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How companies adapt and react

Hilary Steedman, Karin Wagner, Jim Foreman

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Hilary Steedman
Centre for Economic Performance, London School of Economics and Political Science

Karin Wagner
Fachhochschule für Technik und Wirtschaft, Berlin

Jim Foreman
Centre for Economic Performance, London School of Economics and Political Science

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Anglo-German Foundation for the Study of Industrial Society/
Deutsch-Britische Stiftung für das Studium der Industriegesellschaft
34 Belgrave Square, London SW1X 8DZ
Tel: +44 (0)20 7823 1123 Fax: + 44 (0)20 7823 2324
Website: www.agf.org.uk

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Executive summary

This study analyses and assesses the contrasting national strategies associated with skill supply for information and communication technologies (ICT) in Britain and Germany. We also examine the impact of these strategies on firms and assess the usefulness to companies of skills at different qualification levels. Finally we point to policy implications for change in publicly financed ICT skill supply strategies that emerge from this analysis.

The study is based on published statistical sources and on interviews with some 90 firms in Britain and Germany, drawn from four sectors: financial services, retailing, motor manufacture and software development. Half the interviews were carried out face to face by two researchers, one from Germany and one from Britain. The remainder were interviewed by one researcher over the telephone. The resulting data were logged and analysed.

The study points to important differences between countries in external constraints, originating in the education system, on the supply of highly educated ICT graduates and graduates in cognate disciplines. These have led to substantially different recruitment and training policies.

In Britain the supply of graduates increased substantially in the latter half of the 1990s and early 2000s. The supply of graduates from ICT degree courses increased even faster. This has been made possible by a high level of responsiveness from universities (providing additional places) and students (choosing courses where demand from industry is high). In addition, government funding has met part of the cost of expansion, and low drop-out and short (three-year) courses have meant that lead times for skill production from universities are relatively short.

In Germany, by contrast, there has been no expansion in numbers entering universities and applied universities (FHS); universities and FHS have not been able to find places for all those who applied to study computer science. The very long lead times to degree qualification (between five and seven years) and high drop-out rates have resulted in very low numbers qualifying at the time of particularly high demand around 1999/2000. While numbers studying have now increased substantially, those students will qualify in 2006/7 at the earliest.

Company approaches to recruitment in the two countries have been structured and conditioned according to different traditions of occupational identity. In Britain occupational identity is relatively weak except in certain recognised professions (law, medicine etc.) and the older industrial crafts. Employees in the service sector are used to carrying out a variety of tasks as required and are also used to shifting into new areas of work. Firms adopt a flexible approach to the recruitment of skilled employees. New employees are recruited on the basis of relevant experience, and those hired straight from university frequently hold qualifications that are unrelated to the job they are expected to do. Firms expect to provide this latter group with substantial training and place them in 'starter' positions within larger teams, where they can acquire relevant knowledge and experience.

Most of the German firms visited adhered to the occupational model of competence, whereby each employee is expected to own and apply a recognised set of skills for the occupation trained for and practised within the firm. While this model may well lead to greater breadth and depth of technical competence, it undoubtedly creates difficulties when a flexible response is required to adapt to fast-moving technological change. Furthermore, it was observed that the model can create difficulties in integrating new employees from abroad and new employees without the recognised occupational preparation – for example those from 'conversion' courses.

These factors – the unresponsiveness of higher education and the occupational competence model – were, in our opinion, important reasons for the difficulties German companies experienced in recruiting the skilled employees they were seeking in the late 1990s.

However, these same difficulties have also spurred German companies on to work together to 'bypass' the universities and create a system of skill production – apprenticeship and continuing work-based training structures – that is more flexible and offers the prospect of training large numbers of highly skilled ICT employees. Some 60,000 are currently in training and will undergo principally work-based training and constitute a pool of work-ready employees at lower cost than graduates. While graduates will still be needed and recruited, company-based skill production will provide for many of the middle-level posts which had previously proved difficult to fill.

British companies have benefited from a relatively plentiful supply of graduates and a flexible approach to skills. Individual companies have invested heavily in training new employees and upskilling existing employees to combat skill shortages. However, because companies were able to 'get by' on the basis of these strategies, there has been little concerted action on the part of companies to tackle future skill shortages comparable to that undertaken by German companies. This lack of concerted action by firms has led to companies bearing much of the training costs for new recruits and losing that investment a few years later when employees move to self-employed status. In Britain only around 3,000 young people are in IT apprenticeship schemes.

In both countries public institutions generating high-level skills are of prime importance to all companies requiring specialised ICT practitioner skills. When, as is the case in Germany, importing skills or outsourcing work is more difficult for linguistic and cultural reasons, the power of these institutions to restrict or open up the supply heavily constrains companies' ability to respond to new business opportunities. Britain benefits from the universality of the English language and strong cultural links to the Indian and Asian sub-continents. Importing skills and outsourcing is less problematic. However, a plentiful supply of relatively unspecialised graduates has shaped company behaviour in Britain, leading to training investment from which the individual benefits more than the company and a lack of standardisation of qualifications and experience.

Introduction

The use of information and communication technologies (ICT) to organise business processes and information in the UK dates back to 'Leo', the first business computer device constructed for the catering and food-producing company J. Lyons in the early 1950s (Land, 1999). However, it is generally considered that the impact of these technologies on business productivity and growth was not felt until considerably later. New communication and faster information retrieval and manipulation possibilities opened up in the early 1990s, with the advent of in-house networking and faster and more powerful electronic communication, including direct communication between data capture and data manipulation devices.

The extent to which the potential of these technologies was exploited for the automation of many business and manufacturing processes (e.g. updating of customer accounts in financial services, improved inventory management in manufacturing) in advanced industrialised countries was undoubtedly driven by the heightened competitive environment of the last quarter of the 20th century. Entirely new types of economic activity – for example software development and, more recently, web page design and web server support – assumed much greater relative weight. More established sectors of economic activity (such as retailing, financial services and manufacturing) increased investment in ICT and consequently expanded ICT-related employment. The Organisation for Economic Co-operation and Development (OECD) estimates that employment in computer and related activities in the UK was 115 per cent higher in 1999 than ten years earlier (OECD, 2001).

Using an occupational measure developed by Dixon (Council of European Professional Informatics Societies – CEPIS, 2002), Germany has fewer ICT practitioners than Britain: 550,000 in Germany compared to 850,000 in Britain. ICT practitioners represent 1.45 per cent of total employment in Germany and 2.1 per cent of service employment. In Britain the corresponding figures are 2.33 per cent and 3.1 per cent respectively. In this study we consider evidence for the view that the supply of specialist ICT skills may have contributed to constraining ICT growth in Germany relative to Britain.

The aim of this study is to analyse and assess the contrasting national strategies of ICT skill supply in Britain and Germany, to examine the impact on firms and to assess the usefulness to companies of skills at different qualification levels. Policy implications for change in publicly financed ICT skill supply strategies will be drawn from this analysis.

