

## Issues Paper 5

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### Information technology skills

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#### *Summary*

*The paper reports the principles and approaches underlying the classification of Information Technology (IT) skills, the meaning and usage of the term, and describes the development of current thinking on their specification. It notes certain differences between "Anglo-Saxon" and continental European perceptions of IT skills, and goes on to illustrate how the continuing turbulence of the field and market exploitation have prevented convergence and stability in skill needs assessment, institutional structures and qualification maturity, as well as posing barriers to the establishment of a real "IT Profession". The paper concludes with consideration of some implications for policy analysis and development at the European level.*

#### **Introduction**

Information undoubtedly represents one of the key resources in our world, and is - in the workplace - acknowledged to play a fundamental role in the operation of both public (where there is a need for open, effective flow between providers and users) and private (as the lubricant for the operation of markets) sectors.

It is therefore unsurprising that our efforts to capture, harness, share and deploy this resource through Information Technology represent an all-pervasive activity in today's world. And while we see, and experience every

day, many of its problems and limitations, as well as the deeper challenges that arise from its influence, Information Technology (defined in 1982 as the combination of computers and telecommunications) has established an enormous presence in our world - a presence on which we often depend more than we might care to. It is recognised that the word "revolution" is not ill-placed for the impact IT has had on our world, and most would accept the arrival of an "Information Age".

So, despite much "hype", IT is with us - presumably to stay - and it is necessary to come to terms with Information Technology, at the very least by understanding enough about it and how it works to be able to explain the basic role it has in our world - both in relation to work and to our lives more generally.

It was therefore no surprise that, despite the absence of a relevant "sector body" for the IT industry within the United Kingdom, interest in workforce skill needs in relation to IT burgeoned over the 1980s, and IT skills has grown steadily in importance in relation to government skills policy over the intervening years.

The (IT supply) industry's own efforts - articulated initially through the Computer Services Industry Training council (CoSIT) - led, with government support, to the IT Industry Lead Body (1988), the IT Industry Training Organisation (1993), the IT National Training Organisation (1997), and e-skills UK (from 2000). Over that period, in particular during the 1990s, efforts to develop National Occupational Standards of Competence in accordance with the agreed (NCVQ) format gained momentum, and the first IT S/NVQs based on them appeared in 1995. While the take-up of IT S/NVQs has been limited, this development work was fundamental in distilling the essence of occupational structure, and it grappled with, and began to clarify, some important questions in relation to employers' competence requirements.

## **The Structure of IT Occupational Competence**

Perhaps the most significant question was whether there is a fundamental difference of kind between IT Practitioner and IT User Skills - a distinction that is now taken for granted within the United Kingdom, although not so clearly (yet?) within continental Europe.

The first set of National Occupational Standards (1993) consisted of separate sets of competencies for Practitioners and Users. However the second set, which emerged in 1995, presented Practitioner and User competencies within the same overall framework, and there was talk of a continuum of competencies. Since then, the assumption of two quite separate domains has been more strongly established, so that the latest sets of Standards (completed

during 2003) retain this fundamental distinction, although the word "Practitioner" has been replaced by the word "Professional" - to reflect the growing workplace practice to discontinue the traditional distinctions between professional- and vocational- workers among those with technical jobs.

### **Practitioners vs. Users**

The general assumption underlying the distinction between IT Users and IT Professionals is that IT Practitioners' work is (only) Information Technology. Their whole "working week" is devoted to (some activity within) the designing, developing, installing, testing, operating, maintaining, supporting or managing IT systems for use by others. Conversely IT Users' work concerns something else (e.g. banking, manufacturing, local government, engineering, practising health care, teaching and researching, providing travel services, etc.) for which IT provides (one or more) tools which help them to carry out this other work. It is important to recognize that the term "IT User" can be (and is) used to refer both to the individual who uses (one or more) IT systems and the organization which uses these systems in support of its objectives.

