. In this way, the UK electronics industry will be better positioned when each upswing arrives. The EIGT also suggests that temporarily surplus/laid-off industry people could be redeployed to fill electronics-related teaching vacancies. The EIGT recommends:

7.6: DfES and the Treasury should work with the industry to consider innovative mechanisms so training provision is closer aligned to the needs of the electronics business cycle.
Electronics 2015 – peak and bleak scenarios

Crystal ball gazing is always a risky business. But here are some considered ‘Peak’ and ‘Bleak’ scenarios for the UK electronics industry, based on the EIGT consultation exercise, and visions of the sector and UK plc 10 years from now if the key recommendations are taken on board (peak) or ignored (bleak) by Government and the industry.

Government and industry (Chapter 3)

PEAK scenario 2015

1. Government has a well-informed understanding of the electronics industry, and has a policy framework that plays to UK electronics industry strengths. The policy framework enables the industry to be ‘world-class’, as a star performer on the international stage.

2. Public procurement is used as a showcase for UK and world-class capability, creating an environment which catalyses innovation and generates new business opportunities. This results in improved public services, infrastructure and productivity. UK electronics capability is recognised and often favoured for public procurement, particularly for products and services supplied by SMEs.

3. Inward investors beat a track to the UK. There is a healthy balance of inward investment and indigenous investment. New businesses and inward investment improves our ability to supply global markets, and raises the industry’s investor profile. Major multinationals see the UK as the ‘place to be’ in the long-term.

4. The Electronics Alliance is a powerful, influential and trusted voice for a rapidly evolving industry, offering strategic leadership. The sector is more focussed and devotes critical mass to technologies that play to our strengths. There is a single body which has strong capability in key cross-cutting areas, vis à vis the regulatory impact on the supply chain, new technology and research priorities.

5. The industry has leaders with vision and the ability to communicate effectively nationally and internationally, in a way that inspires industry and young people. The UK is seen as a global player in multinational technology initiatives, standards and protocols, in concert with leveraging numerous business opportunities.

6. The new generation of electronics industry companies are seen as world leaders – based on expertise in design, systems integration, exploitation of new materials and strong synergies with other sectors.
7. The financial community has more realistic engagement with the technology providers, boosting the success rate of technology spin-outs, and enabling them to grow and thrive, as well as allowing numerous companies to expand to the next level. More electronics companies feature in the FTSE 500.

8. The industry has more visibility to investors and people considering career opportunities, and the science base engages more effectively with UK companies. Managers, and the business community in general, understand better the opportunities offered by new and emerging technologies.

9. The UK has a regulatory environment that facilitates growth and innovation, as business seizes new regulatory policy as opportunities for first mover advantage. The Government gets the regulatory, tax and investment environment right, as a priority.

10. Education and research communities and policy makers work together to deliver a joined-up vision for the industry. Industry coalesces around a few major initiatives that will attract sufficient funding to have a real chance of success. Critical mass R&D attracts high value added investment, which is turned into real prototypes, products and services.

**Bleak scenario 2015**

1. The Government takes no notice of the electronics industry. Foreign companies gain the lion’s share of Government contracts, with most products imported because of the lack of UK capability. The balance of trade deficit in electronics will become increasingly negative.

2. We lose procurement intelligence. There is declining value for money in public expenditure, and public services decline.

3. The UK is no longer seen as an attractive investment location for global OEMs, because we no longer have a strong R&D base.

4. Innovation is stifled and our best technology ideas are exploited abroad.

5. The industry remains fragmented.

6. Many UK firms go to the wall due to lack of management leadership.

7. New regulations are seen as a barrier and cost-contributor rather than a revenue generator, and the UK loses competitive edge with introduction of new legislation.

8. More electronics and physics departments in universities and colleges close down.

9. The skills gap widens.

10. The financial community continues to ignore this sector.
Market sectors and technology (Chapter 4)

Peak vision 2015

1. UK is recognised as a major source of world-class, independent semiconductor design. The UK maintains its position as Europe’s largest independent semiconductor design industry, representing 40% of the design houses and 40% of the design revenue.

2. UK electronics underpins world-class performance in other sectors, so that the GDP contribution is increased significantly.

3. The UK electronics industry shares knowledge between design houses for a new generation of semiconductors via a new e-based infrastructure. This new infrastructure acts as a magnet for innovation, inward investment and new business development.

4. UK has increased its global share by successfully addressing growth markets. We are in the Top Three nations pioneering capabilities in emerging technologies, such as organic and carbon-based electronics, nanotechnology and bioelectronics. Our electronics design capability is stronger and extends to emerging technologies.

5. We are at the leading edge in the provision of electronic solutions for environmental services, waste and water management, recycling and sustainability.

6. Public Government procurement programmes in key sectors are designed to be a major spur to growth and competitiveness across the board. For example, our transport infrastructure is seen as a national asset, underpinned by innovation using UK-developed technology.

7. We maintain or upgrade our position in active sectors (e.g. defence, system design), and make significant advances in security, ID, health, IT and other sectors.

