FUTURE SKILLS ISSUES AFFECTING INDUSTRY SECTORS IN WALES

Electronics Sector

Futureskills Wales

FUTURE SKILLS ISSUES AFFECTING INDUSTRY SECTORS IN WALES

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Executive Summary

Introduction

This document is one of a series commissioned by the Future Skills Wales Research Forum. The overall project aims to extend and complement the work begun by the original Future Skills Wales project, which forecast future generic skills needs across Wales using forecasting and survey data. The current project adds studies of future vocational skills needs within key sectors in Wales. Each sector study is based on desk research and qualitative interviews with practitioners and employers, and aims to provide an overview of the sector, the skills issues, and current and potential actions to further strengthen the sector.

Businesses and employees in each of the sectors studied have achieved great successes; that is why these sectors have become important for Wales. Our focus on current skills issues should not obscure these achievements or the determination of all concerned to meet current and future challenges.

Sector Profile

Electronics is an important sector within Welsh manufacturing with:

- over 300 companies;
- 37,600 employees;
- turnover exceeding £2.5 bn per annum.

Key sub-sectors include:

- electronics (including opto-electronics);
- semiconductors;
- information technology, telecoms and software.

Sources of Change & Prospects for the Future

It is anticipated that the electronics sector in Wales needs to position itself in the higher value-added 'knowledge-based' sub-sector, **"the Welsh Electronics Sector must move up the value chain"**[1]. This sub-sector is capital and skill intensive. Digital TV will impact most areas of the sector. Whilst changes in technology will have an impact, the core skills in electronics remain the same. Global manufacturing cost competitiveness is having an effect on manufacturing efficiency resulting in 'cost down' and the need to reduce lead times.

The prospects for the sector are affected by over-capacity in some areas, particularly in consumer electronics, and cyclical demand in others, for example the semiconductor sub-sector. The immediate scenario for the sector in Wales, as for the rest of the UK, is some dislocation and possible decline, followed by recovery if the necessary transition to higher value-added operation can be made.

Skills Issues

The major skills issues are as follows:

1. The most acute skills issue is the **availability of the required experienced technicians and engineers** to meet current and projected future demand.
2. Implementing 'cost-down' activities has a direct **impact on skills at a supervisor and team leader level**. Developing **management skills** to support this process is also required.
3. **Prevention of short-term de-skilling which occurs in response to skills shortages and recruitment difficulties.** Complex tasks are being broken down into a series of lower-skill tasks. This process is especially prevalent in the semiconductor sub-sector and needs to be managed carefully.
4. There is a **shortage of specialist skills e.g. software process engineers** with C++, HTML and JAVA programming skills. One software firm has projected a demand for an additional 100 software engineers over the next 18 months.
5. Employers across all sub-sectors in Wales expect to train graduates engineers and, to a lessor extent technicians, over a period of time before they begin to add value to the business. There is a perception that **the technical and commercial skills being taught at University/College do not meet industry requirements.**
6. The **perception of the engineering industry** is still a barrier to potential entrants. This includes students at school who are deciding not to choose maths/science subjects as well as graduates who are choosing IT-related rather than manufacturing careers.
7. The report focusing on the supply and demand for digital training (ERES, 1999[2]) indicated that **attracting employees to Wales** is not an issue. By contrast, our consultations have highlighted that this **is a problem area** particularly in higher skills. Even attracting engineers from Bristol can be a difficulty.
8. **Basic skill levels** across all positions and **employability skills** for graduates have been highlighted as ongoing skills issues.
9. The **impact of moving from an analogue to a digital environment** has already had an impact on the semiconductor industry and will continue to have an impact on the consumer electronics industry.
10. The **cyclical nature** (boom/bust scenario) of the semiconductor industry requires sectoral planning.

Action on Skills

Whilst there are a number of skills issues facing the electronics sector as a whole there are important differences in terminology and emphasis between the electronics, semiconductor and software sub-sectors. A skills strategy embracing these differences needs to be developed and effectively communicated both within the sector and to key policy-makers.

The key recommendations are grouped under a number of themes and are shown in the matrix below.

[1] A Strategy for Electronics in Wales, Welsh Electronics Forum.
[2] The Market Demand for and Supply of Digital Training, Final Report, ERES, 1999

Themes & Recommendations matrix

Theme No:	Rec. No:	Action	Timescale	Key Partners
1	1a	Ensure that funding is available to embed and develop the Technician PDP programme beyond March 2001 and that lessons learnt from the pilot are integrated into delivery	on-going	CETW/SWEFIC
	1b	Consider work placements for technical students and incentives for SMEs offering places	2000/2001	FE Colleges/ HEIs/WEF
	1c	Develop closer links between employers and universities to ensure that the curriculum advances at the same pace as the technology	2000/2001	HEIs/WEF
	1d	Consider introducing a bursary scheme at HNC/D and degree level along similar lines to the current scheme offered to PGCE students who study more 'difficult' subjects	2000/2001	NAW
	1e	Develop effective careers information and promotional materials, it is important to attract more young people and women to the industry	2000/2001	WEF
2	2a	Ensure the Team Leader training programme is embedded and developed.	on-going	CETW/EMP
	2b	Consider cross-company sector mentoring at management/ team leader level	2000/2001	NTOs
	2c	Implement a cross-industry modular management development programme	2000/2001	NTOs
3	3a	Ensure that there are clear progression routes are developed and implemented within individual companies	on-going	WEF
4	4a	Implement the graduate development programme	2000/2001	WEF
	4b	Consider more sandwich students/innovative approaches to attracting graduates	2000/2001	HEIs/WEF
	4c	Courses to include more blocks of good quality employment-based training and incentives for SMEs offering places	2000/2001	FE Colleges/ HEIs/WEF
	4d	Employers need to consider what salaries and progression they need to offer to attract the best graduates and experienced engineers	on-going	WEF
	4e	Consider ways of keeping overseas graduates in the UK	2000/2001	WEF
5	5a	Develop closer ties with NTOs (EMTA, ITNTO etc)	2000/2001	NTOs/WEF
	5b	Audit NVQs/course curriculum against industry needs	on-going	NTOs
	5c	Develop better liaison/more formal links with colleges and universities	2000/2001	FE Colleges/ HEIs/WEF
	5d	FE & HE should develop industry-focused centres of excellence	2000/2001	FE Colleges/ HEIs/WEF
6	6a	Actively seek partnerships with local schools and EBPs	on-going	EBP/WEF/CETW
	6b	Proactively offer teacher/pupil/student placements and incentives for SMEs offering places	2000/2001	EBP/CETW
	6c	Promote sector plans and prospects to schools, young people and communities	2000/2001	EBP/Careers
7	7a	Develop an advertising aimed at individuals	2000/2001	WEF
	7b	Develop a sector pack and sub-sector packs	2000/2001	WEF
	7c	Develop sector/sub-sector web pages with links to fora and electronics companies	2000/2001	WEF
8	8a	Work with the Basic Skills Agency to implement common definitions and tests in recruitment and training needs analyses	2000/2001	NTOs
	8b	Develop pre-recruitment short courses focused on developing core technical skills and employability skills	2000/2001	NTOs
9	9a	Implement the main recommendation of the ERES report i.e. to second/contract an individual to act as a facilitator/marketeer	2000/2001	NAW
10	10a	Encourage a broad skills mix which is interchangeable between industries	2000/2001	NTOs
	10b	Team Wales to capitalise on the strategic planning role of sector forums	2000/2001	CETW
	10c	Investigate the possibility of developing short courses to enable operators, technicians and engineers to switch between manufacturing sectors e.g. mechatronics	2000/2001	NTOs

1. Introduction

1.1 This document is one of a series commissioned by the Future Skills Wales Research Forum. The overall project aims to extend and complement the work begun by the original Future Skills Wales (FSW) project, which forecast future generic skills needs across Wales using forecasting and survey data. The current project aims to add studies of future vocational skills needs within key sectors in Wales.

1.2 Businesses and employees in each of the sectors studied have achieved great successes; that is why these sectors have become important for Wales. Our focus on current skills issues should not obscure these achievements or the determination of all concerned to meet current challenges.

1.3 The FSW Sectoral Skills project aims to take particular note of the importance of the manufacturing sector for the Welsh economy and for employment in Wales. In particular it covers four manufacturing sub-sectors (although for convenience in individual sub-sector reports we will refer to them as sectors). These are:

- food processing;
- aerospace;
- electronics;
- automotive manufacturing.

1.4 This report covers the electronics, semiconductors and software sectors. It shares some elements with the other reports, and particularly with the other studies of manufacturing sub-sectors, but deals specifically with vocational and other skills issues in the electronics, semiconductors and software sectors in Wales and Welsh regions.

1.5 Each of the individual sector reports is complemented by a report on management and information technology skills issues across the sectors studied. This reviews the situation in each sector and draws out common themes and implications.

Method

1.6 The first phase of the study proceeded mainly by desk research (please refer to the Bibliography at **Annex A**) and telephone discussions. In addition an initial meeting with representatives from the Welsh Electronics Forum covering electronics, semiconductors and the software sub-sectors was held. This helped to sketch out the general skills issues facing the sector.

1.7 Further meetings were held with sector representatives, in particular, the Delphi technique (structured brainstorm sessions) has been used with the training advisory groups of the Welsh Electronics Forum, the Electronics Training Advisory Group (ETAG) and the Semiconductor Training Advisory Group (STAG).

1.8 Employer case studies have been undertaken to provide specific examples of the skills issues facing individual companies. The case studies have been selected to include an industry mix within the sector (software, semiconductors, opto-electronics and electronics) as well as a geographic mix.

1.9 The aim was not to conduct quantitative primary research, but to consult with sector representatives in order to identify perceived skills issues, the actions being taken in response to these, and the potential for further action or policy development. The published reports should therefore provide a clear introduction to the sector, a ‘snapshot’ of sector issues, and pointers to current and potential action.