It is a reality rarely adequately understood that there are IT Practitioners and IT Users in both IT (supply) companies and IT User organizations. Indeed, IT Practitioners often move between supply companies and user organizations during their career, and it is generally the case for any economy that there are more IT Practitioners working in the IT Departments of User organizations than within the IT supply sector. It is, of course, the case that IT Practitioners also need to have adequate IT User skills, since they, too, use IT tools for their work. However, the fact that many - perhaps even most - IT Practitioners entered this "profession" from having been competent- often expert - IT users in no way lessens the distinction between the two types of skill.

Thus it is now generally recognised that separate consideration of IT Practitioner and IT User skillsets is desirable, whether in relation to the individual, the employer or to public policy. Thus learning provision (and the accompanying curricula) is generally clearly distinguished into one or other, the management of the skill-sets by employers is handled differently, and public policy measures to tackle skill issues for users and practitioners differ considerably. As might be guessed, within each of these two categories, there is a considerable internal complexity, and occupational or skills frameworks have been developed, in particular in the UK for both (see Figures 1 and 2). As can be seen, the structure of such frameworks is generally two-dimensional, with competence needs specified in a series of "cells", representing requirements for a particular function (or role or activity) at one or more levels.

## Use of IT by Individual and Organisation

IT User skills normally refer to the skills needed/ exercised by the individual, but the skill needs for effective use of IT by Organisations are also of considerable importance, and raise an interesting issue in relation to the User/Practitioner distinction. On the one hand, IT Managers are generally assumed to be IT Practitioner occupations, but this is taken to focus most on the operational management of the systems an organization has in place (or is installing).

Perhaps the greatest strategic challenge for senior management in this area, given the immense power of IT if effectively deployed, is that of identifying the most appropriate emerging IT approaches and systems for the future needs of the organization. As well as this "monitoring" role there is also the challenge of identifying and designing changes in the way that organization does its business<sup>1</sup> that could be enabled by new Information Technologies. These are areas that could be said to require the technical understanding of a good IT Practitioner (especially in relation to imaginative understanding of the functional capabilities of the new technologies), while drawing on a very deep understanding of the nature of the business needs of the organization.

As a result, the skills of harnessing and exploiting emerging IT approaches for business might be viewed as a third class of skills, for which, in the new vernacular, the term e-leadership might be appropriate. While the challenge of harnessing new technology for the future benefit of the business was present well before the emergence of the Internet, it is, of course, evident in its most powerful form in that context, for which the terms, e-commerce and particularly e-business- skills have been coined.

## The Boundaries of the field: ICT and beyond

With the Internet in mind, it is necessary to consider the recent emergence of the term ICT - Information and Communications Technologies - and the related skills. Two things must be borne in mind in considering the relationship (and usage) of "IT skills" to "ICT skills". The first, already alluded to above, was that the term IT was introduced specifically (in 1982, strongly promoted by government) to acknowledge the immense power expected in the integrating of computing and communications systems. The second is that - probably because it took another dozen years from the invention of the term to the full realization of its aspirations through the arrival of the internet - IT had by the

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<sup>1</sup> or even, particularly in the private sector, identifying new (albeit generally related) businesses into which the organisation might move by harnessing the opportunities of new technologies...

**Figure 1: Structure of an IT Practitioner Skills Framework**  
(skill/competence requirements are specified in all shaded cells)

## Skills Framework for the Information Age

(Version 2 - being updated during 2005)

		Strategy and Planning	Management & Administration	Sales & Marketing	Development & Implementation	Service Delivery
		Information Management Advice and Guidance	Supply Management	Sales and Marketing	Systems Development	Education and Training
		Business/IS Strategy and Planning	Project Management		Human Factors	Infrastructure
		Technical Strategy & Planning	Quality Management		Installation & Integration	Operation
			Resource Management			User Support
7: Set Strategy, Inspire, Mobilise	Information Resource Management					
6: Initiate, Influence		Information Resource Management				
5: Ensure, Advise		Consultancy				
		Technical Specialism				
		Business Process Improvement				
		IS Strategy & Planning				
		Business Risk Management				
		Systems Architecture				
4: Enable		Business Continuity Planning				
		Emerging Technology Monitoring				
		Network Planning				
		Procurement				
		Project Management				
		Quality Management				
		Asset Management				
		Systems Development Management				
		IS Coordination				
		ICT Management				
		Service Delivery Management				
		Account Management				
		Selling				
3: Apply		Change Control				
		Contract Management				
		Quality Assurance				
		Compliance				
		Project Office				
		Marketing				
		Business Analysis				
		Data Analysis				
		Systems Design				
		Database Design				
		Programming/Software Development				
		Systems Testing				
		Systems Ergonomics				
		Media Creation				
		Systems Integration				
		Systems Installation/Decommissioning				
		Education & training management				
		Development & Training				
		Training Materials Creation				
		Education & Training Delivery				
		Configuration Management				
		Network Control				
		Capacity Management				
		Security Administration				
		Application and System Support				
		Database Administration				
		Service Level Control				
		Network Administration and Support				
1: Follow		ICT Operations				
		Database Administration				
		Service Level Control				
		Network Administration and Support				
		User Support				