In order to examine the impact of skill supply policy on firms, around 90 firms in Britain and Germany were interviewed. These were selected at random from trade literature and the internet in four sectors: financial services, retailing, motor manufacture and software development. In this way we hoped to cover users of ICT in services and manufacturing together with a specialist ICT sector. Around half of the firms originally approached agreed to be interviewed within the timeframe of the project. Half the interviews were carried out face to face by two researchers, one from Germany and one from Britain. The remainder were interviewed by one researcher over the telephone. In both cases a structured questionnaire was used and, in the course of discussion, core questions and issues were put to our respondents in the companies in both countries. The resulting data was logged and analysed.

A full report of our research is published as *Centre for Economic Performance Discussion Paper No. 575* and can also be downloaded at:
http://cep.lse.ac.uk/pubs/default2.asp?pubyear=2003.

This summary report is structured as follows:

- Summary of trends in the supply of skills in the core ICT study areas supported in whole or in part by public funding
- Comparison of important government initiatives to improve skill supply in Britain and Germany
- Report on companies' skill procurement and deployment strategies based on the results of our visits to companies in the two countries
- Discussion of policy implications and conclusions.

1 Trends in the supply of ICT skills

1.1 Skill supply from higher education

In Britain, the skill supply is characterised by:

- A rapidly expanding university population
- An above-average increase in students on ICT courses but with lower than average A-level points scores
- Three-year first degree (Bachelor) courses
- Low university drop-out rates
- Almost no use by companies of apprenticeship programmes
- Increasing use of work permits to import ICT skills
- Extensive use of contractors and outsourcing.

The skill supply in Germany is characterised by:

- A relatively small number of students completing university courses in computer science, with a long study period of between six and eight years
- Graduates from applied universities (FHS) studying for four years and often spending two six-month periods working in companies
- An increasing number of apprentices
- Difficulty in attracting/integrating employees from other countries to work in Germany under the Green Card arrangements
- Substantial use of contractors and some outsourcing.

In 2001 the output of computer science graduates from German universities and FHS institutions was in the region of 6,000. In Britain in the same year some 20,000 – more than three times as many – computer science graduates left university with two-year diplomas, first degrees or postgraduate qualifications. Of these, some 16,000 had first or higher degrees. **This puts Britain ahead of Germany by a factor of 2.5.**

The relatively low numbers qualifying at graduate level in computer science have had an important impact on the skill supply strategies of German companies. German companies pay higher real starting salaries to graduate entrants than their British counterparts and continue to experience concerns about future supply. The pool of contractors available to German companies is smaller than in Britain, probably as a result of the relative scarcity of graduates.

The German language is a barrier to employment of non-German speakers in ICT occupations, even though English is the working language in ICT. As some German companies pointed out to us, employees still need to communicate with other colleagues and customers and to fit into the working environment. Lack of knowledge of the

German language had proved a significant barrier. Because of this, German companies considered that they were losing out to Anglo-Saxon countries in the competition to attract good ICT practitioners from abroad, precisely because foreign workers usually had English as a second language and preferred to work in an English-speaking environment. However, the situation has eased since 1999/2000.

German companies have thus faced a much lower supply of university graduates with computer science degrees than British firms. Together with the difficulty of recruiting from overseas, this may well be an important factor in the lower numbers in ICT occupations in Germany. This problem has been greatly compounded by German companies' reluctance to recruit and train graduates from disciplines not connected with computer science – an approach that is common practice in Britain.

The very long lead time taken to produce graduate-level skills in Germany and the high drop-out rate have combined to create a very low annual output of ICT graduates. Numbers have now been expanded, but increased supply will not be available for some years yet. Shorter courses and lower drop-out in Britain have led to a steady increase in ICT graduates.

An important advantage of the British system is that there is flexibility to move from first to postgraduate degree (Bachelor and Master are usually consecutive courses). It is also possible to change between subjects when moving from the first to the postgraduate degree. Those with a first degree and some years of experience often return to university for additional one- or two-year courses to attain a Master degree.

In Germany the courses at traditional and applied university (FHS) are parallel and take at least four years; changeover between subjects is cumbersome and time-consuming and rarely occurs. However, the introduction of newly designed Bachelor and Master courses in Germany will eventually lead to greater opportunity for subject change and higher graduate output. So far only a small number of students have graduated from these shorter degree courses: two Bachelor and 15 Masters graduates in 2001.

Compared to Britain, an advantage of the German system is the requirement of internships at FHS. This leads to an early contact of the students with companies and provides experience of the world of work, facilitating an easier recruitment process if the student subsequently enters a job at this company. Consequently this will reduce the training costs for the company. This effect is strengthened when the student also writes his/her thesis at the same company.

The length of German degree courses means that universities cannot react in a timely fashion to changes in market demand. This, together with high attrition rates, leads to wasteful use of public resources devoted to higher education in Germany. At the same time the government incurs heavy costs of further training courses for unemployed graduates. To reduce the attrition rates the government has announced measures to improve the provisions for studying.

1.2 Skill supply at intermediate skill level: ICT apprenticeships

More intense global competitive pressures and the need for flexibility and adaptability in manufacturing and commerce have led to extensive questioning of the relevance of the traditional German apprenticeship (Baethge and Baethge-Kinsky, 1998). In particular, these authors argue that companies are moving towards a flexible, more customer-oriented model of work organisation, characterised by more rigorous cost control. This requires co-operation across traditional organisational boundaries, a less hierarchical work organisation and flexible working times. They argue that this type of organisation is incompatible with the traditional concept of *Beruf* (occupation/profession), which defines the individual's status in relation to other employees as well as his/her 'ownership' of a defined area of skills and action.

The development and application of ICT was characterised by all the elements identified as emerging from the more competitive environment of the 1990s. The decision in Germany in 1997 to establish four new apprenticeship occupations in the ICT field of economic activity was widely perceived as a test of the 'innovative potential' of the German 'dual system' (its apprenticeship system): could the concept of *Beruf* be redefined as a dynamic, process-oriented qualification that would allow employees to adapt to the rapid pace of change and highly competitive environment of ICT activity (Ehrke, 1997; Schelten and Zedler, 2001)?

Institutional rigidities affecting the supply of graduate skills in Germany and the associated higher costs help to explain German employers' strong support for the initiative to increase the number of young people entering a career in ICT through the apprenticeship route. German employers co-operated with the government and with the trade unions in planning the curriculum and regulations governing the new apprenticeships. Since the apprenticeships were launched in 1997, German companies have recruited and trained some 50,000 young people in the three-year apprenticeship programme; a further 60,000 are currently in training.

The new qualifications were developed in about a year, in contrast to the accepted wisdom that the development of apprentice qualifications was an inevitably lengthy and cumbersome procedure. Four occupations were identified, and the apprenticeship programme sought to ensure that apprentices acquire relevant and cutting-edge skills and competences. The training programme is composed of core competences and optional elements, which allow for specialised training relevant to the apprentice's training firm. Training in project management and team-building is also included, and a proportion of assessment is based on successful completion of a project. Employers were thereby given greater freedom to determine the content of the work-based training element than was the case in many traditional apprenticeships.