8. The UK is territory of choice for inward investors. We also attract business R&D and their links with our universities re-stimulate UK interest in electronics.

9. Our science base is enhanced. Our bank of IP continues to grow significantly, and we make more than simply licensing revenue from it. UK companies are able to protect IP for major competitive advantage.

10. We are a major exporter into emerging export markets across Asia, while maintaining our position in North America.

Bleak vision 2015

1. We miss the boat in gaining lead position in new disruptive technologies due to lack of appropriate networking between Government, industry and academia.

2. We fail to match growth in existing sectors and don’t take advantage of regional opportunities.
3. The electronics industry fails to gain any leverage from Government procurement e.g. health, defence, and the like. This results in the UK being a follower instead of a leader in terms of innovation.

4. All innovation from our science base is exploited by global multinationals, because there isn’t an indigenous UK industry.

5. Lack of IP protection in Asia places UK electronics in a worse position than other nations.

6. Most of our electronics industry moves offshore.

7. Our electronics design skills decline so previously strong sectors are weakened by lack of product/innovation renewal.

8. Foreign interests exit due to poor UK environment in terms of skills, academia, taxation, etc.

9. We lack sufficient business leaders, managers or technologists.

10. Most UK business managers remain uninformed about technology issues to a far greater extent than Europeans, and we lag far behind the Americans.

**Innovation (Chapter 5)**

**Peak scenario 2015**

1. The UK is seen as a leader in innovation and exploitation – considering innovation across the board, as electronics plays such as pervasive role in all walks of life.

2. The UK is recognised as a key driver for innovation and productivity, with high impact on other sectors including healthcare, security, defence and a new generation of consumer products and services. Innovative UK electronics companies feature in the Top 10 worldwide in several areas.

3. The UK is a centre of gravity for international activity in new and emerging fields.

4. Innovation creates jobs, and more importantly GDP. New initiatives promote the industry and boost recruitment.

5. There are spin-offs in other industries, as electronics is a key enabler in other sectors. The sector fosters a more entrepreneurial and less risk averse culture, with individuals and companies using their wealth to develop new business.

6. Significant, high value IP is generated. UK companies gain access to leading edge R&D, leveraging new business opportunities and partnerships at home and abroad.

7. The UK industry has strong visibility worldwide for electronics design and high value-added manufacturing capability.

8. Despite lack of manufacturing in the UK by 2015, we secure our design effort and support organisations in their R&D initiatives and service operations.
9. There is a dynamic relationship between universities and industry for commercial exploitation of new R&D, spawning new SMEs and medium-sized enterprises of all descriptions serving the global market.

10. Foreign OEMs choose to locate more high value-added departments in the UK.

**Bleak scenario 2015**

1. The electronics industry continues to decline, with a marked fall in the number of electronics, activities and percentage of GDP.

2. Our design capability dribbles away to areas that have manufacturing strength, like South East Asia. Loss of electronics impacts on other areas of industry.

3. The UK suffers loss of prestige internationally. The standard of living falls.

4. There is a continued brain drain, as smart people go where there is activity.

5. The VCs are even more risk averse to the electronics sector.

6. There is a spiral downward that is difficult to pull out of.

**Supply chain vision (Chapter 6)**

**Peak scenario 2015**

1. UK companies have access to a central databank of supply chain management (SCM) best practice. Consequently, many UK electronics companies achieve elements of best practice in SCM:

   - With better analysis and understanding of customer needs on inventory, supply flexibility, and costs associated, e.g. landed costs;
   - Better strategic decision-making regarding ‘make or buy’;
   - Better use of e-business, not simply for procurement.

2. The UK maintains its position as a significant EU player in the global supply chain.

3. UK companies are closely involved in design and prototyping for volume manufacture.

4. UK electronics firms are closely involved in the strategic, decision-making process for volume manufacture, sourcing and distribution. Consequently, the UK is a popular choice for location of key value-added departments.

5. The UK continues to manufacture high value-added products, though typically in low-to-medium volume.

6. The sector plays a pivotal role in new environmental and industry-related legislation, taking advantage of any opportunities and adapting products and business models accordingly.

7. Environmentally, UK companies exploit the opportunities associated with end-of-life management, e.g. for reverse logistics and repair.
Bleak scenario 2015

1. EIGT recommendations are mostly ignored and the electronics industry declines.
2. Because electronics is a pervasive technology, decline in the sector results in loss of competitiveness and collapse in other sectors.
3. Production continues to move offshore, including low volume manufacture and prototypes, based on flawed analysis. Once that production is lost, the UK is unlikely to regain that manufacturing capability.
4. Design follows manufacture abroad and the UK simply becomes a sales base for electronics products.
5. New UK-developed product introduction is rare.
6. UK companies fail to benchmark against global best practice. Many firms become uncompetitive, unproductive and die.
7. Use of e-business remains an aspiration rather than a reality, and the failure to embrace e-business results in the collapse of many SMEs.
8. The UK has little or no profile in the electronics market.