2. The Electronics Sector in Wales

Definition

2.1 The definition given in **Table 2.1** below is a subset of a definition that has been formulated by the DTI and which is used by the Foresight Programme. The definition is also used by the Information Technology, Communication & Electronics (ITCE) Skills Strategy Group.

Table 2.1: Definition of the electronics sector by SIC code

Description	SIC Codes
Manufacture of computer equipment	30.02
Manufacture of electronic components	32.10
Manufacture of broadcast and network equipment	32.20/1 & 32.20/2
Manufacture of consumer electronics	32.30
Manufacture of electronic instrumentation	33.20/1 & 33.30/1
Telecommunications	64.20

2.2 The Welsh Electronics Forum uses the following descriptive definition:
"(the sector) primarily comprises companies which design and/or manufacture products with a high electronics or software content or application. It also includes companies which support the supply chain, but does not include retail, servicing or repair"[3]

2.3 In broad terms we have segmented the sector into three sub-sectors:
- electronics (including opto-electronics);
- semiconductor;
- information technology, telecommunication and software (referred to as software in the remainder of the report for brevity).

2.4 However, the sector can be broken down into the following eight sub-sectors:
- **Components** - passive components, connectors, cabling, material, power supplies and sub-systems;
- **Consumer Equipment** - computers, security, multimedia, consumer and training equipment;
- **Instrumentation and Control** - industrial control, drives, monitoring and application-specific instrumentation;
- **Systems** – telecom, datacom, opto, software and embedded systems
- **Software** – application-specific software packages;
- **Electronic Manufacturing Activities** – tooling, metal pressing and plastic injection moulding;
- **Contract Manufacture** – PCB assembly and contract manufacture;
- **Semiconductor** – semiconductor manufacture, equipment and supplies.

Sector Characteristics

UK Electronics Sector – Facts & Figures

2.5 The key points of note are:
- 270,000 people are directly employed in the UK sector (1996);
- sector output represents 6% of all manufacturing within the UK and represents 17% of all engineering manufacturing;
- output is £30 bn (1996);
- £26 bn worth of exports (16% of UK visible exports);
- there has been strong growth – 62% between 1990 and 1998;
- global growth of the sector is projected at 8% p.a. for the next 5 years.

Welsh Electronics Industry – Facts & Figures

2.6 The following characteristics of the Electronics Sector in Wales are taken from the publication 'A Directory of Electronics in Wales', sponsored by the WDA and produced by the Welsh Electronics Forum:
- there are more than 300 companies in the electronics sector;
- turnover exceeds £2.5bn per year;
- the total number of people employed in electronics in Wales is 37,600[4];
- the electronics sector employs at least 50% more people in Wales than the automotive sector[5];
- the amount of money invested through inward investment in the last seven years is £7.9 bn[6];
- 20% of electronics companies specialise in software and embedded systems;
- 75% of the companies listed in 'A Directory of Electronics in Wales' have adopted electronic commerce and 60% of the companies operate ISO 9000, ISO 9001 or ISO 9002.

Location

2.7 The location of electronics companies within Wales is shown in **Figure 2.1** below. A breakdown of the number of people employed within the sector, by location, is shown in **Figure 2.2**. The key points of interest are:
- nearly 45% of the companies in the sector are based outside South East Wales;
- over half of the people employed in South East Wales work for the five largest companies;
- there is a strong opto-electronics sector in North Wales.

[3]A Directory of Electronics in Wales, Welsh Electronics Forum.
[4]Cambridge Econometrics, Regional Eceonomic Prospectus, February 1999.
[5]Annual Employment Survey 1997: NOMIS and Cambridge Econometrics, Regional Economic Prospectus, February 1999.
[6]Source, WDA.

Figure 2.1: Location of Electronics Companies

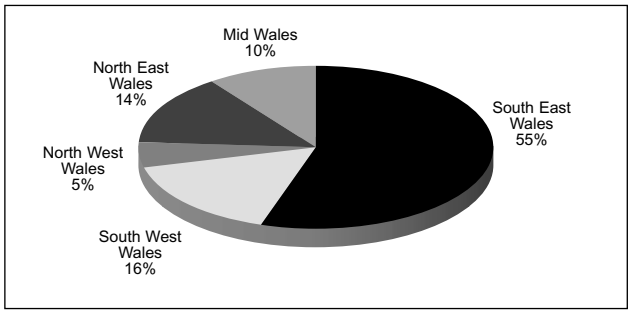
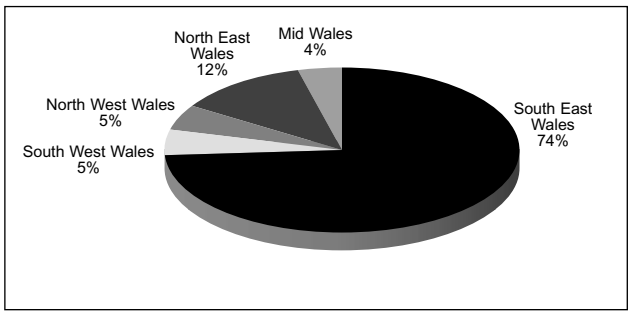


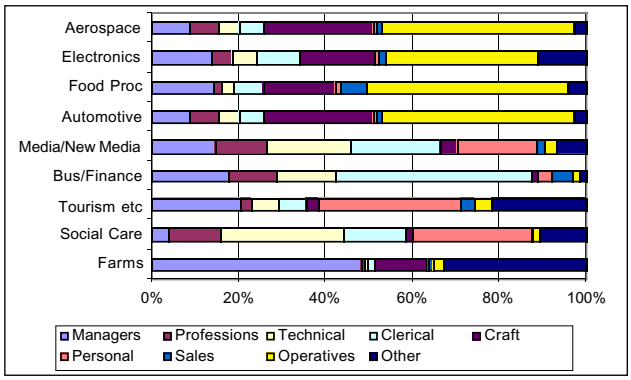
Figure 2.2: Breakdown of Employees by Location



Employment by Occupation

2.8 Recent forecasts, by Business Strategies Limited (BSL), provide an estimate of the broad occupational profile of this and the other sectors studied by York Consulting. **Figure 2.3** below compares the profiles. The electronics sector as one might expect has a relatively large proportion of operatives, but a surprisingly small number of technical staff.

Fig 2.3: Sector Occupational Profile



Source:BSL sector forecasts, 2000

2.9 A paper presenting an overview of the sectors selected for the study, the relative scale of the sectors involved and some idea of their relative importance in Wales can be found at **Annex B**.

2.10 BSL has also produced forecast data by occupation and by region for the electronics sector within Wales. The data shows that there are 62 different occupations within the electronics sector, however, 65% of total employment for the year 2000 is covered by nine occupations. These are shown for Wales and by region in **Table 2.2**. These figures confirm that the majority of employment for the sector is in South East Wales (80% of total employment) and North Wales (15% of total) with not much activity in either Mid Wales or West Wales.

Table 2.2: Regional Employment by Occupation

Occupation	Wales	SEW %	MID %	WW %	NW %
Production Managers in Manufacturing	1,850	83	2	3	12
Engineers and Technologists	1,350	86	1	3	10
Metal Machining, Fitting and Instrument Making Trades	1,660	83	2	3	12
Electrical/Elelectronic Trades	2,670	73	3	7	17
Metal Working Process Operatives	1,630	86	1	4	9
Assemblers/ Lineworkers	4,250	81	2	5	12
Other Routine Process Operatives	1,710	82	2	3	13
Plant and Machine Operatives	2,380	80	1	3	16
Other occupations, in Communications	2,100	65	5	10	20

Workforce Characteristics

2.11 There does not appear to be any reliable information about the demographic characteristics (gender, age, qualifications, part-time/full-time etc.) of the electronics sector workforce in Wales. However, the following issues were highlighted in the brainstorm sessions:

- the average age of employees in electronics companies is approximately thirty/thirty four;
- it is more difficult to recruit people aged under 25 and over 40;
- operators tend to be aged between 18 and 45;
- engineers and technicians tend to be aged between 20 and 35
- the gender ratio is fairly evenly split for operatives, but is heavily weighted towards men at the technician and engineer grades;
- a large number of operatives in electronics (as opposed to software or semiconductor employees) are employed on temporary contracts, this varies between 50% to 60%;
- the majority of operatives are sourced from the local population;
- companies are having to recruit out of area to attract technicians, graduate engineers and middle managers, and for higher electronic/software engineering skills, companies are recruiting from the USA and the Far East.

Sources of Change

Technological

2.12 It is anticipated that the UK electronics sector needs to position itself in the higher value-added 'knowledge-based' sub-sector. This sub-sector is capital and skill intensive.

2.13 This UK picture has been reflected in the brainstorm sessions with electronics and semiconductor companies in Wales. In particular the following issues were identified:

- a number of technological drivers for change emanate from large parent companies in Japan and Korea. Whilst it is a difficult task there may be a need for a forecasting model that addresses this issue of technological change on a global basis;
- digital TV technology will impact most areas of the sector;
- whilst changes in technology will have an impact, the core skills in electronics remain the same.

Competitive

2.14 The UK sector is dependent on large-scale manufacture of TVs, PCs etc but competition is increasing, squeezing margins and during the year 2000 Euro tariffs will be reduced to zero.

2.15 The perspective from companies in Wales is similar with global manufacturing cost competitiveness having an effect on manufacturing efficiency. This has an impact on skills especially at a supervisor level. There is an increasing need to identify competent operators who have the ability to become supervisors. These people are required to know the manufacturing process inside out and are able to solve problems and identify efficiency gains.

2.16 Customer demand was highlighted by both groups as a driver for change. Companies need to invest in capital and skills "just to stand still".

2.17 Short-term de-skilling was identified as an issue and is occurring in response to skill shortages and recruitment difficulties. This is having an impact on technician and junior engineer occupations.

2.18 The cyclical nature of the semiconductor sub-sector was highlighted as a weakness and continued growth, investment and planning was identified as a way out of the 'boom and bust' scenario.