German employers were clear from the outset that one aim of promoting apprenticeships was to produce the skills the company needed at a lower cost. 'Skilled manpower trained within the dual system [apprenticeship] are to replace the overly costly higher education graduates' was the expectation put forward by an employer representative at a conference held in Germany (Dubiella, 2000).

While in training, German apprentices are paid around one-third of the full rate for the occupation they are training in. The data we collected on apprentice salary levels when qualified confirmed that salaries for those with completed apprentice qualifications are around two-thirds of graduate salaries. Many of the German companies with apprentices in training expected that apprentices would take on some tasks similar to those now carried out by graduates. Other companies hoped to develop a core of personnel that did not aim for fast promotion and provided stability at the base of the firm. In line with the skill matrix project for continuing qualifications analysed below, it was emphasised that apprentices would need to continue training and study. However, there was confidence that if that condition was satisfied, they would play a significant part in combating skill shortages in the future.

There is a huge contrast between employers' enthusiasm for apprenticeships in Germany and British employers' almost complete neglect of the British Modern Apprenticeship in the ICT sector. **Just under 1,000 young people started a technical ICT apprenticeship in Britain in 2001, compared to 20,000 in Germany.**

We investigated the standard required of the German and British apprenticeships to see whether a difference in the usefulness of the standard of training given could explain the difference in numbers. The expert consulted considered that the British and German standards were not grossly out of line. A good Modern Apprentice capable of attaining NVQ Level 3 could cope with most of the demands of the German apprenticeship.[1]

It is important to remember that in Germany there is no tradition of apprenticeship training in an industry as young as the ICT industry; in fact, the ICT Modern Apprenticeship in Britain was established in 1995, two years before the establishment of the four German ICT apprenticeships discussed here. A tradition of training cannot therefore explain the higher investment by German employers in apprenticeships.

British companies' neglect of apprenticeships cannot be explained by arguing that they do not need or use intermediate skills in ICT occupations. On average only around two-thirds of those employed in ICT in Britain are educated to degree level; the remaining third have almost invariably reached at least the equivalent of A-level (ISCED 3) (CEPIS, 2002). Many of the companies we visited in Britain, in particular those in the 'user' sectors, recruited young people at A-level and devoted a considerable proportion of their own resources to training them in ICT occupations. It is not therefore possible to argue that British companies do not need intermediate skills below graduate level, or that they are not interested in training at this level.

Two factors may help to explain the difference between German and British companies in their attitude to the development of intermediate skills:

1. As has been pointed out, British companies have benefited from a larger supply of graduates and have been more flexible in their attitude to employing non-ICT graduates.

[1] This comparison of standards will be explored more fully in a separate paper comparing German and British ICT apprenticeships.

2. A larger pool of contractors and a relaxed attitude to the issue of Green Cards for foreign workers have also helped to ease skill shortage problems.

British companies undoubtedly suffer from information failure in relation to apprenticeships. Hardly any of those we spoke to had heard of the Modern Apprenticeship scheme, and we therefore could not explore with them their reasons for not taking it up. By contrast, German managers we spoke to were familiar with the new ICT apprenticeships and had usually considered whether or not to take on apprentices. Considerable campaigns by the German government and the Chambers of Commerce had informed them, the public and school leavers about the new ICT apprenticeships.

However, perhaps the most important difference between the two countries is the difference in the pool of young people available to enter apprenticeships. When, as in Germany, around two-thirds of all young people expect to enter apprenticeships (with around 20 per cent of these young people subsequently entering university or FHS), the pool of those able to take on a challenging apprenticeship such as ICT is relatively large. **Thus the relatively small numbers entering university in Germany proves to be a positive advantage when promoting an intermediate skills route.** When, as in Britain, around 50 per cent of the age cohort is aiming for university on the A-level route, the pool of those able to work to the demanding standards required in an ICT apprenticeship is considerably smaller. This pool is further reduced when companies recruit young people with A-level to their own training schemes.

While the behaviour of the German companies in the face of skill shortages appears rational, that of the British companies cannot be so easily understood. We must conclude that a combination of factors explains that behaviour:

1. Companies may not have sufficient information about Modern Apprenticeships to appreciate possible advantages.
2. Anecdotal evidence from discussions with two British companies that have taken on ICT apprentices suggests that the regulations governing the assessment and certification of Modern Apprentices in Britain are burdensome and costly to companies.
3. Evidence from training providers who try to place young people on ICT apprenticeships suggests that insufficient young people with the requisite educational level are currently coming forward.

2 British and German government initiatives to encourage investment in specialist ICT skills

The very rapid development of new ICT tasks and functions within organisations and the consequent urgent requirement for employees with the necessary skills caused quite severe problems for recruitment and training within companies in Britain and Germany. Particularly in user companies, ICT departments had to be built up at a rapid pace and in a rapidly changing and developing technological environment. This meant that, unlike managers in more established departments of a business, ICT managers often lacked a base of tried and tested understanding as to how the activities of the ICT department should be allocated and managed with maximum efficiency. Furthermore, the tasks required of the ICT department were changing and evolving rapidly, making stabilisation and reflection on effective management an unattainable luxury for many ICT managers and chief information officers.

It is not surprising, therefore, that according to the National Training Organisation (NTO) for the ICT sector (formerly e-skills NTO, now e-skills uk), no commonly agreed classification of the jobs that exist in ICT or of the skills required to perform them existed at the start of the new millennium. Employers lacked a framework that they could use to measure the skills they had in-house against skills needed. The plethora of ICT qualifications meant that identifying new employees' skills and skill levels from qualifications held was exceptionally difficult.

In Britain the e-skills NTO reported that 'Employers and individuals have difficulty understanding the relative merits of the 800 different ICT qualifications in Britain, and the inter-relationships between them' (e-skills UK, 2000a). In Germany ICT managers faced similar problems: German experts reported more than 300 offers of further qualification in the ICT field, many of which were of dubious quality (Borch and Weissmann, 2002). Recruiters in the ICT field in Britain and in Germany were forced to fall back on candidates' reports of 'experience' of different applications, platforms etc. when recruiting externally. ICT staff often have no professional qualifications at all, further complicating and slowing recruitment. The lack of an agreed framework for identifying the skills needed by ICT developer and user companies also inhibited investment by individuals in further education and training in the ICT field.

The problems outlined above affected ICT development and user companies in both Germany and Britain during the 1990s. However, the higher activity levels resulting from buoyant economic conditions and the Y2K changeover at the close of the last decade led to damaging skill shortages in both countries. In the aftermath of the scramble for skills in 1999/2000, both countries initiated action to map the skills required by ICT professionals and to establish a stable framework for the development of initial and further qualifications. However, the German and UK conceptualisation of this task were radically different.