Chapter 7: Skills

PEAK vision 2015:

1. The sector is seen as a good place to find a career. Electronics skills are in demand – particularly in specialist and niche areas. So we overcome the cyclical ups and downs of the electronics sector.
2. The UK builds on its reputation for being a nation of improvers and innovators. We link innovation properly with IP development and funding – all underpinned by continuous people development and upskilling.
3. The education system is more synchronised to business needs and responds in a shorter, more flexible cycle in response to industry demands.
4. There is a strong maths and science base in school leavers.
5. There is far better retention of our postgraduate talent. Most of the best engineers stay in electronics as a vocation.
6. UK industry has world-class managers at every level. They are strategic thinkers and display visionary leadership to inspire the workforce, the City, potential employees and investors.
7. Management is flexible, innovative and forward thinking, harnessing changes in the global supply chain, as an opportunity rather than a threat.
8. The workforce is diverse and able to work flexibly.
9. Technologists have strong business skills, operating in a highly strategic rather than tactical way. Acting in a climate that fosters strategic thinking, companies think and plan for a long-term vision.

10. The image of the electronics sector improves and encourages regular tie-ins between education and business. Industry will be able to attract the best talent for all functions.

**Bleak vision 2015:**

1. Whereas 7,500 UK enterprises employed about 420,000 in 2004, employment is halved by 2015 or even worse in the doomsday scenario.

2. Management and leadership skills simply aren’t up to the job.

3. The UK electronics industry loses competitiveness because it does not have the skills to innovate or compete globally.

4. Training provision is out of touch with industry needs. Training budgets are vulnerable to short-term expediency.

5. The industry loses more business offshore due to global price pressure. There is an accelerated loss of employment in the sector. Those companies that survive have to do more and more to remain competitive, with continuing lack of Government support.

6. As we continue to lose critical mass, there is major loss of key capabilities on the people side. For example, most colleges and many universities cease offering any electronics courses.

7. The gender divide continues and industry sticks rigidly to inflexible employment practices, which deter men as well as women. The industry becomes increasingly out of touch with the female dimension of the customer base.

8. Industry continues to recruit in its own image and, therefore, draws limited talent from an ever-declining pool. It also denies itself innovative ideas from other sectors. At the same time, electronics is considered to be even less attractive to young people.

9. We don’t get to grips with adult training in the workplace. (In 2004, most of the electronics workforce was over 25, so 93% were ineligible for most streams of training funding.)

10. There are severe skill shortages and industry does not rise to the challenge of a global supply chain. As staff grow older in the electronics sector they simply can’t be replaced. There are few new entrants into the electronics business, and few design graduates. UK universities and colleges mostly train young designers for work abroad, then we lose the courses and the skill base.
The electronics supply chain

The electronics supply chain is highly complex and continually changing in response to new technologies, new markets, investment constraints, competition and margins, plus external factors. The industry is characterised by high specialisation of firms along the value chain, depending on the product. Often it is not appropriate to talk of ‘an electronics supply chain’ but individual supply chains, depending on which product or market is concerned, and at what time.

The diagram below (Fig A.1) illustrates the complexity of the interactions and the relationships that need to be managed in order to deliver a product to a particular quality level and price point.

**Fig A.1: UK electronics value chain**

![Diagram of the UK electronics value chain](image-url)
A product is generally designed in response to a market opportunity or demand. Typically, the product will be assembled into a prototype/pilot that is manufactured in relatively small quantities and tested in the marketplace. The product will then be manufactured in low volumes in response to demand and then manufactured in high volume as demand increases. Both quality control and R&D features throughout the value chain.

A number of supporting activities are involved in taking a product to market, such as consultancy services, software provision, marketing, sales and customer services.

Reverse logistics is becoming an increasingly important part of the chain for environmental sustainability, where products are returned by the end-user once they have reached the end of their useful product life. Recent EU regulation requires the companies who produced the products to dispose of them in an environmentally sound manner, by recycling the materials used or refurbishment for re-selling the product.

The highly modular nature of electronics products allows OEMs to outsource production steps and to purchase parts and modules from specialised manufacturers. More and more processes are being outsourced to specialist partners and EMS providers in order to achieve cost reductions, increase asset management efficiency and reduce time to market. As a consequence, the value chain has become more complex and involves more players and stages in a global business.

To illustrate the complexity, here is an analysis of each stage of the process and what type of organisation conducts an activity, e.g. global multinational or SME; and where this process is likely to be undertaken.

**PRIMARY SUPPLY CHAIN FUNCTIONS IN CLOSE-UP**

**Design**

**Who does it:** Product design (including semiconductors, PCBs and other bespoke components) is conducted in-house by an OEM or outsourced in whole or in part to EMS providers or to a range of specialist design houses.

**Location:** For convenience, design is often co-located with the manufacture of the product. Therefore, the UK's strength is under threat from Far Eastern countries where the manufacture of high volume products has already migrated. The UK has significant design strength but this is under threat.

**Quality control**

**Who does it:** All players in the supply chain carry out quality control, including specialist organisations such as test houses.