2.19 The relative strength of Sterling compared to the Euro is having an impact and some firms may be considering moving their manufacturing operations to central Europe. Sony and Matsushita have already transferred some operations to the Czech Republic and Poland. Aiwa has also transferred some production back to Asia.

Regulatory

2.20 The main impact of the regulatory environment appears to be focused on maintaining existing recognised quality standards and responding to European legislation such as environmental regulation, the working time directive, data protection issues, unionisation etc.

Sector Activity

2.21 The companies that we have consulted with are acutely aware that there is increased competition for scarce high quality labour within the sector. This being the case, employers are keen to ensure that the demand for skills is communicated to the relevant public agencies.

2.22 South Wales Education For Industry Consortium (SWEFIC) is a collaborative forum of five colleges that has responded to the needs of the electronics sector by developing the successful Technician PDP Programme.

2.23 There appears to be a desire amongst Welsh electronics companies and other manufacturing sectors for increased co-operation on training issues. Mechatronics was cited as an example in one of the brainstorm sessions. The responsiveness of providers of education and training to industry demand and ensuring that there is an ongoing dialogue between industry and providers needs to be constantly under review .

Prospects for the Future

2.24 The immediate scenario for the UK is some dislocation and possible decline, followed by recovery if the necessary transition to higher value-added operation can be made. This general trend is reflected in the employment data forecasts produced by BSL Limited. The forecasts show employment levels by occupation and by region up to the year 2010. Current employment within the sector (year 2000) is estimated to be 30,250, somewhat lower than estimates produced by Cambridge Econometrics, and is forecast to be quite static, rising only by 1% to 30,490 by the year 2010. Figures produced for the four Welsh regions show a similar picture of static employment levels over the next ten years.

2.25 The forecast change in employment numbers over the next ten years for the nine predominant occupations in the sector is shown in **Table 2.3**. The data reflects themes arising out of our discussions with employers in the sector. The data indicates that there will be an increase in demand at higher qualification levels (technicians, engineers and production managers) and a modest decline in the number of assemblers/operatives required.

Table 2.3: Forecast Employment Trends by occupation

Occupation	2000	2010	Change	
			No.	%
Production Managers in Manufacturing	1,850	1,940	+90	+5
Engineers and Technologists	1,350	1,420	+90	+7
Metal Machining, Fitting and Instrument Making Trades	1,660	1,360	-300	-18
Electrical/Electronic Trades	2,670	2,230	-440	-16
Metal Working Process Operatives	1,630	1,580	-50	-3
Assemblers/Lineworkers	4,250	4,200	-50	-1
Other Routine Process Operatives	1,710	1,680	-30	-2
Plant and Machine Operatives	2,380	2,300	-80	-3
Other Occupations in Communication	2,100	2,380	+280	+13

2.26 BSL has also produced employment quotients for the electronics sector for the year 2000 and the year 2010. These figures give a feel for how representative the Welsh electronics sector is compared to the sector in the UK as a whole and are shown in **Table 2.4** below. The data illustrates that the electronics industry will continue to be an important element of both the Welsh and UK economy.

Table 2.4: Employment Quotients 2000 & 2010

		Wales Emp			
Year	**UKEmp**	**No.**	**%**	**Quotient**	**Narrative**
2000	500,980	30,250	6.04	1.40	very strongly represented
2010	523,590	30,490	5.82	1.35	slight decline, still strong

2.27 During the brainstorm sessions, participants were asked to identify the strengths, weaknesses, opportunities and threats for each of the sub-sectors. The output from these sessions is shown in **Table 2.5**.

Table 2.5: Swot analysis of the Welsh electronics sector

Strengths	**Weaknesses**
Semiconductors Determined cohesive proactive current growth area high value-added geographically clustered two world class companies cycle time/lead-time focus high-tech, clean image trendy industry - interesting for engineers image of professionals/academics non-mass manufacturing **Electronics** large companies, large employee numbers extensive supply chain **Software** high-tech high level of skills high value-added accessible to entrepreneurs	**Semiconductors** cyclical nature of industry skills shortfall (management, process/device engineers) stability potential global overcapacity **Electronics** low level of 'visible' R & D perception (and fact?) of large numbers of low skill roles lack of key skills smaller financial resources due to costs being driven down **Software** calibre of UK graduate software engineers compared to USA
Opportunities	**Threats**
Semiconductors good partnerships modular courses flotation international industry - opportunity to travel **Electronics** change the perception of low skill roles and promote the opportunities for cross-skilling and multi-skilling **Software** flotation fast growth	**Semiconductors** over capacity - redundancy/retention lack of investment in skills unable to grow quickly enough to meet demand **Electronics** global business transfer to lowest cost producers low skill levels leading to a lack of competitiveness basic educational standards **Software** ease of entry to the market scarcity of software engineers

3. Sectoral Skills Issues

3.1 The First Report from the ITCE Skills Strategy Group focused on the electronics sector and indicated that there is evidence of skills shortages constraining current performance of the sector. Additionally there is a longer term need to increase the skills base to move into higher value-added product areas. This is reflected in 'A Strategy for Electronics in Wales', published by the Welsh Electronics Forum. The document identifies the main objective for the sector as being:
"The Welsh Electronics Sector must move up the value chain"

3.2 Employment in the sector is characterised by two main occupational areas:
- operators & assemblers;
- professionals & technicians (HNC/HND, Grad, Post-Grad).

3.3 There is some evidence of skill shortages in the UK across all occupations in the sector but the key problem is attracting people at the professional/technician level. Up to 40% of hard to fill vacancies are at this level. Whilst electronics graduates are attractive to employers in a range of sectors (e.g. IT, business services), graduates from other technical backgrounds are not necessarily suitable for the electronics sector. This UK message is reinforced by consultees across all three sub-sectors in Wales.

3.4 Whilst there has been an expansion in Higher Education entrants during the 1990s, the numbers of young people pursuing degrees in electronic-related subjects has fallen. A factor may be that young people perceive that sectors such as IT are higher paid. There is a concern amongst Welsh electronics companies that fewer students are taking Maths and Physics at A Level, which are highly desirable qualifications for entrants wishing to pursue degree courses in electronics.

3.5 Employers are looking for good key skills and commercial awareness as professional staff are expected to take on responsibility at an early stage. Some companies we consulted with are concerned that professional staff and especially graduates are not in a position to add value to the business from day one.

Vocational Skills

3.6 In the brainstorm exercise, companies were asked to separately identify current vocational skills issues and skills issues that are likely to have an impact in the future. It is important to note that the terms operator/assembler, technician and engineer are not interchangeable between the electronics industry and semiconductor industry. We have therefore reported the responses separately.

3.7 Common issues across the sector include:
- the need to attract more women with technical and engineering skills;
- there is a scarcity of software engineers with C++, Java and HTML programming skills;
- there is a need to develop and implement clear career paths within companies to attract and retain technical staff;

- there are concerns about the lack of people taking maths and science as post-16 options at school, which will have an impact on the numbers of technicians/engineers in the future;
- there is a difficulty in gauging and identifying the particular skills needs of SMEs.

Electronics - Current Skills Issues

3.8 The 'Strategy for Electronics in Wales' report produced by the Welsh Electronics Forum identified two broad priorities to enable the sector to move up the value chain:

- tailoring support to encourage business development and growth;
- raising the skills base and perceptions of the sector.

3.9 Under the second of these two priorities the following skills issues are identified:

- create a pipeline of new potential employees;
- attract world-class engineers, managers and entrepreneurs;
- aggressively upskill the entire workforce;
- retain existing employees.

3.10 There are skills issue at all levels from operator/assembly level right through to engineering grades. A number of companies identified that quality awareness and cost awareness are skills that are required at all levels. There needs to be a perception that all employees can have an impact on the quality and cost of the product.

3.11 The concerns are more acute with technical grade staff and include the need to attract more experienced technicians, multi-skilled engineers and digital engineering skills. There is a concern that it is becoming more difficult to attract the required level of engineering competence at cost competitive levels.

3.12 The need to develop operators who can improve the production process is a key skills need for the electronics firms that are involved in mass production.

3.13 Other skills shortfalls/difficult to fill vacancies, specifically at technician level, include skills associated with digital technology, surface-mounting and auto-insertion skills.

Electronics - Future Skills Issues

3.14 The future skills issues identified fell into the following three groups:

- innovative action skills to improve and make the manufacturing process more efficient;
- developing and/or acquiring skills to meet the impact that digital products and associated changes will have on the manufacturing process;
- skills needed to implement process change on a corporate scale linked to the introduction of new products.

Semiconductors - Current Skills Issues

3.15 There are skills shortages at a technician/engineer level including:

- test technicians;
- process engineers;
- customer support engineers;
- development engineers.

3.16 A straw poll within the semiconductor sub-sector identified the following demand within the next six months:

- 100 operators;
- 80 technicians;
- 50 engineers.

3.17 Graduate recruitment was highlighted as an area of concern. In particular there appear to be few graduates with the appropriate technical knowledge and there are clear gaps in technical as well as management skills. Additionally the majority of graduates want to work in R & D and do not want to work the shifts that the manufacturing side of the business requires.

3.18 There is very little relevant education in the UK for compound semiconductors.

3.19 Other skills issues that were identified include skills gaps in Computer Aided Design (CAD) and computer programming and a concern about the costs of vendor training. The semiconductor industry relies on industry specific skills which inevitably means that people are recruited from other industries and retrained.

Semiconductors - Future Skills Issues

3.20 It is anticipated, as is indicated by the UK research, that production will move to more value-added products and processes. This will require more people with advanced technical skills (technicians/engineers) in the future.

3.21 The need to ensure a regular stream of young people taking maths/science options is of particular importance as some companies wish to develop their pool of future process engineers using the "raw material of graduates and school leavers".

Qualification Levels

Supply of Manufacturing and Engineering Qualifications in Wales

3.22 The latest comprehensive figures on the provision of qualifications in the Welsh FE and HE sectors are published by the Wales Funding Councils and relate to the academic year 1997-98. They describe provision which will generate skills and qualifications which typically became available to the labour market from late 1998 and (in the case of students in the earlier years of three year courses) in 1999 and 2000. Figures for 1998/99 should be published in late 2000.