**Figure 2: Structure of an IT User Skills Framework**

(e-skills UK: (updated in 2005))

(skill/competence requirements are specified in all shaded cells)

	Inexperienced	Foundation	Intermediate	Advanced	Super User
<b><i>Systems: Use, improve and maintain systems:</i></b>					
Operate a Computer	.....	.....	.....	.....	.....
IT Trouble-Shooting for Users	.....	.....	.....	.....	.....
IT Maintenance for Users	.....	.....	.....	.....	.....
IT Security For Users	.....	.....	.....	.....	.....
<b><i>Communication: Access and share Information</i></b>					
Internet and Intranets	.....	.....	.....	.....	.....
e-mail	.....	.....	.....	.....	.....
<b><i>Use Application Software:</i></b>					
Word Processing Software	.....	.....	.....	.....	.....
Spreadsheet Software	.....	.....	.....	.....	.....
Database Software	.....	.....	.....	.....	.....
Website Software	.....	.....	.....	.....	.....
Artwork and Imaging Software	.....	.....	.....	.....	.....
Presentation Software	.....	.....	.....	.....	.....
<b><i>Make Effective Use and Evaluate:</i></b>					
Make Selective Use of IT	.....	.....	.....	.....	.....
Evaluate the impact of IT	.....	.....	.....	.....	.....

1990s began to be associated mostly with the software side of things, so that the term ICT was introduced to provide coverage of what was assumed to be the additional domain of telecommunications.

The scope of the concept of IT within common usage inevitably had its impact on "institutional geography", so that policy on Telecommunications skills was handled, until 2001, by the National Training Organisation for Telecommunications, and, among professional bodies, IT was generally taken to be the domain of the British Computer Society (BCS) while Telecommunications Engineering was unquestionably within the scope of the Institution of Electrical Engineers (IEE). These clear distinctions are beginning to break down, and the development paths of technologies and markets, and particularly the accelerating convergence of initially separate technical fields, can indeed make a mockery of our institutional demarcations...!

The use of the term ICT within the UK has arisen in particular from its adoption within the education world and within government, and - although this was not always a term in most other Member States' languages - growing use within the European policy debate. Interestingly, although e-skills UK, as a government-recognised body with more significant core funding as a Sector Skills Council than the former National Training Organisations, gained recognition to cover Telecommunication skills on the demise of NTO Telecom, it eschews the ICT label in favour of IT, essentially since, for whatever reason, it believes the marketplace, in particular its employer community, has not taken up ICT.