**Location:** Global.
Raw materials and process supply

**Who does it:** Generally, multi-national organisations or specialist niche providers. A significant level of innovation enters the industry via these organisations, as they undertake R&D in order to improve competitive position.

**Location:** The majority of raw materials and process suppliers have moved out of the UK, as most of their high volume customers are in Eastern Europe and Far Eastern countries.

Component manufacture

**Who does it:** Typically conducted by specialist manufacturers, e.g. semiconductor wafer foundries, integrated device manufacturers (IDMs), OEMs, packaging companies, etc. They range in size from SMEs to large multinational component manufacturers.

**Location:** Typically located in low cost countries for components that are manufactured in high volumes. Component manufacture remains in the UK for low/medium volume specialised products.

**Customers:** Global OEMs, EMS providers, distributors, fabless semiconductor companies, and PCB brokers.

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**Fabless semiconductor supply chain**

By way an example, the supply chain for the fabless semiconductor industry is shown at (Fig A.2). These companies undertake the design function only and contract the manufacturing to so-called ‘foundries’, which provide a contract manufacturing service and do not own any IPR. The industry is important, being part of UK’s independent semiconductor design industry, and representing some 40% of Europe’s design houses and 40% of the design revenue.

The supply chain is complex. There are management issues associated with the many different players in the chain. In addition there are technology issues associated with the complexity of the activity. As chip design has increased in complexity so has the number of issues associated with the all the elements comprising the supply chain. This includes compliance with the design rules of the chosen semiconductor process, wafer fabrication, assembly and test. Cost has risen too, such that the up-front tooling charge of the latest processes is approaching £555,000 ($1 million), and is in the £100,000’s for more mature processes.
Distribution/logistics

Who does it: These tend to be global organisations & local organisations. Distributors typically source a number of components for a range of customers (SMEs, large multinational OEMs and EMSs). Distributors have a key role to play as they increasingly provide first line customer support, as more and more component manufacturers move to low cost geographies, and downsize their own customer service organisations. Manufacturers (OEMs, EMSs and component suppliers) also often optimise their supply chains by outsourcing the transportation of inventory and finished goods to distributors and specialist logistics firms.

Location: Global but good representation in the UK.

Customers: Large component suppliers may have direct relationships with major OEMs and EMS providers. However, if a component supplier or a customer conducts low to medium volume business, they may choose to source/supply their product via a distributor. Franchised distributors have 31% of the component market (by value) but trade with 95% of the sector1.

Electronic product manufacturing/assembly

Who does it: Typically OEMs outsource production to global EMS providers.

Location: Increasingly manufacturer/assembly is located in low cost geographies, such as the Far East or Eastern Europe, except for low/medium volume higher value added products and prototypes.

Customers: OEMs are customers for EMSs, but EMSs may be required to interact directly with end-users under the OEM brand.

Reverse logistics

Who does it: Product repair is typically outsourced to large specialist organisations who may interact directly with customers under the OEM brand. Alternatively, repairs are undertaken in-house by the OEM. Significant numbers of SMEs are involved with repair on a local level. Recycling and resale is undertaken by specialist environmental companies, and this market is expected to increase significantly as a result of new EU environmental legislation. Re-use of components is sometimes feasible but repair for most components is unusual.

Location: Repair and reverse logistics is a global business, but repair is usually undertaken within the UK for the UK branch of the business.

Customers: Global OEM’s, EMS and distributors generally contract out this aspect of the business to specialist organisations, including significant use of courier/logistic services for retrieval and re-distribution of products. Markets exist in the Far East, Africa and Eastern Europe for product resale.

1 2002 figs, Europartners Consultants Report 2003
**SUPPORT FUNCTIONS**

**Manufacturing equipment providers**

**Who does it:** Generally multinational organisations or specialist niche providers provide manufacturing equipment. Equipment manufacturers introduce innovation into the overall supply chain, using their own R&D to improve competitive position.

**Location:** The majority of equipment manufacturers have moved out of the UK as the demand has decreased.

**R&D:** Equipment manufacturers are typically multinational companies who conduct their R&D in-house or use university research facilities on a global basis.

**Customer service:** Increasingly the equipment suppliers are moving their customer services organisations out of the UK, thus reducing the levels of customer service provided to the UK.

**Software tool providers**

**Who does it:** For design software tools (e.g. computer-aided design (CAD) software and electronic design automation (EDA) tools) the suppliers tend to be (but not entirely) US-based organisations with global operations. For enterprise software (e.g. supply chain management (SCM), enterprise resource planning (ERP) systems, etc), the suppliers are global organisations headquartered in a range of countries, including increasingly the Far East.

**Location:** The majority of software tool providers have UK operations and global support organisations.

**Consultants**

**Who does it:** There are a range of global consultancies, from supply chain specialists to local design consultants.

**Location:** UK & globally.

**Marketing & sales**

**Who does it:** Marketing and sales is typically handled OEMs themselves & retail organisations that the OEMs use as a channel.