FE Qualifications

3.23 Approximately 4% of FE students (16,543) aimed for Engineering qualifications. In addition around 1% (5,441) of students were pursuing qualifications relating to manufacturing.

3.24 These proportions are broadly reflected in the figures for the Welsh regions (**Table 3.1**). There are

Table 3.1: FE Enrolments in Manufacturing/ Engineering by Region 1997/98					
	SE	**W**	**Mid**	**N**	**Totals**
Manufacturing	1,697 1%	2,721 3%	174 1%	849 1%	5,441 1%
Engineering	7,204 4%	3,728 4%	824 3%	4,787 5%	16,543 4%
Totals	**8,901**	**6,449**	**998**	**5,636**	**21,984**

slight variations: manufacturing qualifications, for example, are more strongly represented in West Wales, and engineering in the North, perhaps reflecting the emphasis of local demand.

3.25 As for the rest of the UK, Wales displays a strong gender bias to this enrolment pattern. Of those seeking engineering qualifications, almost 94% (15,506) were male. This contrasts, for example, with the case of IT qualifications, where males represented just under 43% of the students enrolled.

3.26 For 1997/98 and the succeeding years, this total of 21,984 students enrolled will form the main input (from Further Education) of new skills and qualifications which are specific to the manufacturing sectors. This input will be complemented by entries to manufacturing of FE students with less sector specific qualifications and skills in, for example, sales and marketing, science and mathematics, or IT.

HE Qualifications

3.27 In Higher Education, student enrolments are recorded for Engineering and Technology. The total enrolled for these qualifications in Welsh Higher Education Institutions in 1997/98 was 7,800. These enrolments are concentrated in institutions in the South-East and South-West of Wales (**Table 3.2**). The main exception is the North-East Wales Institute, with 857 enrolments, though Bangor also has 233 enrolments in these subject areas.

3.28 Again, there is a very pronounced gender bias in terms of enrolments - 92% of students in this subject area are male. Only 1.6% of female students are enrolled in these subjects, as against 15% of male students.

3.29 In 1997/98 a total of 990 first degrees were awarded in Engineering and Technology by Welsh Higher Education Institutions (HEIs), mostly by full time and sandwich study. A further 776 other undergraduate qualifications were awarded, the majority via part-time study, giving a total of 1,766 awards at undergraduate level. Postgraduate qualifications were awarded in 256 cases.

3.30 A short paper estimating the total number of qualifications awarded per annum in manufacturing and engineering matched against demand can be found at **Annex C.**

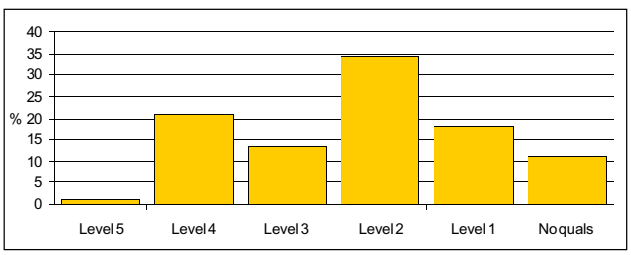
Qualification Profile for the Sector

3.31 The Labour Force Survey (LFS) produces estimates of qualifications by Standard Industry Classification (SIC) code. These have been used to produce workforce qualification profiles for each of the sectors studied in the FSW Sectoral Skills project. These need to be treated with caution, as in many cases sample sizes are inadequate to provide firm estimates.

Table 3.2: Engineering & Technology Enrolments, 1997/98		
Institution HEI	**Enrolled in Engineering & Technology**	**Total Enrolled at HEI**
University of Glamorgan	2,014	15,148
University of Wales Aberystwyth	0	9,743
University of Wales Bangor	233	10,017
Cardiff University	1,394	20,294
University of Wales Lampeter	0	2,313
University of Wales Swansea	1,323	13,085
Univ. Wales Coll. Of Medicine	0	3,208
Univ. Wales Institute Cardiff	415	7,853
Univ. Wales College Newport	976	7,757
North East Wales Institute	857	4,952
Swansea Inst. of Higher Ed	588	4,272
Trinity College Carmarthen	0	1,590
Welsh Coll. of Music & Drama	0	599
Total for Welsh HEIs	**7,800**	**100,831**

3.32 The LFS profile for the electronics sector is shown in **Figure 3.1**. The figure shows that the sector has a large percentage of the workforce qualified at craft level (Level 2) and a fifth of the workforce are qualified to degree level (Level 4).

Fig 3.1: Estimates of Highest Qualifications



3.33 One of the issues we have identified is the need for more people qualified at supervisory level (Level 3). This will be largely achieved by upskilling those employees currently qualified to NVQ Level 2. This issue has also been identified in the automotive sector, and to a lessor extent, the aerospace sector.

3.34 Just under a third of the workforce is qualified at NVQ Level 1 or lower. A similar trend is evident in the other manufacturing sectors and whilst the situation is not as pronounced as in either the

automotive or food processing sectors, there is a need for progression, and in some cases, starting on the learning ladder.

3.35 The move to digital products will have an impact on consumer electronics manufacture and contract manufacture and associated changes to the manufacturing process. There will be a need to upskill current employees to take these changes into account. Additionally, the move to digital products will mean that process change will take place on a corporate scale linked to the introduction of new products.

Key Skills

3.36 The key skills issues that have been identified by Welsh companies include:

- attitudinal skills issues, particularly at graduate level;
- some evidence of numeracy and literacy deficiencies at all levels;
- lack of courses in generic IT skills within the workplace.

Management Skills

3.37 The brainstorm sessions led to the following management skills issues being identified (see **Table 3.4**).

Table 3.4: Management Skills Gap

	Graduate	Technician	Operator
Software	time management, problem solving	N/A	N/A
Semiconductor	problem solving	problem solving communication	communication
Electronics	supply chain management skills	first line supervisor competence, production planning skills	none identified

3.38 The semiconductor companies we consulted with identified developing management and leadership skills as a critical issue within their industry.

IT Skills

3.39 IT skills issues identified include:

- software design;
- a massive shortfall from basic Microsoft applications to web design;
- CAD - design and development;
- basic PC skills to facilitate web access.

3.40 There appears to be a skills gap in terms of general IT skills across professional grades within the workforce.

3.41 The scarcity of software engineers and retaining them once they are recruited is an ongoing issue for all three sub-sectors.

Case Studies

3.42 For the final part of this section, we use four case studies to highlight specific examples of the current and future skills needs within the Sector.

Case Study - Ubiquity Software Corporation

Simon Gibson and Michael Doyle started Ubiquity in 1994. Their vision was that the future of the interface between telephony switches and electronics would reside in software and not hardware. By 1997 the company had grown to 12 employees, received its first injection of venture capital and moved to its present premises in Langstone Park, Newport. Ubiquity's products include proxy-server software, application services brokerage and software applications. The company's clients are predominantly based in the US and Scandinavia and include Ericsson, 3Com and Cisco Systems. The company's expertise resides in exploiting the commercial benefits of Session Initiation Protocol (SIP).

Ubiquity currently employs 55 staff, 48 of which are based in Newport, with the remaining 7 employed in

the company's Canadian site in Kanata, Ottawa. Twenty of the employees based in Newport are software engineers and their skills are the 'lifeblood' of the organisation. In the future it is anticipated that engineers will constitute 90% of the workforce.

The company is in receipt of mezzanine-finance venture capital worth £28 million. The primary business objectives in the medium-term are to quadruple staff size and open two sales offices in the United States.

Technology is a key driver for change and a start-up company with a handful of good quality software engineers could enter this niche market. It is therefore of paramount importance that the company recruits and retains high calibre software engineers with the technical and commercial skills required to compete in an increasing competitive market place. The quality and skills within the company has a direct relationship to the value of the company with each additional engineer contributing between £0.5 million and £1 million.

Ubiquity requires people with Java and C++ programming skills. Unfortunately these skills are in short supply and large companies in the sector (e.g. Worldcom and Hewlett Packard) tend to 'sweep up the talent'. The company wishes to recruit 150 people within the next 18 months, 100 of which will be software engineers.

It is important that the software engineers who are recruited have a fundamental understanding of the programming languages and can apply lateral thinking and problem solving techniques to their work. In addition, management skills are critical for the ongoing success of the company. These skills include time management; task management, business management, commercial awareness and being able to solve problems at source.

In the early days of the company's development, the software-engineering workforce was recruited through friends and family. More recently engineers have been recruited from Cardiff University and Bristol University. Universities in the UK do not appear to be teaching undergraduates the skills that mean that they are able to add value on day one of their employment and new graduates expect to be spoon-fed.

In order to recruit the required number of software engineers, the company is looking beyond the immediate locality and expanding the recruitment net to include the rest of the UK and the United States. Ubiquity has retained a firm of recruitment consultants to act as a single agent for the recruitment process. Experience has shown that from 75 CVs received, approximately one third of these candidates will be suitable and of these, about half (12) will be invited for interview.

Case Study - Pinacl Communication Systems Ltd

Pinacl is based in Kinmel Park, Bodelwyddan, near St Asaph in North Wales and has other offices in London, Ayr and New York. The company is split into four divisions, two of which are products-based and are heavily dependent on recruiting personnel with the right mix of technical and management skills to drive these divisions forward. The divisions are:

- the provision of fibre-optic cable for datacoms and telecoms applications;
- the provision of higher added-value telcoproducts, for example access multiplexers, access ethernet, and digital video codecs.

The company has recently invested £1.5 million in its fibre optic cable manufacturing plant increasing production capacity by 300%. Turnover in this division has tripled in the last 6 months. This has enabled the company to capture 20% of the UK datacomms market. Technology is a 'given' in this sector and providing a fast, flexible and responsive service to clients is Pinacl's unique selling point.