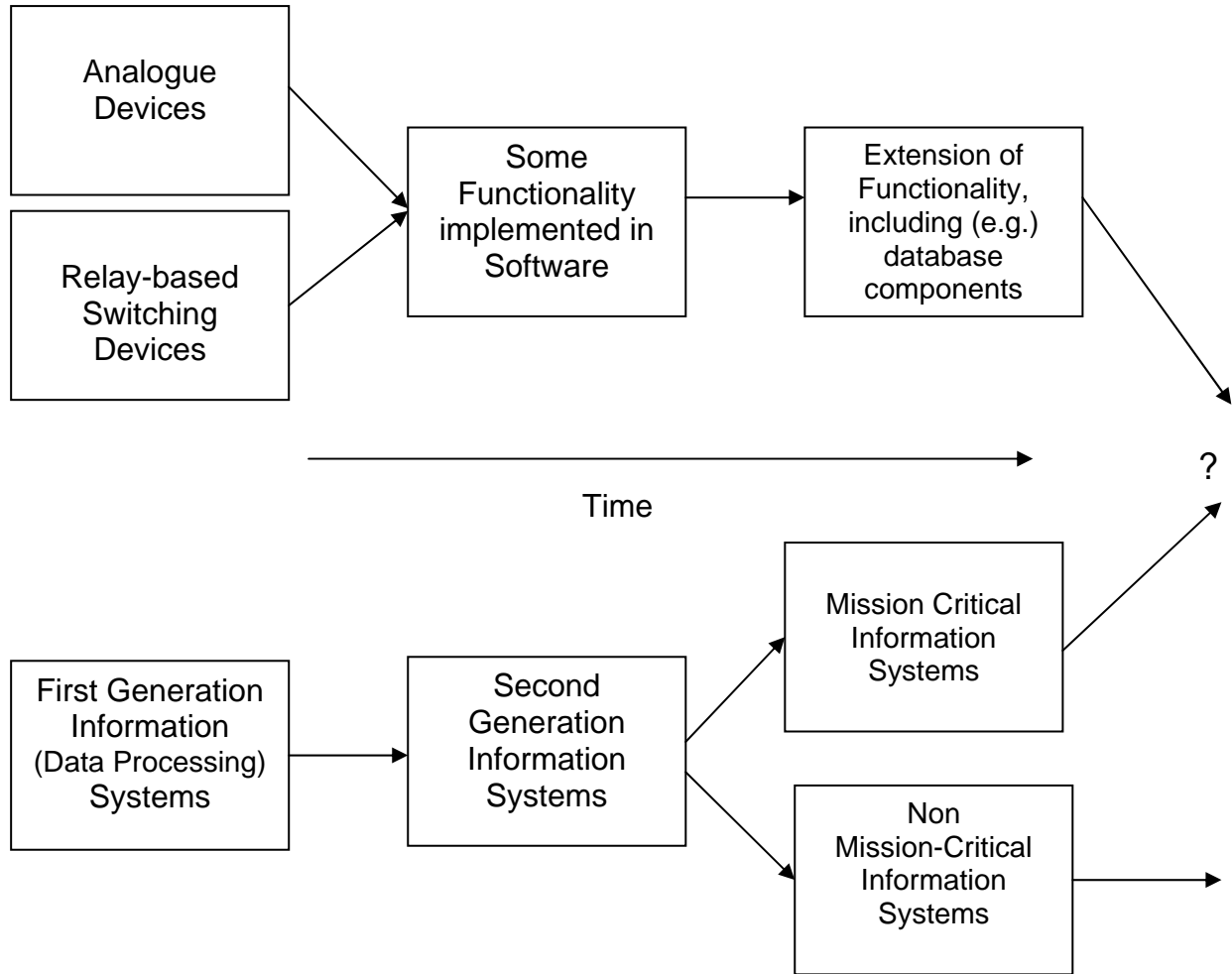
In this context it is also worth noting the important differences of perspective on the waves of powerful new enabling technologies that have characterised the IT world, and how they should be used, from the different technical communities. While there are many complexities and subtleties here, the most significant contrast lies between the "software" and "hardware" communities, influenced by the academic communities of, respectively, Computer Science and Engineering, and this plays a role in the differences of perspective within the corresponding professional bodies - in particular the British Computer Society and (in particular) the Institution of Electrical Engineers. The reality is that the dramatic growth in the development of Software tools, and the power of the technology as evident from the growth of IT markets has far out-run both the ability and capacity of the academic community to develop and refine curricula (in particular within Higher Education) and - influenced by this - the ability of the traditional professional institutional structures to cope.

A particularly clear example of the challenges posed by the growing convergence arising from technological development is that of differences of view about the "best" approach to designing complex engineering products, in particular those required to perform in safety (or mission-) critical situations, sometimes in adverse environments. Figure 3 shows the independent development of two separate technical approaches espoused by separate traditions and communities. Initially the functionality required was implemented using hardware devices, while the continuing development of software-based components (often called "embedded systems") began to deliver the required functionality with additional benefits. As can be seen, it is to be expected that, as in many other cases, one technology will eventually prevail.