**Location:** Local to whatever geography the OEM is trying to address.

**Customer service**

**Who does it:** For end-products, OEMs may do it themselves or may outsource customer service to specialist organisations.

**Location:** Local to the country of sale.
Fabless companies possess their own integrated design IP – strong focus on core competencies – other activities outsourced.

- **Utopia** = Success in one ramp with seamless and trouble-free manufacturing;
- **Reality** = Multiple iterations & debugging + manufacturability/yield problems in volume production
The 5 stages of the Internet

Fig A.3: The five stages in the process of becoming fully e-enabled

**Stage 5** – ecosystem comprises highly integrated infrastructures linking customers, suppliers and other key partners. Processes and logistics are largely automated using Internet technology, creating a seamless chain of communication management.

**Stage 4** – e-business in which processes are increasingly driven by Internet technology. Through secure intranets and extranets, remote workers, customers and suppliers can access the business at selected points.

**Stage 3** – e-commerce enables orders to be placed via the website 24 hours a day, 365 days a year. Together with online service and support, sales opportunities can increase, and sales costs fall.

**Stage 2** – a website serves as a shop window to the world and gives even the smallest local business a global presence.

**Stage 1** – e-mail makes global communication as easy as exchanging data with a computer on the next desk.
Semiconductor market cycles

The electronics industry, and some sub-sectors in particular, e.g. electronic components and semiconductors, are characterised by complex markets and extended supply chains, high and spiralling capital costs but dramatically falling product prices driven by shortening product cycles and extremely rapid commoditisation.

The chart below (Fig A.4) shows the dramatic impact on the market for semiconductors and integrated circuits (chips) since their invention.

**Fig A.4: Semiconductor market cycles**

[Graph showing semiconductor market cycles from 1950 to 2007]
A question of productivity

There is strong evidence that UK electronics industry is not as economically productive as equivalent firms in Europe, and other sectors both in the UK and Europe, which in turn lag behind the USA, as highlighted by Figure A.5.

Fig A.5: Electrical and electronics equipment, labour productivity levels 1996 and 1999

While 1999 is the latest date for which reliable comparable data is available, DTI’s 2004 Value Added Score Board\(^1\) and other sources suggest that while there have been some improvements by UK electronics firms broadly, the UK is still lagging well behind its main competitors.

Nevertheless, many UK electronics companies, both home-grown and those from overseas, are leading the way in harnessing productivity. The UK plants of most, if not all, global companies are the best or equal to the best in the world. Evidence from the DTI Small Business Service’s Benchmark Index\(^2\) finds that electronics SMEs achieve the highest pre-tax profits both in terms of turnover and per employee among all other manufacturing sectors. However, the evidence is compelling that the electronics sector has an issue with productivity.

Why is productivity important when what businesses is interested in is profitability and getting the best yield from manufacturing processes?

Productivity is broadly a measure of wealth creation or added value divided by the cost of making the product. Gross Value Added (GVA) is obtained by subtracting the cost of bought-in services and materials from the value of the sales of the product.

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\(^1\) Source: DTI 2004 Value Added Score Board

\(^2\) Sources: DTI – SBS Benchmark index – Closing the Gap; www.benchmarkindex.com
Essentially GVA is a measure of what you have at the end of the day to pay taxes, shareholders, employees, and to reinvest in the future of the business.

The most commonly used measure of productivity is average labour productivity (ALP) and is equal to the GVA per worker or worker-hour.

While profitability is essentially a function of costs, productivity enables business to think more strategically. In economist’s speak Ceteris paribus, i.e. with all factors being equal in a given market, a company that has higher productivity will enjoy greater profitability. A more productive company can therefore produce the same output with less input, and enjoy a cost advantage or produce more or better output with the same inputs, and command a price premium.

Unfortunately the productivity picture for the UK electronics sector is complex. Analysis is hampered by the problems mentioned with national statistics referred to in chapter 3. There are also significant variations between electronics sub-sectors, as highlighted in Figure A.6.

**Fig A.6: Productivity of electronics sub-sector in GVA per head in 2002**

Comparisons with other countries are further complicated by the variable use of specific price indices. *Figure A.7* shows the impact on the UK computers sectors’ productivity data of using the UK retail price index (RPI) and the US computer prices index. These so called hedonic indices are used in some electronics sub-sectors when the quality of the product has been increasing over time and the price per unit of quality has been falling e.g. computers and PCs.
UK computer sector sensitivity to price index

To underpin the work of the EIGT, the DTI Electronics Unit commissioned a significant body of analysis on the competitiveness and productivity of the UK electronics sector, to supplement its own analysis activities. To understand productivity and its main drivers the EIGT and its working groups drew on the findings of NERA, DTZ, and the DTI Small Business Service’s Benchmark Index.

From this body of work and its own analysis the EIGT has identified, markets and technology (chapter 4); innovation (chapter 5); supply chains (chapter 6); and skills (chapter 7) as the key drivers that need to be addressed to raise the productivity of the sector and harvest its global competitiveness.