The company employs 500 people, 140 of which are employed at Kinmel Park. This site has very low turnover of staff and recruitment at lower skill levels is not a difficulty. There is an increasing trend towards home-working and personnel with higher skills levels are commuting from Chester and Manchester. Approximately 20% of head office staff commute in from other areas.

The main skills difficulties that the company faces relates to recruiting staff to specialised positions. Examples include IT professionals and Electronics Development Managers. In order to attract the required calibre of staff, salaries are pitched slightly higher than the industry norm.

The company faces a dilemma in recruiting specialist engineers. Recruiting an engineer and then providing vendor training (e.g. CISCO) can cost £12k per annum. But as soon as the engineer is trained they are highly marketable. In order to 'buy in' the expertise, the company has to pay a premium in terms of salary, maybe two to three times "normal" salary.

Another source of recruitment difficulty is finding electronics managers. It took over a year to source an Electronics Development Manager. Placing adverts in the electronics trade press and using a recruitment specialist resulted in a disappointing response. The person with the required skills (an electronics lecturer) was recruited from a local college.

Pinacl is a member of the Opto-Electronics Forum and Pinacl's Business Development Director is a former Chairman of the Group. The Forum has submitted a European Objective One funding bid to develop a Business Incubation Centre at St Asaph Business Park.

Case Study - IQE plc

IQE plc is the world leader in the supply of custom epiwafers to the compound semiconductor industry. The company was formed in May 1999 by the merger of Epitaxial Products International (EPI), Cardiff, Wales and Quantum Epitaxial Designs (QED), Bethlehem, Pennsylvania. IQE is currently undergoing a major expansion programme and has vacancies for operators and technicians as well as equipment and process engineers at both junior and senior levels.

IQE require people who have a firm grasp of the 'first principles' of semiconductor technology and are also able to apply theory to practical situations. Apart from technical skills IQE requires individuals who are lateral thinkers and problem solvers and as IQE is growing very quickly, potential employees need to be able to embrace change.

Finding people with the right mix of technical and problem solving skills is a difficulty at graduate level and for Senior Engineer and Technical Manager positions, IQE is actively pursuing suitably qualified candidates from across the UK and overseas.

Part of the recruitment process involves encouraging applicants to consider Wales as a good place to live and work. Staff retention is very good and people who make the move tend to stay.

IQE has been involved in University Roadshows at Cardiff, Nottingham, Strathclyde, Surrey and UMIST but the response from graduates has been disappointing. One of the difficulties appears to be attracting materials science graduates to a process-orientated working environment that will involve shift work. The perception of engineering/manufacturing is also a barrier. Additionally, a number of graduates wish to work in R & D, from the outset of their careers.

IQE is committed to training its workforce and realises that new graduates will need to be moulded so that their skills can start to add value to the company. Apart from the cost of training there is also an opportunity cost of both the trainee and trainer not contributing to production, for the period of training.

Some of the solutions to this recruiting dilemma for IQE include:

- producing a short video that presents the quality of life aspects of living in Wales, that can be given to candidates;
- changing the perception of engineering and manufacturing. This can only be achieved by a concerted effort by industry and government at both regional and national level;
- promote links between universities and the semiconductor industry to ensure a steady stream of graduates with the right mix of technical and employability skills.

Case Study - LG Electronics Wales Ltd

LG Electronics Wales Ltd. (LGEWA) opened its site in Newport in January 1997 and production started in November 1997. The company employs 2,000 people, 70% of whom are operators with the remaining 30% being managers, team leaders, supervisors, technicians, engineers or administration support staff. The plant manufactures PC monitors and associated components, specifically Colour Display Tubes, Colour Picture Tubes and Deflection Yokes. The LG Electronics group, including LGEWA and it's parent and sister companies around the world manufacture current plus second and third generation technology components in the colour monitor market.

The prospects for the industry are currently very positive with LGEWA competing with major international players for future investment. The parent company has recently invested in Mexico, China and Turkey. The high value of sterling is having an impact on trading and whilst the company has always been set up to trade in Euros, uncertainty over the currency is a concern.

The main drivers for change are:

- There is a pressure to cut manufacturing costs and get the product to the target market much more quickly, both locally in Wales and globally;
- Provide higher added-value product portfolio to offset, in part, the higher wage costs in Wales compared to elsewhere;
- One of the main technological drivers is the speed of product specification and product design change.

The company has three factories with widely differing vocational skills requirements. The tube plant focus is on process skills and knowledge including chemical based knowledge, mechatronics and process flow management. The assembly plants focus is predominantly about manual dexterity with optimisation of labour resource allocation .

LGEWA has a number of skills issues that are currently being addressed including:

- **First Line Supervisory Management Development** - ensuring that the right people receive training to be competent and confident in these positions;

- **Key Skills** is an issue at all levels from operator through to management. A recent example is that some engineers are struggling with the numeracy elements of a 6 Sigma programme that is being delivered. A recent visit to Korea confirmed that the basic levels of numeracy and literacy are higher at the parent company;

- Instilling the parent company's challenging **ethos of speed and teamwork** through "innovation, openness and partnership" at all levels within the company. This process has started through induction training but it is important that this attitude and mindset becomes the norm. Allied to this is developing a **'quality' mindset** for all employees encapsulating the relevant world class manufacturing principles and techniques centred again on effective team working (functional and cross functional).

Issues Arising out of the Case Studies

3.43 The case studies demonstrate the diversity that exists within the electronics sector within Wales. Each company is facing different technological and competitive pressures that results in a common issue, the need to attract and retain people with skills required to meet business objectives.

3.44 Each of the companies is not acting in isolation and is either a member of the Welsh Electronics Forum or the Opto-electronics Forum.

4. Action on Skills

4.1 Whilst there are a number of skills issues facing the electronics sector as a whole there are important differences in terminology and emphasis between the electronics, semiconductor and software sub-sectors. A skills strategy embracing these differences needs to be developed and communicated both within the sector and to key policy-makers.

4.2 The Welsh Electronics Forum (and the Opto-Electronics Forum) provides an ideal vehicle for closer integration and partnership between the key public and private sector players in the sector. The skills strategy for the electronics sector needs to be able to integrate with similar strategies for other manufacturing sectors and the national economic development strategy.

4.3 Below we highlight the key skills themes and recommendations for the electronics sector in Wales. A number of these issues are common to other manufacturing sectors (especially automotive and aerospace) emphasising the need for closer collaboration between these sectors.

Themes

1. The most acute skills issue is the **availability of the required experienced technicians and engineers** to meet current and projected future demand.

2. Implementing 'cost-down' activities has a direct **impact on skills at a supervisor and team leader level**. Developing **management skills** to support this process is also required.

3. Prevention of short-term **de-skilling** which occurs in response to skill shortages and recruitment difficulties. Complex tasks are being broken down into a series of lower-skill tasks. This process is especially prevalent in the semiconductor sub-sector and needs to be managed carefully.

4. There is a need to ensure that a **steady stream of graduates** (with the right skills and experience) continue to enter the sector. Specifically there is a **shortage of specialist skills e.g. software process engineers** with C++, HTML and JAVA programming skills. One software firm has projected a demand for an additional 100 software engineers over the next 18 months.

5. Employers across all sub-sectors in Wales expect to train graduates engineers and, to a lessor extent technicians, over a period of time before they begin to add value to the business. There is a perception that **the technical and commercial skills being taught at University/College do not meet industry requirements.**

6. The **perception of the engineering industry** is still a barrier to potential entrants. This includes students at school who are deciding not to choose maths/science subjects as well as graduates who are choosing IT-related rather than manufacturing careers.

7. The report focusing on the supply and demand for digital training (ERES, 1999[A]) indicated that attracting employees to Wales is not an issue. By contrast, our consultations have highlighted that this is a problem area particularly in higher skills. Even attracting engineers from Bristol can be a difficulty.

8. Basic skill levels across all positions and employability skills for graduates have been highlighted as ongoing skills issues.

9. The impact of moving from an analogue to a digital environment has already had an impact on the semiconductor industry and will continue to have an impact on the consumer electronics industry.

10. The cyclical nature (boom/bust scenario) of the semiconductor industry requires cross-sectoral planning.

Current Actions

4.4 Electronics companies within Wales are aware of the following initiatives that are addressing some of these skills issues at varying levels:

- Technician Personal Development Plans - developed through a partnership of representatives of the semiconductor manufacturing sector in South Wales, education (further and higher), awarding bodies, NTOS and TECs. The initiative was supported by the Welsh Office as part of the Action Plan for Manufacturing in Wales;
- team leadership programme;
- manager development;
- process controller development;
- implementation of internal company development paths.

Recommended Actions

4.5 Consultation with companies in the sector in Wales identified a number of potential actions. In addition, the potential ways forward identified by the ITCE Skills Strategy Group are also considered. These actions are grouped under the ten themes and are described below and shown in **Table 4.1**. A number of these activities are either already happening, are being piloted or being considered by key partners.

Theme 1

4.6 There are five recommended actions which seek to stimulate the number of technicians and engineers entering the sector and to ensure that their experience matches the requirements of the industry. The first action (**1a**) is focused on upskilling the existing technician workforce by continuing and improving the Technician PDP programme. This programme, in its pilot form, has proved to be effective.

4.7 Recommendation **1b** seeks to ensure that technical students receive more relevant work experience to complement the technical training they receive at college/university. Work placements already exist but tend to be offered by the larger companies in the sector. In order to achieve a 'critical mass' of work placements, SMEs need to be encouraged to participate.

4.8 Closer links between industry and universities are needed (recommendation **1c**) in order for employers to have more input into curriculum development, and to enable universities to be more responsive to the changing skill needs of the sector.

[A]The Market Demand for and Supply of Digital Training, Final Report, ERES, 1999.