A recent international conference exploring Global IT Skill needs: the role of Professionalism (IFIP/OECD / WITSA, 2002) saw the admission that the IT profession bore more resemblance to a "Wild West" than to a profession in the mature, respected

**Figure 3: "The influence of technical community legacies:  
Engineering vs. Data Processing"**

**Development of Hardware and Software System Functionality**  
(from which technical skillsets are specified)  
(from Dixon (2003))





sense represented by the likes of medicine, accountancy and the law, and their traditional professional bodies. The debates on these issues over the comparatively short life of the British Computer Society since the early 1970s reflect these challenges.

### **Implications of the classification of IT Skills**

It is clear from the above that understanding IT skills involves handling a further level of complexity above and beyond the understanding of IT systems themselves. As a result, many developments in the field have been characterized by widespread limits of adequate understanding and resulting errors in initial industry and policy conclusions and initiatives. Policy work in IT skills in the UK with a decade or more greater experience than within other EU Member States, has meant that the development of policy thinking at the European level since the turn of the century has drawn significantly on UK input. As hinted above, the differences of perspective about certain rather fundamental concepts have made progress in developing shared understanding on "e-skills" within Europe frustratingly slow. The e-skills Forum, over 2003 and 2004, did begin to achieve consensus and clarify some of the key issues, and its "Synthesis Report" (EU e-Skills Forum (2004)) presents a sound basis for further explorations.

Sadly, however, the underlying problem of lack of stability in the field continues to pose real problems with Commission endeavours, not least in the current difficulties associated with the development of a "European ICT Skills Meta-Framework". This work, involving the drafting of a "Collaborative Workshop Agreement" under the auspices of the European Standards body for the Information Society (CEN/ISSS), brings the need for an agreed set of "horizontal and vertical descriptors" for learning outcomes in a "Sectoral Framework" to map against the emerging European Qualifications Framework (EU Commission, 2005). As might be guessed, this aspiration implies a stability and consensus that is simply not yet present, and is sorely testing the continued interest and commitment of participating employers and knowledgeable stakeholders.

### **The Qualifications position for IT Skills**

The above specifications of IT skill requirements are expressed - as now usual in UK Skills Policy - in terms of a structured consensus of employer needs, articulated as statements of skill or competence. Over the course of the 1980s and 1990s, learning providers, both within the formal education system and within the training marketplace, worked to respond to employer needs by developing and refining a wide range of courses and qualifications. This "secondary" activity naturally suffered from the "moving goalpost" posed by the continuing upheavals, and it soon emerged that the relationship between the academic body of knowledge of what might generically be termed "Computing" and the competencies required in the IT Practitioner workplace was extremely complex. This has made the task of designing

university undergraduate course curricula to produce graduates of direct (immediate!) use to employers a particularly difficult one. The generally poor relations between employers and HE IT departments that have arisen around the perceived value of IT graduates, and the significant, and growing, fraction of graduates recruited for IT Practitioner roles with degrees other than IT, are understandable outcomes.

In addition this "mis-match" has contributed to the unprecedented and very strong growth of so-called "industry certifications" - courses and accompanying qualifications designed and developed by the proprietors of the software tools and environments that have gained major market share within the IT world. The IT majors (Microsoft and CISCO are significant players) now gain substantial revenue streams from these spin-off "education" businesses, and this world of "industry certifications" has, understandably, been described as a "Parallel Universe" (Acemoglu and Pischke (1999) and Adelman (2000)). Intriguingly, the labour market for IT Practitioners remains so much in flux, that it appears that employers pay little more attention to these expensively-acquired "skill passports" than any other qualifications, with very few job adverts citing requirement for anything more than (relatively modest numbers of) years of experience with particular software tools...!

### Towards Maturity?

While SKOPE Associates have made important contributions in this complex technical field, the task of clarifying employer skill needs, and the consequent design of appropriate and effective learning experiences that will raise skills in response to those needs, seems set to continue to challenge the wit of man for a while to come.

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