Fig A.7: Average labour productivity*

Fig A.8: Electrical and electronics equipment, skill composition (1998)
Take for example the impact of skills. *Figure A.8* compares the quality mix of skills between Germany and the UK – the disparity is obvious. The picture is similar across all the electronics sub-sectors. NERA identified in its report to the DTI that there is no correlation in the UK electronics sector between productivity and the capital that is employed per worker. In other words, it appears that it’s not what you do but how you do it that’s important.
Glossary of acronyms

AIDC  Automatic Identification and Data Capture
AIM   Alternative Investment market
ALP   Average Labour Productivity
ASEM  Asia Europe Meeting
ASIC  Application Specific Integrated Circuit
CAD   Computer Aided Design
CAGR  Compound Annual Growth Rate
CCD   Charge Coupled Device
CCTV  Close Circuit Television
CDT   Craft Design and Technology
CEM   Contract Electronic Manufacturer
CGT   Capital Gains Tax
C’I   Command, Control and Communication
CMOS  Complementary Metal Oxide Semiconductor
CRT   Cathode Ray Tube
DTV   Digital Television
DTZ   DTZ Pieda Consulting
DVD   Digital Versatile Disk
EDA   Electronic Design Automation
EDI   Electronic Data Interchange
EDP   Electronics Data Processing
EMC   Electromagnetic Compatibility
EMS   Electronic Manufacturing Service
FDI   Foreign Direct Investment
FPD   Flat Panel Displays
FTSE  Financial Times Stock Exchange
GDP   Gross Domestic Product
GVA   Gross Value Added
HEI   Higher Educational Institutes
HNC   Higher National Certificate
HND   Higher National Diploma
I&P   Interconnect and Packaging
IMRC  Innovative Manufacturing Research Centre
INTERSECT  Intelligent sensors for control technologies
IP    Intellectual Property
IPO   Initial Public Offering
IPR   Intellectual Property Rights
IT    Information Technology
ITEC  Information Technology Electronics and Communication
ITRI  Industrial Technology Research Institute
JCGQ  Joint Council for Qualifications
LCD   Liquid Crystal Display
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>LEP</td>
<td>Light Emitting Polymer</td>
</tr>
<tr>
<td>LFS</td>
<td>Labour Force Survey</td>
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<td>MBO</td>
<td>Management Buy-Out</td>
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<tr>
<td>MEMS</td>
<td>Micro-Electro Mechanical Systems</td>
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<tr>
<td>MRO</td>
<td>Maintenance, Repair and Operations</td>
</tr>
<tr>
<td>MSP</td>
<td>Member of the Scottish Parliament</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics Space Administration</td>
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<td>NASDAQ</td>
<td>National Association of Securities Dealers Automated Quotation</td>
</tr>
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<td>NDI</td>
<td>Northern Defence Industries</td>
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<td>NERA</td>
<td>National Economic Research Associates</td>
</tr>
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<td>NIESR</td>
<td>National Institute of Economic and Social Research</td>
</tr>
<tr>
<td>NOP</td>
<td>National Opinion Poll</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
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<tr>
<td>OLED</td>
<td>Organic Light Emitting Diodes</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed Circuit Board</td>
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<tr>
<td>PRIME</td>
<td>Products with Interdependent Mechanical and Electronic parts</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RAPID</td>
<td>Reconfigurable Pipelined Data Paths</td>
</tr>
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<td>REACH</td>
<td>Registration Evaluation &amp; Authorisation of Chemical Hazards</td>
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<td>REPIC</td>
<td>Recycling Electrical Producers Industry Consortium</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
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<td>RoHS</td>
<td>Restriction of Hazardous Substances</td>
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<td>ROI</td>
<td>Return On Investment</td>
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<td>RPI</td>
<td>Retail Price Index</td>
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<td>SBRI</td>
<td>Small Business Research Initiative</td>
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<td>SCM</td>
<td>Supply Chain Management</td>
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<tr>
<td>SEA</td>
<td>Science and Engineering Ambassador</td>
</tr>
<tr>
<td>SEEDA</td>
<td>South East England Development Agency</td>
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<tr>
<td>SIC</td>
<td>Standard International Classification</td>
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<tr>
<td>SLD</td>
<td>Super Luminescent Diodes</td>
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<tr>
<td>SME</td>
<td>Small &amp; Medium sized Enterprise</td>
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<td>SMS</td>
<td>Short Messaging Service</td>
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<tr>
<td>SoC</td>
<td>System-on-a-chip</td>
</tr>
<tr>
<td>STB</td>
<td>Set-Top Box</td>
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<tr>
<td>STEM</td>
<td>Science Technology Engineering and Mathematics</td>
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<tr>
<td>TAC</td>
<td>Technical Adaptation Committee</td>
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<td>UKEA</td>
<td>UK Electronics Alliance</td>
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<tr>
<td>VC</td>
<td>Venture Capitalist</td>
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<td>WEEE</td>
<td>Waste Electrical and Electronic Equipment</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organisation</td>
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</tbody>
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### Skills