Table 4.1: Themes & Recommendations matrix

Theme No:	Rec. No:	Action	Timescale	Key Partners
1	1a	Ensure that funding is available to embed and develop the Technician PDP programme beyond March 2001 and that lessons learnt from the pilot are integrated into delivery	on-going	CETW/SWEFIC
	1b	Consider work placements for technical students and incentives for SMEs offering places	2000/2001	FE Colleges/ HEIs/WEF
	1c	Develop closer links between employers and universities to ensure that the curriculum advances at the same pace as the technology	2000/2001	HEIs/WEF
	1d	Consider introducing a bursary scheme at HNC/D and degree level along similar lines to the current scheme offered to PGCE students who study more 'difficult' subjects	2000/2001	NAW
	1e	Develop effective careers information and promotional materials, it is important to attract more young people and women to the industry	2000/2001	WEF
2	2a	Ensure the Team Leader training programme is embedded and developed.	on-going	CETW/EMP
	2b	Consider cross-company sector mentoring at management/ team leader level	2000/2001	NTOs
	2c	Implement a cross-industry modular management development programme	2000/2001	NTOs
3	3a	Ensure that there are clear progression routes are developed and implemented within individual companies	on-going	WEF
4	4a	Implement the graduate development programme	2000/2001	WEF
	4b	Consider more sandwich students/innovative approaches to attracting graduates	2000/2001	HEIs/WEF
	4c	Courses to include more blocks of good quality employment-based training and incentives for SMEs offering places	2000/2001	FE Colleges/ HEIs/WEF
	4d	Employers need to consider what salaries and progression they need to offer to attract the best graduates and experienced engineers	on-going	WEF
	4e	Consider ways of keeping overseas graduates in the UK	2000/2001	WEF
5	5a	Develop closer ties with NTOs (EMTA, ITNTO etc)	2000/2001	NTOs/WEF
	5b	Audit NVQs/course curriculum against industry needs	on-going	NTOs
	5c	Develop better liaison/more formal links with colleges and universities	2000/2001	FE Colleges/ HEIs/WEF
	5d	FE & HE should develop industry-focused centres of excellence	2000/2001	FE Colleges/ HEIs/WEF
6	6a	Actively seek partnerships with local schools and EBPs	on-going	EBP/WEF/CETW
	6b	Proactively offer teacher/pupil/student placements and incentives for SMEs offering places	2000/2001	EBP/CETW
	6c	Promote sector plans and prospects to schools, young people and communities	2000/2001	EBP/Careers
7	7a	Develop an advertising aimed at individuals	2000/2001	WEF
	7b	Develop a sector pack and sub-sector packs	2000/2001	WEF
	7c	Develop sector/sub-sector web pages with links to fora and electronics companies	2000/2001	WEF
8	8a	Work with the Basic Skills Agency to implement common definitions and tests in recruitment and training needs analyses	2000/2001	NTOs
	8b	Develop pre-recruitment short courses focused on developing core technical skills and employability skills	2000/2001	NTOs
9	9a	Implement the main recommendation of the ERES report i.e. to second/contract an individual to act as a facilitator/marketeer	2000/2001	NAW
10	10a	Encourage a broad skills mix which is interchangeable between industries	2000/2001	NTOs
	10b	Team Wales to capitalise on the strategic planning role of sector forums	2000/2001	CETW
	10c	Investigate the possibility of developing short courses to enable operators, technicians and engineers to switch between manufacturing sectors e.g. mechatronics	2000/2001	NTOs

4.9 As well as ensuring that the required skills and experience are being developed there is a need to boost the number of entrants to the sector at technician/engineer level. A bursary scheme (recommendation **1d**) along similar lines to the existing scheme for PGCE students for more 'difficult' subjects is likely to have a positive impact.

4.10 Recommendation **1e** proposes that sector specific information and promotional materials are developed and targeted at young people (and especially women) to make the sector more attractive to the potential future workforce.

Theme 2

4.11 The need to develop supervisory level skills has already been recognised. The current Team Leader training programme needs to continue (recommendation **2a**) as it seeks to meet this known need.

4.12 Useful lessons can be learned from the experience of those companies that are already upskilling their supervisors/team leaders (recommendation **2b**). It is also recognised that lessons can be learned from companies within the manufacturing sector as a whole (recommendation **2c**).

Theme 3

4.13 A number of companies we have spoken to have stressed the importance of ensuring that there are clear progression routes (recommendation **3a**) within companies so that all employees are working towards a higher skill level.

Theme 4

4.14 The Welsh Electronics Forum has recognised that recruiting and retaining graduates is critical if the sector is going to move into higher value-added products by developing a graduate development plan (recommendation **4a**). Attracting more graduates into the sector may be achieved by offering more sandwich placements (recommendation **4b**) and blocks of employment-based training (recommendation **4c**). SMEs may need to be offered incentives in order to encourage them to participate.

4.15 Some employers are experiencing difficulties in recruiting graduates with specialist skills (e.g. C++, HTML and JAVA programming). Reviewing salary levels and progression routes (recommendation **4d**) and considering ways of keeping overseas graduates (recommendation **4e**) will be needed to attract the best.

Theme 5

4.16 Ensuring a good match between the commercial/technical skills being taught at University/College and industry requirements can be achieved by having a closer dialogue with National Training Organisations (recommendation **5a**), periodically auditing the curriculum against industry standards (recommendation **5b**) and developing more formal links with academic/learning institutions (recommendation **5c**). Further and Higher Education institutions should also be encouraged to develop centres of excellence that seek to meet the requirements of industry (recommendation **5d**).

Theme 6

4.17 A number of the misconceptions about the engineering and manufacturing industries are formed at an early age. Developing links with schools/ Education Business Partnerships (recommendation **6a**), offering teacher placements (recommendation **6b**) and promoting the electronics sector as a legitimate (and exciting) career option (recommendation **6c**) can be effective ways of generating interest with the younger age group.

Theme 7

4.18 All sectors need to work together to promote the benefits of living and working in Wales. Advertising focused on persuading individuals to relocate (recommendation **7a**) and developing sector specific information in various media (recommendations **7b** and **7c**) may be necessary.

Theme 8

4.19 Basic skills and employability skills have been identified as an area requiring specific attention. Developing closer links with the Basic Skills Agency (recommendation **8a**) and developing short courses to address basic (and employability) skill deficiencies (recommendation **8b**) will be a good starting point.

Theme 9

4.20 The ERES report into the demand and supply of digital skills identified the need to second/contract an individual with the appropriate skills to undertake the role of facilitator/marketeer (recommendation **9a**) for the sector

Theme 10

4.21 Recent history has shown that the cyclical nature of the semiconductor sub-sector can have a dramatic impact on both employment and skill levels. Reducing the potential impact could be achieved by encouraging the development of skills that can be used in a variety of sectors (recommendation **10a**), planning on a strategic basis (recommendation **10b**) and developing specific courses to enable employees to use their skills in other sectors (recommendation **10c**).

Potential Impacts of Action

4.22 The impact of successful action must be to maintain the competitiveness of the sector. This can only be done by allowing the sector to move into higher value-added areas, based on a higher skills base than currently available.

Recommendations for Future Research

4.23 More specific research is needed on the demographic characteristics of the Welsh electronics workforce. This should make provision for specific findings for the component parts of the sector, including electronics, semiconductors and software.

4.24 It is thought that a number of the skills issues identified are being acutely felt by the large number of SMEs in the sector. However, there is little evidence to support this assertion, as the active members of the Welsh Electronics Forum tend to be the large players. Research is required to fully investigate the skills requirements of SMEs and integrate potential solutions within the wider skills strategy for the sector.

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Annex B: Welsh sectors in context

A Brief Overview of the Relative Size and Importance of Welsh Sectors

This paper presents an overview of the sectors selected for study within the Future Skills Wales Sectoral Skills project. It aims to give the relative scale of the sectors involved and some idea of their relative importance in Wales.

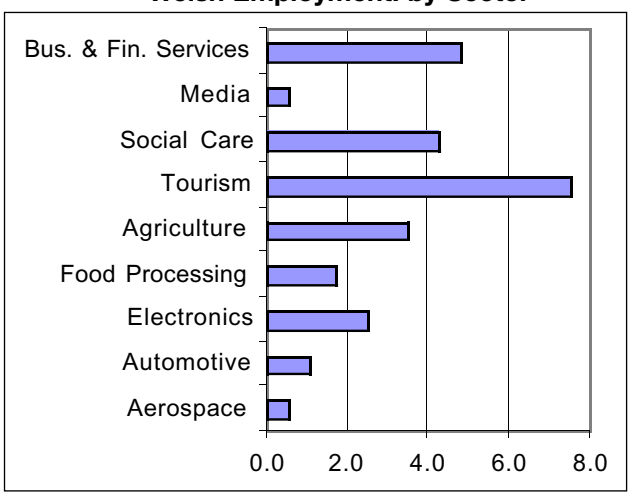
The data on employment used in this section is taken from the latest estimates from Business Strategies Limited (August 2000). Data on business units are taken from NOMIS. Some of the values given (for example for the number of businesses within Wales, or the size of the workforce, for a given sector) will not agree with estimates or calculations from other sources. This is due to differences in the detailed definitions of sectors, or in methods of estimation. However by using one source in this discussion, consistency in measurement or estimation is established, and better comparability is ensured. This is appropriate since here we are concerned with the relative sizes of sectors and their workforces, as much as with absolute numbers.

Sector Size: Workforce Numbers

Figure B.1 shows the employment figures for each of the sectors (employees and self employed) as a percentage of the total for Wales. By this measure Tourism, Leisure and Hospitality is the largest of the selected sectors, followed by Business and Financial Services, Social Care, and Agriculture and Farm Enterprises.

Together, the nine sectors selected for study in this project provide work (either as employees or in self employment) for around 26% of people working in Wales. This indicates the scope and potential importance of the exercise for the understanding of skills issues in Wales and the formulation of policy responses. (The rest of employment in Wales is accounted for by a large public sector, including government, education and public sector healthcare, and by the primary, construction, transport and distribution sectors, including retail).