2.1 ICT skills frameworks

The German approach was based on the principle of *Beruf* (occupation/profession), which underpins all training programmes in industry and the service sector in Germany and consequently influences the structure of much work organisation in Germany. The British approach reflected the functional analysis principle that gained favour with UK employers and the British government in the 1980s and which led to the introduction of competence-based National Vocational Qualifications (NVQs).

The German APO-ICT skill matrix, developed by the *Bundesinstitut für Berufsbildung* (BiBB – Federal Institute for Vocational Training) is composed of occupational specifications in eight areas of activity, grouped to form a three-level hierarchy of qualifications.[2] Each level maps to a corresponding level of continuing education qualification (Figure 1).

The structure proposed by BiBB is designed to achieve two purposes:

1. It offers companies structured routes that employees with apprenticeship qualifications can follow in order to operate at a more autonomous level of competence.
2. It offers employees and those considering entering a career in ICT via the apprenticeship route a transparent alternative pathway to career development and graduate status.

The Skills Framework for the Information Age (SFIA), developed by the British e-skills NTO with financial support from the Department of Trade and Industry (DTI), identifies 57 skill areas which can be deployed at one or more than one of seven levels of responsibility in a total of six areas of activity (e-skills uk 2000a).[3]

Clearly, the German further training profiles and the SFIA are very different conceptualisations of the organisation of work within the ICT area. The German framework outlines a range of related skills that an individual is expected to apply in order to develop solutions, co-ordinate, ensure and advise in their own – admittedly broad – area of specialisation. The SFIA framework appears to suggest that many of the discrete skills required for ICT development and support might be exercised both at very low levels and at higher levels of responsibility and in a variety of unspecified combinations.

Unlike the German continuing education framework, the SFIA framework does not link skills to occupations or qualifications but only to levels of responsibility. This conforms

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[2] APO = Arbeitsprozesse-orientierte (work process-oriented): the continuing education qualification levels specified in the German skill matrix can only be obtained while in employment and, in most cases, the minimum prerequisite is a completed apprenticeship.

[3] Further details of SFIA are given in the full version of this report, which is published as Centre for Economic Performance Discussion Paper 575, available from http://cep.lse.ac.uk/pubs/default2.asp?pubyear=2003

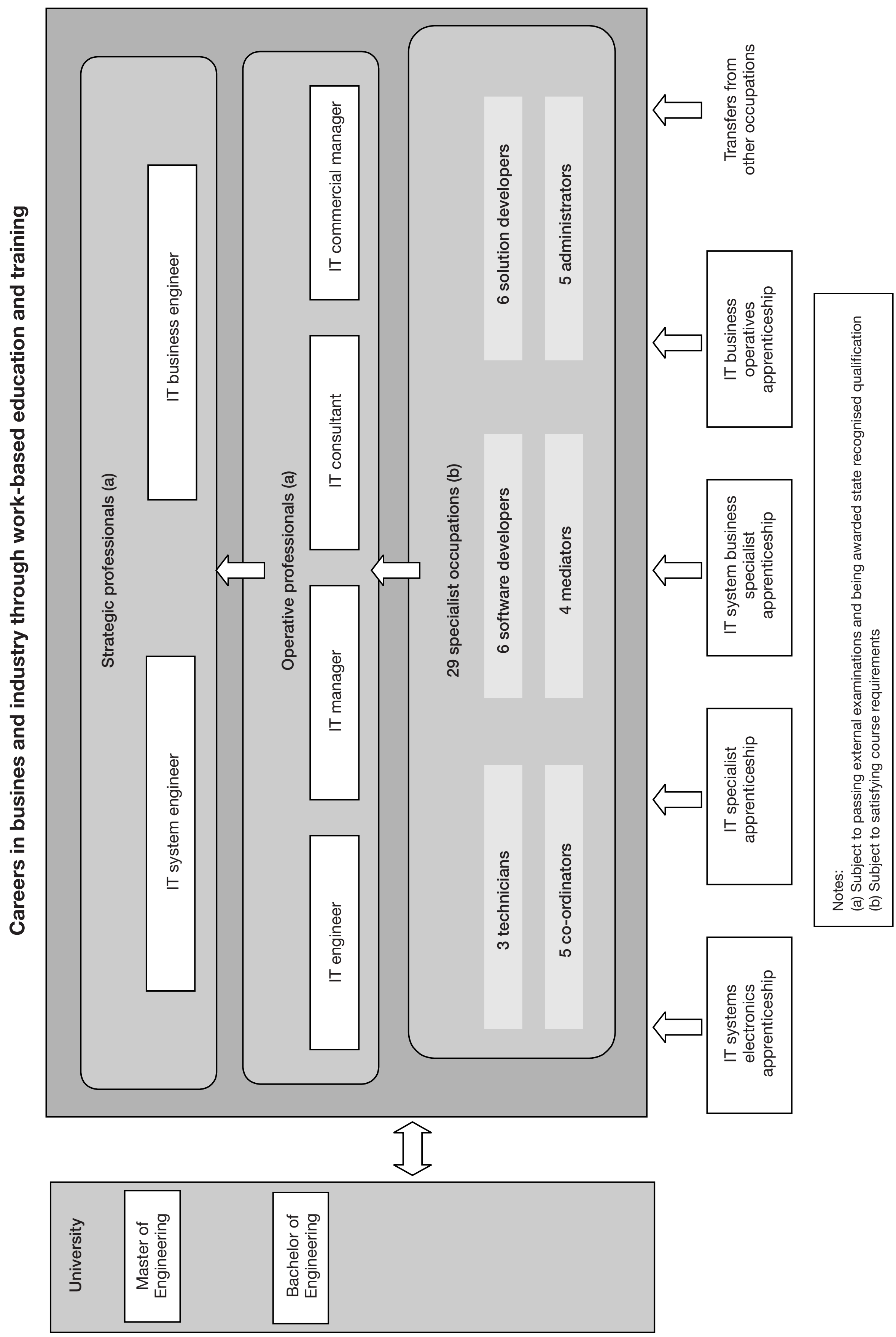

Figure 1 German APO-ICT – continuing education system

with British employers' long-standing practice of avoiding wherever possible the specification of qualifications as a condition of employment in a particular role.[4]

The ICT sector leads the way in Germany by explicitly articulating the apprentice qualification to the APO-ICT ladder of further training and qualification, agreed between employer and employee organisations and government. This provides apprentices with a clear route to qualifications recognised as equivalent to a university degree.

The German ministry and policy-makers also had a strong interest in the success of the new ICT apprenticeships, and not only because they were designed to refute the accusation that the apprenticeship model could not be adapted to 21st-century business requirements. The ministry was also concerned with the image of apprenticeships among parents and new entrants.