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<td>Derek Boyd</td>
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<tr>
<td>Silu Ali</td>
<td>Oracle (on secondment to DTI)</td>
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<td>Richard Foggie</td>
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<td>Dr Tim Reynoldsdon</td>
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### Other contributors

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<td>Rick Donnegan</td>
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<td>Carol Rice</td>
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</tbody>
</table>
INDUSTRY CONSULTATION LIST

3i Group plc
A&R Electronics Development Ltd
Abacus Group plc
Acal plc
Alps Electric (UK) Ltd
Amadeus Capital Partners Ltd
Anglia Circuits Ltd
Anglia Components Ltd
ARM
Artetch Circuits Ltd
Astute Electronics Ltd
Audiotell International Ltd
Axiom Manufacturing Services Ltd
BAE Systems Avionics Ltd
Beran Instruments
Bookham Technology plc
BPX Electromechanical Ltd
Brandon Medical Co Ltd
BreconRidge Manufacturing Solutions Ltd
Broadband Technology 2000 Ltd
Bulgin Components plc
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Campbell Collins Ltd
Campbell Scientific Ltd
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Kestronics Ltd
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Linwave Technology Ltd
Mantra Court Electronics Ltd
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Tunstall Group Ltd
Whitehead Mann
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Xitek Ltd
Zap Controls Ltd
Zetex plc
Zodion Ltd

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EEDA
EMDA
GO-East
GO-EM
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National Physical Laboratory
Prime Faraday Partnership
Scottish Executive
Surrey Ion Beam Centre
SWRDA
The Cambridge-MIT Institute
University College Northampton
University of Cambridge
Yorkshire Forward

**Stakeholder Groups**

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GAMBICA
Institution of Electrical Engineers (IEE)
Intelect
JEMI (Joint Equipment & Materials Initiative)
Microsystems Manufacturing Association (MMA)
National Microelectronics Institute (NMI)
SEMTA
TUC (Trades Union Congress)
Sources of information

Trade Bodies

Association of British Certification Bodies (ABCGB)
www.abcb.demon.co.uk
Association of British Healthcare Industries (ABHI)
www.abhi.org.uk
Association of Franchised Distributors of Electronic Components (AFDEC)
www.afdec.org.uk
Association for Automatic Identification & Mobility (AIM)
www.aimglobal.org
Association of Manufacturers of Domestic Appliances (AMDEA)
www.amdea.org.uk
Association of Police and Public Security Suppliers (APPSS)
www.appss.org.uk
British Electrical and Allied Manufacturers Association (BEAMA)
www.beama.org.uk
Bio Industry Association (BIA)
www.bioindustry.org
British Measurement and Testing Association (BMTA)
www.bmta.co.uk
British Naval Equipment Association (BNEA)
www.maritimeindustries.org
British Plastics Federation (BPF)
www.bpf.co.uk
British Standards Institute (BSI)
www.bsi-global.com
British Security Industries Association (BSIA)
www.bsia.co.uk
Confederation of British Industry (CBI)
www.cbi.org.uk
Chemical Industries Association (CIA)
www.cia.org.uk
Defence Manufacturers Association (DME)
www.the-dma.org.uk
Engineering Employers Federation (EEF)
www.eef.org.uk/UK
Fibreoptic Industry Association (FIA)
www.fibreoptic.org.uk
Fire Industry Confederation (FIC)
www.the-fic.org.uk
Freight Transport Association (FTA)
http://www.fta.co.uk
Institution of Electrical Engineers (IEE)
www.iee.org.uk
Instrumentation & Control Industry Trade Association (GAMBICA)
www.gambica.org.uk
Chartered Institute of Logistics and Transport
www.ciltuk.org.uk
Information Technology Telecommunications and Electronics Association (INTELLECT)
www.intellectuk.org
Institute of Directors (IOD)
www.iiod.com
Joint Equipment & Materials Initiative (JEMI)
www.jemiuk.com
Joint Security Industry Council (JSIC)
www.jsic.co.uk
Microsystems Manufacturing Association (MMA)
www.mma.org.uk/
National Consumer Council (NCC)
www.ncc.org.uk
National Microelectronics Institute (NMI)
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Personal Computer Association (PCA)
www.pcassoc.org
Photonics Cluster UK (PCUK)
www.photonicscluster-uk.org
Recycling Electrical Producers Industry Consortium (REPIC)
www.recyclingtoday.com
Society of British Aerospace Companies (SBAC)
www.sbac.co.uk
Semiconductor Industry Association (SIA)
www.sia-online.org
Society of Motor Manufacturers and Traders (SMMT)
www.smmt.co.uk
Scottish Optoelectronics Association (SOA)
www.optoelectronics.org.uk
Telecommunications Industry Association (TIA)
www.tia.org.uk
UK Consortium for Photonics and Optics (UKCPO)
www.ukcpo.org
UK e-Health Association (UKEHA)
www.ukeha.org.uk
UK Microelectronics Environmental Advisory Committee (UKMEAC) (now part of NMI)
www.nmi.org.uk
Virtual Socket Interface Alliance (VSIA)
www.vsi.org
Government departments