Figure B.1: Employment as a percentage of Welsh Employment: by Sector

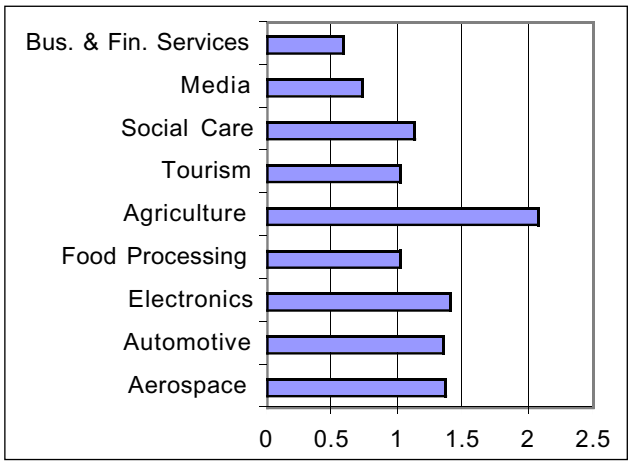


Source: BSL FSW Sector Forecast

Employment Location Quotients

Figure B.2 provides a different view of the sectors, in terms of their importance within Wales relative to the UK as a whole. It does this by comparing the employment location quotients for the sectors. Employment location quotients are used to express the degree to which employment in a given sector is located in a selected region. To calculate a location quotient, an average percentage is first calculated for all employment in the region. Using the BSL estimates, for example, one finds that 4.3% of all employment in the UK is located in Wales.

Figure B.2: Employment Location Quotients for Wales: by Sector



Source: BSL FSW Sector Forecast

Therefore, if employment in a given sector is distributed evenly over all regions of the UK, one would expect 4.3% of its employment to be in Wales. The sector's Welsh employment percentage, at 4.3%, will be equivalent to the average employment percentage for Wales.

To calculate the employment location quotient, the sector's percentage is expressed as a ratio of the Welsh average percentage. For example if a sector has 5.2% of UK employment, the employment location quotient will be the ratio of 5.2 to 4.3, or 1.2. Quotients of more than 1 therefore indicate over-representation of employment in the Welsh sector relative to the UK as a whole. Quotients of around 1 indicate that employment in the sector in Wales is much as one would expect given the overall distribution of employment across the UK; and quotients below 1 indicates that the sector in Wales is relatively under-represented in terms of employment.

Figure B.2 shows that the strongest Welsh sectors, in these terms, are Agriculture, plus three of the manufacturing subsectors - Automotive, Aerospace and Electronics Manufacturing. UK employment is relatively concentrated in Wales for these sectors, despite the fact that some of them are small in relation to Welsh employment as a whole (Figure B.1). The Social Care sector also shows employment strength, while Food Processing and Tourism, Leisure and Hospitality are approximately in line with the Welsh share of UK employment.

Media and New Media, and the Business and Financial Services sector, are both under-represented in Wales in employment terms, with employment location quotients well below 1.

Sector Size: Number of Businesses

An alternative method of comparing sectors is by the number of business units in each sector. This can be less straightforward than the employment location quotient method used above. Here we are using data on business units in Wales and for Great Britain as a whole, provided in NOMIS. The main difficulty is the definition of a business unit within the published figures. This does not make a distinction between separate businesses, and locations representing branches or sites within one business. It also omits small 'one-person' business sites without formal employees.

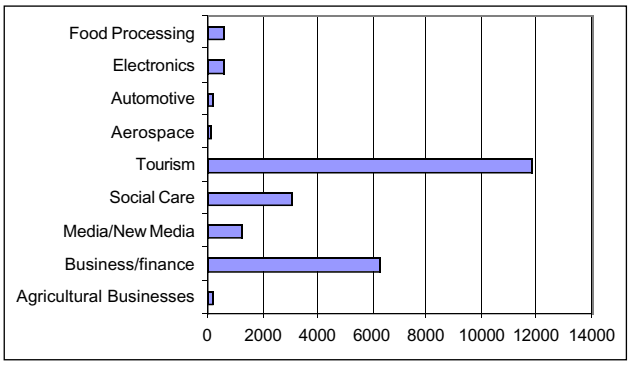
This means, in particular, that these figures are apt to be misleading as applied to the agricultural sector, since they represent agricultural businesses with employees, rather than all farms. They therefore greatly under-represent the number of agricultural enterprises in Wales. Although the business unit figures for agriculture have been included in the following analysis, they are therefore **not a reliable guide to agricultural sites in Wales**.

Figure B.3 shows the sectors studied in terms of the number of business units in Wales. It shows that, by this measure, the Tourism, Leisure and Hospitality sector is by some way the largest. According to the NOMIS figures, this sector contains 12.4% of all Welsh business units, - around 1 in every 8.

A further 6.6% of Welsh business units are in the Business and Finance sector, and 3.2% in Social Care. The next largest sector, Media and New Media, includes a large number of businesses classified under 'Other computer related services'. Many of these may be 'New Media' businesses within our study definition. Others, however, may be providing services which are not relevant within this definition. As explained above, the figures for agriculture do not represent the farming sector accurately.

In total the sectors covered by the study account for over 25% of business units located in Wales.

Figure B.3: Number of Business Units – Selected Sectors



Source: NOMIS

Site Location Quotients of Welsh Sectors

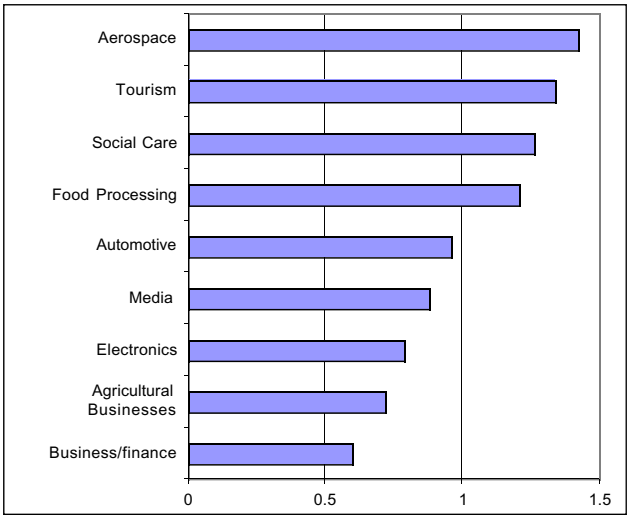
Figure B.4 shows the site location quotients calculated for the sectors covered by this study. These are calculated as for the employment location quotients used earlier, but using business unit figures instead of employment numbers. Four of the sectors have quotients greater than 1. In other words, these sectors are 'over-represented' in Wales relative to what one might expect taking Great Britain as a whole. These quotients represent a degree of concentration of business units in

these sectors within Wales. These sectors are Aerospace, Tourism, Hospitality and Leisure, Social Care, and Food Processing.

The Automotive Manufacturing sector in Wales, with a location quotient of 0.96, is close to the size one might expect (in terms of numbers of business units). In other words, Wales has 'a fair share' of business units in this sector, according to these NOMIS figures. At the other end of the scale, the Business and Finance sector, with a site location quotient of only 0.6, is under-represented within Wales - confirming the findings of the first Future Skills Wales study in 1998.

Again, the quotient for 'Agricultural Businesses' reflects the limitations of the method, although it may indicate that Welsh farms and agricultural businesses tend to be smaller than the average for Great Britain, inasmuch as fewer of them are large enough to be included as business units.

Figure B.4: Site Location Quotients



Source: NOMIS

Selection of Sectors for the Study

The above discussion sheds light on the reasons for selecting this set of nine sectors. The reasons vary, but can be simply expressed as follows (some sectors are selected for more than one reason):

- sectors with significant proportions of Welsh businesses and/or workforce (Tourism, Business and Finance, Social Care);
- sectors which are important components of manufacturing industry within Wales (Aerospace, Electronics, Automotive, Food Processing);
- sectors which are relatively strong in Wales (Aerospace, Tourism, Social Care, Food Processing);
- sectors which are relatively weak in Wales, but are important for future growth (Business and Finance, Media/New Media);
- sectors with particular significance for Welsh culture and communities (Agriculture, Media/New Media).

The Manufacturing Sector

Manufacturing has been more important in the Welsh economy than for the UK as a whole. In 1998 employment in manufacturing (including but not limited to the sectors studied in this project) accounted for 19.7% of Welsh employment. This contrasted with 16.6% for the UK - a difference of 3.4 percentage points. Projections for 2004 show manufacturing employment as a lower percentage of employment in both cases - 17.3% in Wales, against 14% for the UK. Although the percentages are smaller, the difference between Wales and the UK, at 3.3 percentage points, remains almost unaffected. (DfEE, Skillsbase/IER, June 2000).

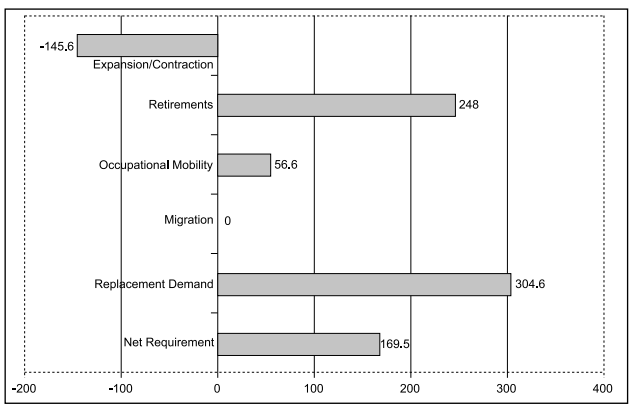
Although these projections show a fairly significant decline in the size of the manufacturing sector as a percentage of overall Welsh employment, the absolute numbers involved change less significantly. This is due to a projected rise in the total numbers employed in Wales over the period 1998-2004. Thus, the figure of 227,000 for those employed in manufacturing in 1998, becomes 205,000 in 2004 - a decline of 22,000, or just under ten percent.

When considering the future demand for skills it is important to keep in mind that, as illustrated above, relative decline in the manufacturing sector does not imply lack of future demand for manufacturing skills. This was one of the insights behind the original Future Skills Wales project methodology.