Policy-makers had long been aware that an emerging trend towards higher education – either following on or instead of apprenticeships – risked depriving firms of many of the well-educated entrants that were also essential to the long-term survival of apprenticeship. The ICT apprenticeship with its superstructure of further training opportunities and its promise of degree-equivalent qualifications is designed to counter that trend. Against the cost of higher education, particularly the opportunity cost of lengthy degree studies with high drop-out risk, the ICT apprenticeship claims to offer a low-cost, low-risk route to the same destination.

The APO-ICT framework therefore has a dual purpose. This route already provided a transparent progression to additional skills and skill recognition for existing ICT employees and for those wishing to switch to a career in ICT. It was also designed to encourage employees to share some of the costs of upgrading and further training by leisure time study and payment for additional tuition. But a further important innovation is the explicit intention to open up employment in ICT development and service provision to those who do not have a university degree, and to offer a route to degree equivalence through apprenticeship and a combination of work-based and off-the-job learning.

In Britain the promotion of investment in continuing education and training for ICT skills is an explicit objective of the e-skills NTO strategic plan (e-skills NTO, 2000b). However, the SFIA framework has not as yet been complemented by a framework for progression at work through continuing education and training as is the case with the German framework.

2.2 The 'skills model' versus the 'occupational model' in British and German companies

The view of career and work organisation in ICT departments and in the ICT sector in Germany, as expressed in the APO-ICT skill matrix, is based on the core concept of

[4] However, 200 of the most commonly used ICT qualifications have now been mapped to the SFIA framework. This mapping confirms the view offered above that qualifications at a variety of NVQ levels, ranging from Level 2 to Level 4, are considered appropriate for a single occupation – see http://www.e-skills.com/pdfs/sfia-ict-qualifications.pdf

occupational competence. This concept has a long history in German work organisation but has more recently been criticised as lacking the flexibility required by modern organisations. While the German model bundles together work functions into occupations and produces individuals capable of a range of functions, the British model – on which the SFIA framework is based – leaves the individual and the company freedom to develop any combination of skills. The German model could prove to be more constraining and less flexible than the British. In our visits to companies we were interested to discover the extent to which the two theoretical models were applied in practice.

German companies used a variety of strategies for managing the skills available for the tasks that need to be performed. While a few referred to fairly formal structures of three or four levels of promotion and promotion on the basis of qualifications, a larger number promoted employees on the basis of performance as evaluated in appraisals and stressed the need for individuals to take responsibility for their own career development.

All this was not, of course, incompatible with work organisation based on defined occupations. While the few German companies in our sample that were partly or wholly foreign-owned were implementing an Anglo-Saxon skill/performance-based HR model, evidence from others suggested that most were strongly influenced by the occupational concept. German companies rarely entertained the notion – common in Britain – that an individual with aptitude could switch occupations, from, say, personnel to ICT. The German companies normally only recruited graduates with ICT or ICT-cognate qualifications such as physics and had little time for those who switched into ICT from a different degree subject by means of further training courses.

Some anecdotal evidence from the companies suggested that there was resistance to attempts to promote greater movement of employees to undertake tasks within their competence but not part of their recognised occupation. One interviewee commented that 'In Britain the manager orders what type of job has to be done; in Germany there is a big discussion if somebody has to change his job … And sometimes people leave because of this.'

Another company stressed that a conservative attitude to a change of roles within the company was more common among older workers with apprenticeship qualifications than among graduates. However, it would be wrong to give the impression that German companies generally felt constrained by the occupational model of competence. Those who complained were a small minority. It must also be remembered that German ICT employers were at the forefront of initiating action to set up new apprenticeships for the ICT industry. This support was largely echoed in the German companies visited and is further evidence that German companies do not see the occupational model of competence (as developed in the new ICT apprenticeships) as a barrier to effective work organisation. It must also be stressed that a majority of German companies in every sector made quite extensive use of contractors to meet specific skill needs, which of course provided considerable flexibility.

Just as most of the German companies did not conform to the theoretical German model of skill developed in the skill matrix, the British companies did not conform to the SFIA framework in their management of skills and work. In particular, the British companies did not normally recruit below A-level or equivalent professional experience. There was little evidence that the lowest two levels, Levels 1 and 2 (NVQ Levels 1 and 2) of the SFIA framework were much used. In fact, the organisation of work in the British companies seemed closer to the three-level German model, with A-level type entrants carrying out the more routine tasks, graduates carrying out project-type work and high-flying graduates performing strategic managerial roles.

Some British companies had sophisticated skill monitoring and audit in place so that they could plan ahead to fill skill gaps on future projects. However, this was not normally the case. More frequently the British companies carried out annual or twice-yearly appraisals, in which employees identified skills acquired and agreed on targets for additional skill acquisition. Some companies claimed that this process was left entirely to employees, who were expected to continually upgrade their skills – for example, by using the company Intranet. We were unable to ascertain how effective this was in practice.

However, from company recruitment strategies it became clear that skills acquired – whether through experience, or education plus experience – were the most important criterion on which British companies' recruitment decisions were based. All this points to the use of a skills-based model, close to the SFIA framework, as a basis for skill management.

3 Comparison of company skill procurement strategies

Companies in the two countries were faced with very similar challenges, having to respond fast and flexibly in a rapidly changing technological and competitive environment. British and German companies were keenly aware that high skill levels are vital in achieving profitable operation.

3.1 Recruitment practices

British companies were extremely flexible in their attitude to recruitment of skills. New employees were predominantly graduates; however, little attention was paid to degree qualifications once sufficient experience had been obtained. We were told that ‘the last three jobs’ were what really counted in the recruitment decision. Graduates seeking first employment could be employed from a wide range of academic disciplines, and not just from ICT or cognate courses. This obviously widened the pool of recruits to encompass those who were self-taught, had switched careers or were seeking permanent employment after a spell in self-employment. However, a fairly undiscriminating approach to recruitment led to problems in narrowing down the pool of applications and locating good-quality applicants in the pool. British companies used recruitment agencies (and incurred high costs as a result) to assist with this task. However, as a result, we surmise that shortage of skills has had less of an effect on the British than on the German companies.

It was not difficult for British companies to get work permits for skilled ICT staff, and there was a ready supply of skilled personnel overseas willing to apply. A number of British companies recruited skills from overseas or outsourced to other countries. However, British companies showed lack of innovation in recruitment practices below graduate level. Hardly any had considered taking advantage of the public funds available for ICT apprentice training in the Modern Apprenticeship initiative. Instead, a considerable number continued to meet all the costs of training for non-graduate entrants. The corollary of a flexible approach to graduate recruitment is, of course, relatively high initial training costs. British companies trained new graduate recruits for longer and more intensively than was the case in Germany, although at lower salary costs.

German companies were less flexible in their recruitment strategies. They mostly mistrusted applicants who had been through ICT ‘conversion courses’ funded by the Ministry of Employment, even when they already had a first degree. Companies sought a mix of graduates and non-graduates, as in Britain. However, they sought almost exclusively ICT graduates or those from a closely cognate discipline. This inevitably restricted the pool of potential recruits. German companies spent longer than their British counterparts locating skills, and they rarely used recruitment agencies. It was harder for German companies to persuade non-German speakers from outside Germany to apply for work permits, and lack of German language skills created difficulties for team-working etc.