Better Regulation Task Force (BRTF)
www.brtf.gov.uk

Department for Education and Skills (DfES)
www.dfes.gov.uk

Department of Health (DoH)
www.dh.gov.uk/Home/fs

Department for Transport (DfT)
www.dft.gov.uk

Department of Transport (US) (DoT)
www.dot.gov

Department of Trade and Industry (DTI)
www.dti.gov.uk

DTI – Electronics Unit (DTI)
www.dti.gov.uk/industries/electronics

Foreign and Commonwealth Office (FCO)
www.fco.gov.uk

Home Office (HO)
www.homeoffice.gov.uk

Health and Safety Executive (HSE)
www.hse.gov.uk

Government programme supporting business & research collaborations (LINK)
www.ost.gov.uk/link

Learning and Skills Council (LSC)
www.lsc.gov.uk

Manufacturing Advisory Service (MAS)
www.mas.dti.gov.uk/home.jsp

Management Leadership and Skills Unit (MLSU)
www.dti.gov.uk/bestpractice/

Ministry of Defence (MoD)
www.mod.uk

Office of Government Commerce (OGC)
www.ogc.gov.uk

Office of National Statistics (ONS)
www.statistics.gov.uk

Office of Science and Technology (OST)
www.ost.gov.uk

Registration Evaluation & Authorisation of Chemical Hazards (REACH)
www.dti.gov.uk/sectors_chemicals

Restriction of Hazardous Substances (RoHS)
www.dti.gov.uk/sustainability/weee/

Small Business Service (SBS)
www.sbs.gov.uk/

Small firms Merit Award for Research in Technology (SMART) renamed Grant for R&D
www.dti.gov.uk

Skills and research

Engineering and Physical Sciences Research Council (EPSRC)
www.epsrc.ac.uk

Higher Education Funding Council (HEFC)
www.hefce.ac.uk

Sector Skills Council for Science, Engineering and Manufacturing Technologies (SEMTA)
www.semta.org.uk

Science Engineering and Technology Network (SETNET)
www.setnet.org.uk

Science Engineering and Technology regional delivery POINT (SETPOINT)
www.setnet.org.uk

Regional development

Business Links (BL)
www.businesslink.gov.uk

Department of Enterprise Trade and Investment (Northern Ireland) (DETI)
www.detini.gov.uk

Regional Development Agency (RDA)
www.consumer.gov.uk/rda

Scottish Enterprise (SE)
www.scottishexecutive.gov.uk

Welsh Development Agency (WDA)
www.wda.co.uk

Electronics-related initiatives

Continuing Education in Electronics Systems Integration (CEESI)
www.ceesi.ac.uk

Electronics Design Network (EDN)
www.e-design.org.uk

Electronics Innovation Growth Team (EIGT)
www.dti.gov.uk/industries/electronics/eigt

Electronics in Schools (EiS)
www.electronicsinschools.com

Electronics and Photonics Packaging and Interconnections (EPPIC)
www.eppic-faraday.com

Electronics Scotland (ES)
www.electronics-scotland.com

Energy using Products (EuP)
www.dti.gov.uk/sustainability/EUP

Pan-European Cooperative R&D (EUREKA)
www.eureka.be

Intelligent Sensors for Control Technologies (INTERSECT)
www.intersect.org.uk

Information Technology for European Advancement (ITEA)
www.itea-office.org
Micro-electronics Developments for European Applications (MEDEA)
www.medea.org

Packaging and Interconnection Development for European Applications (PIDEA)

Shell Technology Enterprise Programme (STEP)
www.step.org.uk

Welsh Electronics (WE)
www.welsh-electronics.com

**Other useful contacts**

British Venture Capital Association (BVCA)
www.bvca.co.uk

China Britain Business Council (CBBC)
www.cbbc.org

Defense Advanced Research Projects Agency (US) (DARPA)
www.darpa.gov

DTZ Pieda Consulting (DTZ)
www.dtzpiedaconsulting.co.uk

Institution of Electrical Engineers (IEE)
www.iee.org

Institute of Nanotechnology (ION)
www.nano.org.uk

The Institute of Physics (IOP)
www.iop.org

Industrial Technology Research Institute (ITRI)
www.itri.org.tw/eng

National Economic Research Associates (NERA)
www.nera.com

National Institute of Economic and Social Research (NIESR)
www.niesr.ac.uk

Small Business Research Initiative (SBRI)
www.sbri.org.uk
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We champion UK business at home and abroad. We invest heavily in world-class science and technology. We protect the rights of working people and consumers. And we stand up for fair and open markets in the UK, Europe and the world.

A large number of senior people from electronics companies, Government departments, Trade Associations, universities and research bodies have been involved in the Electronics Innovation and Growth (EIGT) team. This report reflects the broad consensus of their views, though not necessarily those of the Government, nor individuals, companies or organisations.

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