This point is further illustrated by the replacement demand projections for occupations associated with manufacturing. **Figure B.5** shows the replacement demand projection for skilled metal and electrical trades (SOC 52) for the period 1998-2004, across the UK. In this period, 145,600 jobs in these trades are expected to disappear - part of the overall decline in employment in manufacturing noted above. However, losses from these trades are projected consisting of 248,000 from retirement, and 56,600 from occupational mobility (movement into other jobs), a total of 304,600 workers to be replaced. This more than offsets the effects of declining employment, leaving a net requirement figure of 169,500. This represents the requirement for new, trained entrants to these trades in these six years. These may be new entrants to the workforce, or existing workers who have upgraded or added to their skills and qualifications.

Based on the assumption that Wales would require about 4.5% of this number (this being the approximate size of the Welsh workforce relative to that of the UK), this implies a net requirement for some 7,600 skilled metal and electrical tradespeople over this period for Wales.

Figure B.5: Replacement Demand: Skilled Metal and Electrical Trades, 1998-2004 (UK)



Source: DfEE Skillsbase/IER

Annex C: Supply and demand of manufacturing and engineering qualifications in Wales

The Supply of Manufacturing and Engineering Qualifications in Wales

It is far from straightforward to produce meaningful figures on the provision of skills in relation to sector skills needs. However it is at least possible to look at the provision of qualifications in the Welsh FE and HE sectors, and to examine the profile of these in relation to overall demand in the manufacturing sector in Wales.

The latest comprehensive figures on Welsh provision are published by the Wales Funding Councils and relate to the academic year 1997/98. In other words they describe provision which will generate skills and qualifications which typically became available to the labour market from late 1998 and (in the case of students in the earlier years of three year courses) in 1999 and 2000. Figures for 1998/99 should be published in late 2000.

The 1997/98 figures for all of Wales show that within Further Education, around one per cent of students were pursuing qualifications relating to Manufacturing. This represents some 5,441 students from a total of 398,044 enrolled at Welsh FE institutions. (These figures and those below are based on both full and part-time student enrolments). In addition to this, approximately 4 per cent of FE students (16,543) aimed for Engineering qualifications.

These proportions are broadly reflected in the figures for the Welsh regions (**Table C.1**). There are slight variations: Manufacturing qualifications, for example, are more strongly represented in West Wales, and Engineering in the North, perhaps reflecting the emphasis of local demand.

As for the rest of the UK, Wales displays a **strong gender bias** to this enrolment pattern. Of those aiming for Manufacturing qualifications, 83% were male (4,529). Of those seeking Engineering qualifications, almost 94% (15,506) were male. This contrasts, for example, with the case of IT qualifications, where males represented just under 43% of the students enrolled.

For 1997/98 and the succeeding years, this total of 21,984 students enrolled will form the main input (from Further Education) of new skills and qualifications which are specific to the manufacturing sectors. This input will be complemented by entries to manufacturing of FE students with less sector specific qualifications and skills in, for example, sales and marketing, science and mathematics, or IT.

In Higher Education, there are no comparable figures for Manufacturing related subjects, but student enrolments are recorded for Engineering and Technology. The total enrolled for these qualifications in Welsh Higher Education Institutions in 1997/98 was 7,800. These enrolments are concentrated in institutions in the South-East and South-West of Wales (**Table C.2**). The main exception is North East Wales Institute, with 857 enrolments, though Bangor also has 233 enrolments in these subject areas.

Table C.2: Engineering & Technology Enrolments, 1997/98

Institution	Enrolled in Engineering & Technology	Total Enrolled at HEI
University of Glamorgan	2,014	15,148
University of Wales Aberystwyth	0	9,743
University of Wales Bangor	233	10,017
Cardiff University	1,394	20,294
University of Wales Lampeter	0	2,313
University of Wales Swansea	1,323	13,085
Univ. Wales Coll. Of Medicine	0	3,208
Univ. Wales Institute Cardiff	415	7,853
Univ. Wales College Newport	976	7,757
North East Wales Institute	857	4,952
Swansea Inst. of Higher Ed	588	4,272
Trinity College Carmarthen	0	1,590
Welsh Coll. of Music & Drama	0	599
Total for Welsh HEIs	**7,800**	**100,831**

Again, there is a very pronounced gender bias in terms of enrolments - 92% of students in this subject area are male. Only 1.6% of female students are enrolled in these subjects, as against 15% of male students.

In 1997/98 a total of 990 first degrees were awarded in Engineering and Technology by Welsh Higher Education Institutions (HEIs), mostly by full time and sandwich study. A further 776 other undergraduate qualifications were awarded, the majority via part-time study, giving a total of **1,766** awards at undergraduate level. Postgraduate qualifications were awarded in **256** cases.

There are no comparable published figures for **awards** by subject area from FE. Estimation of qualifications awarded per annum in Manufacturing and Engineering would need to take account of the average length of courses and the retention and attainment rates for these subjects. From the 22,000 students enrolled, for example, assuming two year courses, a retention rate of 83% (the average for all subjects), and an attainment rate of 60% (actual rates vary between 49% and 70% by qualification type), we can construct a rule-of-thumb estimate for annual output of these qualifications by FE. This would be 11,000 x 0.83 x 0.6, or 5,480 awards.

Table C.1: FE Enrolments in Manufacturing/Engineering by Region 1997/98

	SE	W	Mid	N	Totals
Manufacturing	1,697 1%	2,721 3%	174 1%	849 1%	5,441 1%
Engineering	7,204 4%	3,728 4%	824 3%	4,787 5%	16,543 4%
Totals	**8,901**	**6,449**	**998**	**5,636**	**21,984**

Taken with the 2,000 outputs from HE, this gives a figure of around **7,500** qualifications in manufacturing, engineering and technology subjects per annum at all levels. A complication is the relative lack of data on student destinations. Especially for Higher Education awards, students receiving the relevant qualifications may leave Wales before entering employment. This may be partly balanced by inflows of Welsh students who have completed studies at other UK universities. Therefore this is in many ways a rough estimate, but it does provide some basis for comparison with the size of the manufacturing sectors now and in future.

To this figure we also need to add qualifications obtained via non FEFCW funded provision - primarily vocational qualifications gained in sixth forms, and those gained via study with employers and private sector training providers, funded by the Welsh TECs. The yearly cohort size for pupils aged 18 or over leaving Welsh schools is around 12,000 (*Digest of Welsh Statistics*, 1999, National Assembly for Wales/Government Statistical Service, Table 3.2). However most of these will leave with non-vocational qualifications and skills; no figures for vocational awards were available at the time of reporting.

We do not have a comprehensive set of figures for qualifications gained, by vocational subject area, via TEC funded provision. Figures provided by Mid Wales TEC and South East Wales TEC suggest that a total of around 1,000 students per annum enter manufacturing related vocational courses in these two regions (at Modern Apprentice and National Traineeship level: adult training not included). Given the preponderance of the population in the South-East, one might assume that not more than another 1,000 per annum enter across West and North Wales. This gives a maximum estimate of **2,000** per annum for possible outputs of learners with manufacturing specific vocational skills and awards from TEC provision.

Taking all the key sources of supply, therefore, we arrive at a rough estimate of 9,500 for the annual supply of new people with manufacturing specific skills and qualifications.

Manufacturing Sector Employment Demand

We can compare these estimates for annual supply with the BSL forecast for job opportunities in Wales, included in the original Future Skills Wales report. **Table C.3** shows gross job opportunities per annum in occupations which are closely related to the qualification subject areas analysed above (The Future Skills Needs of Wales, All Wales Report, Table 6.8). These figures take into account the effects of expansion or contraction in these occupations as well as retirement or movement out of the occupations due to occupational mobility.

The table shows that the forecast for new entrants needed in these largely manufacturing-specific occupations was **18,200** per annum - almost double our estimate of the annual supply of people with directly relevant and newly acquired training and qualifications.

Manufacturing Specific Skills/Qualifications: Supply versus Demand

Given that our estimate of an annual supply of 9,500 is roughly correct, this implies that the remaining 8,700 new entrants to these occupations per annum will fall into one of the following categories:

- people with no training or qualifications;
- people with training or qualifications not in relevant vocational areas;
- people with relevant training and qualifications from outside Wales.

To this extent, one might speak of a mismatch between supply and demand for vocational manufacturing skills in Wales. However, more qualitative evidence from employers suggests that they are often concerned about the quality of skills on offer, rather than the numbers of people applying with qualifications in the right area and at the right level. We must be cautious, therefore, in drawing conclusions about the need to change the balance of provision, based on the estimates presented here.

There is little in the analysis to suggest that the relationship between supply and demand will be significantly different in different Welsh regions. It does suggest, however, that the supply of people with manufacturing qualifications is strongly biased towards males - a situation which is unlikely to assist in the elimination of existing gender imbalances in the manufacturing sector workforce as a whole. In particular it would seem that workers with relevant qualifications - and therefore a better chance of progressing within the workforce - are much more likely to be male.

This attempt to analyse the fit between supply and demand has indicated some of the difficulties arising from limited current availability of provision data, and some of the complexity inherent in this task. While such an analysis can probably not provide a complete and accurate basis for provision planning (which, anyway, will be strongly affected by student demand), it does serve to indicate the relative scales of provision and occupational and sector needs. In the case of manufacturing, it provides food for thought about the balance of provision.

Table C.3: Forecast of Who Will Take Up Job Opportunities in Wales, 1997-2007 (000s per annum)

Occupation	Gross Job Opportunities p.a.	People already working in Wales	Others (new entrants)
Skilled Engineering	3.7	1.8	1.9
Other Skilled Trades	7.9	3.7	4.3
Industrial Operatives	14.4	6.8	7.5
Drivers/ Machine Operatives	5.6	1.1	4.5
Total	**31.6**	**13.4**	**18.2**

Source: FSW All Wales Report, BSL 1998 (ONS and LFS data)

Notes

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