We had the strong impression that German companies expected university and FHS graduates to become fully effective at a relatively high level within a short space of time. Certainly, German companies supplied much less off-the-job training to new graduate recruits than did the British. Most learning was on-the-job through projects and short seminars. It was rare for German companies to invest in graduate recruitment programmes as found in Britain in order to enlist and train top managers. This requirement was met instead by recruiting university graduates who, as stated above, had studied for at least six or seven years under the German system and were likely to be aged around 28 on graduating.

However, a number of sources of additional flexibility were used by German companies that were not taken up by British companies. German companies paid higher salaries than British companies to new graduate recruits and, perhaps for this reason, were conscious of the need to reduce costs at this level. Substantial numbers of interns (university undergraduates) were employed for three months or longer and, we were told, made a useful contribution to the company. Many German companies had taken on apprentices in the new ICT apprenticeship programmes. These non-graduate entrants would be paid only two-thirds of graduate earnings (as mentioned above) once qualified and would require no additional training once employed. While in training (usually 2.5–3 years), apprentices were paid a training allowance of around one-third of their earnings when qualified. It was hoped that, with experience and further training, apprentices could fill many of the posts currently taken by graduates.

British companies usually expected employees to cross occupational boundaries and acquire the skills needed by the company as required by the work programme. It is not clear how well this worked or how high the re-training costs were. However, few British companies complained that employees were unwilling to work flexibly in this way. Indeed, for those contemplating self-employment, a broad skills portfolio acquired while in permanent employment could become a personal asset. A number of German companies suggested that employees were finding it difficult to adjust to this sort of flexible working. However, we did not get the impression that German companies were allowing this to stand in the way of necessary restructuring.

3.2 The use of contractors in British and German companies

Contractors were used extensively in the firms visited both in Britain and in Germany. Contractors almost invariably elect their status following a period of employment as a member of an ICT department. This means that a good part of their skills portfolio has been obtained while in permanent employment. The skills obtained will have resulted in part from on-the-job experience and in part from company investment in their training. These skills, being highly transferable and portable, are then appropriated and exploited by the individual in his/her capacity as contractor. While it might be supposed that this investment would be lost to the company, it is fairly common (in England at least) for employees to change to contractor status and to stay working with the same company.

It was suggested to us in discussion with the Professional Contractors Group (PCG) (UK) that ICT staff might elect contractor status once they have achieved a certain seniority and the next career step would take them into management and away from a technical role they preferred. Others might learn from their appraisal interview that they were unlikely to be promoted further and elect for contractor status as a way of boosting earnings, at least in the short term. A desire for independence and freedom to manage one's own career is also important.

Once contractors, ICT staff have to take responsibility for their own upgrading and skill acquisition. The PCG suggested that contractors might seek out a project that gave them the chance to acquire scarce skills and lower their charges if necessary. However, we were told that as a result of Inland Revenue rules, they are unable to claim tax relief on training courses they might undertake outside of employment in order to enhance their marketability. In the current climate, with large numbers of contractors unable to find employment, it is likely that this rule contributes to skill loss among contractors in Britain, a matter which may be of concern to companies when demand for ICT contractors improves. In Germany expenses for training courses to preserve or improve skills are tax-deductible.

We were surprised to discover how widespread the use of contractors is in Germany. We had initially supposed that the well-known greater inflexibility of German employment legislation would make it more difficult for employers to take on contractors and also lessen the attraction of contracting to individuals. In fact, the total number of contractors employed in the companies visited relative to all ICT staff was 14 per cent in both countries.

3.3 Companies' links with universities

In our interviews with companies we tried to obtain an indication of formal and informal links/contacts between companies and universities. We asked whether companies tried to recruit from named universities and enquired about other types of contact.

The German companies were much less likely than the British to name universities that they were trying to recruit from. We attributed this to the very different way in which students in Britain and Germany are allocated to universities and the consequences for the distribution of ability between universities. In Britain university entrance requirements vary widely, as do types of degree course offered and academic ratings (based on research published by staff). In Germany institutions of higher education are formally divided into two groups: universities and applied universities (FHS). Students frequently choose a university or applied university in the city or region in which they live. German employers are therefore less concerned with an informal hierarchy of institutions as exists in the higher education sector in Britain. They would usually only specify a preference for a university or FHS if it offers specialist courses required by the company – for example, one of the German car companies interviewed expressed a preference for electrotechnical training from a particular German university.

We enquired in the German companies whether there were differences in performance and capabilities between university and FHS graduates. Scarcely any German companies expressed a preference for university graduates over FHS graduates, and some made no distinction at all. Where views were expressed on the comparative strengths and weaknesses of the two groups, university graduates were considered to have good analytical skills and to be particularly well-suited to project management and strategic thinking. FHS graduates were recognised as having good specialised skills and a more practical approach. It appears that the skills of the two types of graduate are to some extent complements rather than substitutes.

British companies were much more likely to name specific universities from which, ideally, they would prefer to recruit. Usually this choice appeared to stem from a desire to screen applicants for ability, using university attended as a proxy, rather than from a requirement for specific skills.

All this should be put in a wider context, however. German companies were more likely than the British to be prepared to recruit new employees straight from university, and qualifications were taken seriously. Views and practice in British companies were very variable. Some British companies stated that they 'only looked at experience, not qualifications' and/or emphasised that they could not see any advantage in recruiting students from ICT degree courses as opposed to students from other (non-cognate) disciplines. Other British companies, usually those with graduate entry programmes, professed themselves well satisfied with the quality of graduates recruited. The greater confidence of the German companies in the reliability of the signalling value of German qualifications probably reflects the lower degree of variability of standards and intake of the German universities compared to the British.

3.4 'Interns' and 'sandwich' students

Around half the German companies interviewed were employing 'interns' – university/FHS students spending several months working in the company as part of their programme of study. Usually the students were also writing a dissertation as part of their course assessment, and the companies arranged a work-based project for them which they could write up and present to fulfill this part of their degree requirement. Interns constituted a surprisingly large proportion of all ICT employees in the firms which were employing them: 7 per cent in the financial sector, 3 per cent in retailing, 10 per cent in motor manufacture and 5 per cent in the software companies. The German companies were generally enthusiastic about the contribution made to the company by interns. They could be entrusted with or participate in projects that were useful to the company, their salaries were considerably lower than those of graduate employees (often they worked for free), and their suitability for permanent employment could be assessed during the internship. It is clear that the requirement for university and FHS students to write up a project in dissertation form as part of their degree benefits both students and the companies that employ them.

The closest to internships in Britain are sandwich courses, where students spend part of their course in employment as a course requirement. Only one of the British companies interviewed employed a student as part of a sandwich course. A further five companies offered paid summer placements, which were open to any students who applied. There was no great enthusiasm in the British companies visited for employing students in this way. Companies complained of the difficulty that ICT departments had in finding suitable projects for the students and their consequent reluctance to take them in.

3.5 Companies' views on how university education could be improved

German companies' views on how university education could be improved were more consistent than the views of the British companies. They felt almost unanimously that university students did not have enough experience of the real world, particularly the realities of the business environment. FHS students were recognised as having followed more practical applied courses. In the case of graduates from traditional universities, and in particular of PhDs, companies spoke of the 'work shock', explaining that it took new graduates some time to become accustomed to the pace and demands of the business environment.

British companies' views about how university education could be improved and respond better to industry's requirements were very varied, and no consistent pattern could be detected. A number of companies were very satisfied with the graduates they had recruited. As was found in an earlier study (Mason, 2000), arts graduates were appreciated for better communication/soft skills; lack of communication skills was identified as a weakness in ICT graduates. Around half of the comments recorded echoed the criticisms of the German companies: lack of understanding of the business environment and poor communication skills were a major weakness of new graduates.

3.6 Ways in which new graduates were employed in companies

British companies are less likely to take graduates without previous experience than German companies. It should also be remembered that British graduates study for about half the time it takes a German student to graduate. It is not surprising, therefore, that new British graduate entrants (not on a recognised graduate training scheme) often needed substantial off-the-job training before starting work in the company. Once in the company, it was common for new graduate entrants to continue learning on the internal helpdesk or as junior members of a project or programming team. In this capacity they would frequently be mentored and were expected to learn on the job for a period of several months.

New graduate entrants to German companies were given much shorter formal training periods than their British counterparts. Human resource managers from multinational companies visited made clear that new German graduates were expected to take more responsible positions than their British counterparts. However, they too were expected to spend several months learning on the job. German companies employing both new graduates and apprentices pointed out that, unlike graduates, the qualified apprentice requires no further period of introductory training when first employed in a permanent position. This was considered to be an important advantage of apprenticeship contracts.

4 Policy implications and conclusions

4.1 Policy implications for companies

In British and German companies a distinct change has taken place in the quality of the ICT workforce since 1999. The lower level of business activity has allowed companies to look more for quality than quantity. Before 1999 the scarcity of ICT personnel and the growth of business meant that almost anybody with some ICT experience was recruited and trained on the job. In the case of software companies these extra costs could easily be billed to the customer. Greater cost consciousness of client companies means that this is no longer feasible.

However, not only in software companies but in all the sectors considered here the performance of existing employees is regularly reviewed and high performers are replacing low performers. This has led to a higher intake of graduates. Although more job applicants were available on the market after 2000, the time required to recruit a new employee has not really changed as the quality of new hires has become more important. This was supplemented in Germany by firms taking on a higher share of apprentices. Banks and software companies showed a particularly strong involvement.

In general, companies in both countries were satisfied with the technical skills of graduates but asked for more soft skills. Key skills were a particular problem with regard to ICT graduates. They were often seen as having difficulties in communicating with colleagues and customers in projects and were too focused on the ICT area. This assessment was emphasised more strongly by British companies and helped to explain why British companies would recruit someone with an arts or language degree if the person had the required soft skills.

The low proportion of graduates in retailing companies seems not to be completely self-chosen or just salary-driven, but rather the result of the way ICT use has developed in the sector. Retailing companies had the highest share of self-developed programmes and legacy systems. This brought a number of disadvantages:

1. The choice of personnel for recruitment was restricted, as usually ICT professionals do not like to work with 'old' technology.
2. The training times even of new graduates to master these legacy systems were long and costly.
3. The developed ICT solutions were laborious and not very efficient. The growing importance of supply chain management increasingly necessitates fast and efficient data exchange with suppliers and customers. To remain competitive a rapid switch to more standardised systems will be needed.

ICT departments in the automobile industry have relatively low numbers of ICT graduates, although the share of graduates was high, especially in Germany. At a first glance this was surprising as the software fraction of the electrics/electronics share in a car is high and growing. It went up to 20 per cent in 2001 and is anticipated to double by 2010. Additionally, one would expect a high demand for ICT skills in this sector since the automobile industry is a leader in supply chain management.

In fact, graduate engineers were preferred to ICT specialists. This was explained by the strong need for knowledge about the product and the manufacturing process. Since graduate engineers usually had some ICT training during their studies, they integrated easily into the software development teams. Keeping these skill requirements in mind, university training should emphasise relevant training in computer science of engineers on the one hand and press for a strengthening of key skills for ICT students in general. As the automobile sector was chosen as a sample for the manufacturing industry, this effect might be found in other manufacturing industries as well.

4.2 Public policy implications: Britain

British universities have proved responsive to the need to increase overall student numbers and to increase numbers studying ICT. This has benefited British companies and may well help to explain the greater expansion of ICT employment in Britain relative to Germany. Variability in quality and course coverage in Britain poses a problem for companies when recruiting, and contacts between universities and the companies in our sample were not common. At the same time it must be recognised that universities and apprenticeships in Britain are increasingly competing for the same young people. The ICT sector could gain from implementing current government policy aimed at opening up a route to higher education through apprenticeship. This would prevent young people having to choose between university and work-based apprenticeship training.

There was no equivalent in Britain to the German internships, which provide contact between German companies and undergraduates. A development of internships and projects to be carried out in companies as part of the university course could help to remedy this and promote greater understanding between universities and companies.

There is considerable scope for apprenticeships to be more widely used by British companies to train new employees to Levels 3 and 4 on the job. Both companies and new employees could benefit. New employees would gain a recognised qualification, and companies could use the scheme to ensure a good supply of skills. However, in such a fast-moving area of activity companies must be allowed more flexibility to base on-the-job training on their own patterns of work organisation and skill deployment. In Germany greater flexibility has led to a rapid expansion of ICT apprenticeship places.

The German example shows that good ICT apprenticeship recruits can be found from those who have the equivalent of good GCSE passes, and that A-level type qualifications are not an essential prerequisite. The challenge of finding young people of sufficient standard to undertake an ICT apprenticeship should be tackled by clear routes into apprenticeship from full-time preparatory college courses, as well as clear routes through to higher education for those who wish to take that route.

British companies could benefit from working together to put in place universally recognised continuing training qualifications – independent of particular operating systems – that would encourage individual employees to invest in their own training. Companies could thereby reduce the cost both of recruitment and of further training.

We have pointed out that contractors in both countries usually benefit from training provided by an employing company before becoming self-employed. However, the tax treatment of training expenses of self-employed contractors is less generous in Britain than in Germany. British contractors are not able to offset the costs of maintaining or improving their ICT skills even during periods when they do not have a contract. Therefore skills may rapidly become outdated during periods such as the current downturn or may be lost to the industry altogether. In Germany tax treatment of training expenses incurred by contractors is more favourable.

4.3 Public policy implications: Germany

Two important changes have been introduced in Germany during the last three years – the APO-ICT skill matrix and a new degree structure.

The establishment of three further national levels of specialisation in ICT in 2002 (APO-ICT framework) provides opportunities for apprentices with experience to move up to gain a level comparable to the *Meister* in industry and then to go on to university level. The opportunity to achieve a qualification equivalent to university graduation along a route that is based largely on on-the-job experience is completely new in Germany. The introduction of a new course arrangement with a three-year Bachelor (first) degree and the possibility to continue education by adding a one- or two-year Master course will improve the system in several ways.

Up to now the transfer from FHS to traditional universities was difficult for students who wanted to study for a postgraduate degree. The new arrangement will allow the achievement of the higher Master degree at both types of universities. With a Master degree it should be easier for FHS students to continue even to a doctorate. Up to now this route was open in theory, but many additional requirements by the traditional universities put great obstacles on this path. Since a doctorate is a basic requirement for university positions, this might also help to enlarge the pool of candidates for university teaching positions.

The introduction of shorter first degree courses should reduce the attrition rate. Shorter courses allow more flexible responses by students to market demand. A system where students can study a new subject at Master degree level is far more appropriate for the fast-changing world of ICT than present arrangements in higher education. Individuals with a first (Bachelor) degree might also be encouraged to go back to university and learn new techniques on a Master degree course. Returning to university after a first degree is quite common in Britain but is rare in Germany.

The new Master degrees will provide a recognised national standard for the retraining of graduates from other subjects. Up to now an enormous number of mainstream graduates were retrained by expensive programmes funded by the Federal Government, covering fees and subsistence. However, they did not attain a standardised qualification. As a result companies were unconvinced about the usefulness of these qualifications and reluctant to offer employment. The greater recognition of ICT Master degrees should provide an incentive for many individuals to choose this course. It will improve their employability and ease strains on the Ministry of Employment.

Finally, assessment of equivalence with international courses and certificates will be more straightforward with respect to the Bachelor/Master level than is currently the case with the longer German degree qualifications. It will be easier for students to study abroad as part of their degree course and to fulfil the requirements of firms for international education and experience.

However, the system will also become less transparent since it is less standardised. Instead of just two types of *Diplom* degree (traditional and applied university), which will continue to exist and were well recognised, an additional four degrees are now on offer: three-year Bachelor and two-year Master, two from each type of institution. It is also not yet clear how easy it will be for employers to assess the different qualifications from the new system.

Will Bachelor and Master degrees of the two types of higher education institution be accepted as equivalent? If the Bachelor degree from a FHS is not accepted as a basis of a Master course at university, the benefits expected from easier transfer between different types of HE institution will not be achieved.

With regard to the new ICT apprenticeships, greater flexibility arises from more company-specific accreditation of practical experience. In addition the new off-the-job training component includes a lot of in-company training. The results have to be closely watched, however, to ensure that the signalling effect of certificates is retained. First surveys show that this higher flexibility is accepted by companies and the signalling effect has been maintained.

4.4 Summary and conclusions

It is widely accepted that differences in national institutions have a significant effect on the national economy through their effects on the behaviour of firms and individuals. However, many studies have concentrated on labour market regulation and social welfare benefits as sources of major institutional difference between countries that affect economic growth and productivity.

This study of how firms in Britain and Germany source and secure ICT skills points to important differences between countries in external constraints, originating in the education system, on the supply of highly educated ICT graduates and graduates in cognate disciplines. Combined with other factors discussed below, these have impacted differentially on firms in the two countries and led to substantially different recruitment and training policies.

In Britain the supply of graduates has increased substantially in the latter half of the 1990s and early 2000s. The supply of graduates from ICT degree courses has increased even faster. This has been made possible by a high degree of responsiveness from universities (providing additional places) and students (choosing courses where demand from industry is high). In addition, government funding has met part of the cost of expansion, and low drop-out and short (three-year) courses have meant that lead times for skill production from universities are relatively short.

In Germany, by contrast, there was until recently no strong expansion in numbers entering universities and applied universities; universities and FHS have not been able to find places for all those who applied to study computer science. The very long lead times to degree qualification (between five and seven years) and high drop-out rates have resulted in very low numbers qualifying at the time of particularly high demand around 1999/2000. While numbers studying have now increased substantially, those students will qualify in 2006/7 at the earliest.

Company approaches to recruitment in the two countries have been structured and conditioned according to different traditions of occupational identity. In Britain occupational identity is relatively weak except in certain recognised professions (law, medicine etc.) and the older industrial crafts. Employees in the service sector are used to carrying out a variety of tasks as required, and they are also used to shifting into new areas of work. New employees are recruited on the basis of relevant experience, and those hired straight from university frequently hold qualifications that are unrelated to the job they are expected to do. Firms expect to provide this latter group with substantial training and place them in 'starter' positions within larger teams, where they can acquire relevant knowledge and experience.

Most of the German firms visited adhered to the occupational model of competence, whereby each employee is expected to own and apply a recognised set of skills for the occupation trained for and practised within the firm. While this model may well lead to greater breadth and depth of technical competence, it undoubtedly creates difficulties when a flexible response is required to adapt to fast-moving technological change. Furthermore, the model can create difficulties in integrating new employees from abroad and new employees without the recognised occupational preparation – for example those from 'conversion' courses.

These factors – the unresponsiveness of higher education and the occupational competence model – were, in our opinion, important reasons for the difficulties German companies experienced in recruiting the skilled employees they were seeking in the late 1990s.

However, these same difficulties have also spurred German companies on to work together to 'bypass' the universities and create a system of skill production – apprenticeship and continuing work-based training structures – that is more flexible and offers the prospect of training large numbers of highly skilled ICT employees. These will undergo principally work-based training and constitute a pool of work-ready employees at lower cost than graduates. While graduates will still be needed and recruited, company-based skill production will provide for many of the middle-level posts which had previously proved difficult to fill.

British companies have benefited from a relatively plentiful supply of graduates and a flexible approach to skills. Individual companies have invested heavily in training new employees and upskilling existing employees to combat skill shortages. However, because companies were able to 'get by' on the basis of these strategies, there has been little concerted action on the part of companies to tackle future skill shortages comparable to that undertaken by German companies. This lack of concerted action by firms has led to companies bearing much of the training costs for new recruits and losing that investment a few years later when employees move to self-employed status.

In both countries public institutions generating high-level skills are of prime importance to all companies requiring specialised ICT practitioner skills. When, as is the case in Germany, importing skills or outsourcing work is more difficult for linguistic and cultural reasons, the power of these institutions to restrict or open up the supply heavily constrains companies' ability to respond to new business opportunities. Britain benefits from the universality of the English language and strong cultural links to the Indian and Asian sub-continents. Importing skills and outsourcing is less problematic. However, a plentiful supply of relatively unspecialised graduates has shaped company behaviour in Britain, leading to training investment from which the individual benefits more than the company and a lack of standardisation of qualifications and experience.

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