The Council of European Professional Informatics Societies is a non-profit organisation seeking to improve and promote high standards among informatics professionals in recognition of the impact that informatics has on employment, business and society.

CEPIS plays a pivotal role in aligning academia with industry through the promotion of key elements of informatics, in particular in the areas of digital literacy, skills, professionalism, and education and research.

CEPIS unites 36 professional informatics societies from 33 countries across greater Europe and represents over 400,000 ICT professionals.

For more information, please visit www.cepis.org or email info@cepis.org
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* This monograph will be also published in Spanish (full version printed; summary, abstracts, and some articles online) by Novática, journal of the Spanish CEPI society ATI (Asociación de Técnicos de Informática) at <http://www.ati.es/novatica/>.
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CEPIS recognises the importance of ICT to almost every facet to personal and business life and to the health, wealth and the well-being of individuals, economies and society. We believe that such powerful technologies and the application must be driven by competent and reliable professionals who possess the necessary knowledge, experience, competence and integrity. We are committed to ensuring that the concerns of our members, the informatics societies of Europe and beyond, around the area of professionalism and the standing of the professional within society are addressed.

Professionalism is a topic of key importance and we will continue to champion ICT professionalism in Europe to lead and to support the development of a strong international ICT profession. The European e-Skills 2009 Conference: Fostering ICT Professionalism, organised by the European Commission, the European Economic and Social Committee and CEPIS, was a milestone in highlighting the importance of this domain. The ongoing work of CEPIS has done much to foster a pan-European understanding of this concept of IT professionalism and from this we work to develop and promote pan-European professionalism, with quality at its core. This will spur innovation, draw more people to the profession and drive benefit to the practitioner, the enterprise and to society.

The CEPIS Vision for IT Professionalism

CEPIS, through its Taskforce on Professionalism, has proposed a common definition of Professionalism as it relates to IT. This sets out the vision regarding Professionalism and details the steps that will be taken in the short to medium term to promote Professionalism and its benefits to individuals, organisations, and policymakers.

At the core of the CEPIS UPGRADE vision is the definition of IT professionalism. A Professional is someone who demonstrates the six characteristics of Professionalism: Knowledge, Quality, Ethics, Accountability, Experience, and Earns Living.

Central to the value of professionalism lie key characteristics such a quality of service, the mobility of labour and service, the recognition of value, the promotion of innovation and providing a competitive advantage for Europe in a global market for IT services.

While much has been achieved, there is a vast amount yet to be done. It is only through the contribution of time, and expertise from the informatics societies of Europe, who form the members of CEPIS UPGRADE that we build upon our success in this domain. We thank members and the members of the Professionalism Task Force and welcome their ongoing efforts.

At time when a pan-European approach is critical to support what is perceived as the emerging professionalization of ICT, we have chosen the 10th anniversary of the CEPIS UPGRADE journal to launch a full monograph dedicate this topic. It is appropriate that after a decade of existence, one mature CEPIS UPGRADE project should herald the advent of a new project. CEPIS UPGRADE has thus been chosen as the best channel to disseminate our work on ICT Professionalism.

As I wish the CEPIS UPGRADE journal a happy 10th birthday, I look forward in hope to producing a 10th anniversary message of a successful vision of ICT Professionalism.

The 10th anniversary of CEPIS UPGRADE is an excellent opportunity for me to congratulate and thank all that have contributed to the success of the journal from CEPIS UPGRADE, the Spanish society ATI and its publication Novática and all our member societies.

Vasile Baltac
President of CEPIS
<president AT cepis DOT org>
The Informatics Profession(al): A Fruitful Vagueness

Declan Brady, Rafael Fernández Calvo, and Luis Fernández-Sanz

"It's a Bird...It's a Plane...It's Superman!"

A debate has been ongoing on for many years about the Informatics profession – its characteristics, its boundaries, its regulation (or lack thereof), etc. However, after such a long time there is not yet a universally accepted definition of what an Informatics Professional is, only varying approaches – of different degrees of completeness – coming from different national or regional bodies and organisations in the IT industry.

This vagueness stems from a solid fact: while established professions like Law, Medicine, Architecture, Accounting, etc have been in place in some cases for centuries Informatics, aka Information Technology or Computer Science, is a relative newcomer (having been born only sixty years ago) and still has to deal with the advantages and disadvantages of its relative adolescence, and very probably will have to for a long time.

In spite of this, the IT industry flourishes; millions of professionals all over the world make a living out of dedicating their efforts to hardware, software, services and the like, and Informatics has become an essential, irreplaceable component of the social and economic fabrics of our societies and personal lives. While not ignoring that progressing in the definition and consolidation of the Informatics profession is a constructive and probably long-term process, society tends to believe that we must keep moving ahead. It can be argued that more certainty in this respect can only benefit industry and society.

Having in mind all the above, CEPIs UPGRADE and Novática are publishing this monograph, which is not the first one dedicated to this topic. In fact, in addition to several individual articles over the last ten years, two CEPIs UPGRADE monographs have already sought to address it: one appeared in the August 2001 issue and the other one in the August 2008 one (both are freely accessible in the "Past Presentation"

The Informatics Profession in Europe: An Overview

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10th Anniversary Issue

The Guest Editors

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The Informatics Profession in Europe: An Overview


We must, of course, mention that this special issue commemorates the 10th anniversary of CEPIS UPGRADE, our open access digital journal, whose publisher is CEPIS, the Council of European Professional Informatics Societies <http://www.cepis.org>, in cooperation with the Spanish society ATI (Asociación de Técnicos de Informática) and its journal Novática.

Content of this Monograph

Today’s monograph covers a necessarily limited set of aspects of the Informatics profession and has two distinct parts: in the first one we present the work and initiatives of CEPIS and some of its member societies and partners in this field, including a description of EUCIP (European Certification of Informatics Professionals), while, in the second one, personal views of recognized IT professionals about the evolution of the profession and also about some of its most critical current problems are included.

Most authors are members of societies belonging to CEPIS. CEPIS, along with its 36 participating societies from 33 European countries, leads the process of giving shape to the Informatics profession in Europe not only through its own projects, Task Forces and member societies but also in cooperation with several bodies and organizations, including the European Commission.

The monograph opens with the report "Promoting IT Professionalism in Europe: CEPIS Vision and Action Plan", produced by the CEPIS Professionalism Taskforce, established to explore, develop and promote a Professionalism in IT practice agenda for Europe that respects existing cultural and national diversity.

Next comes the article "EUCIP and the Pillars of ICT Professionalism", by Paolo Schgör and Renny Bakke Amundsen, where the purpose and activities of this key CEPIS initiative are explained.

In "The British Computer Society's View of IT Professionalism", Adam Thilthorpe describes the approach taken by the BCS, a worldwide leading society in this field, in order to gain greater recognition for IT professionals and the IT profession.

Liz Bacon and Lachlan MacKinnon discuss the issues associated with the upskilling and reskilling of the European active workforce in Information Technologies, IT, and digital technology skills in their essay "EU 2020: Developing the IT Profession to Meet the Vision for Europe".

Luis Fernández-Sanz’s paper "Analysis of Non-Technical Skills for ICT Profiles" presents an analysis of non-technical skills required for a variety of IT (Information Technology) positions and areas based on data extracted from more than 3000 ICT job offers published in Spain in recent years.

"Effective Value through Relevant Innovation: The Challenge to IT Professionals", by Martin Delaney, describes objectives and projects of the Innovation Value Institute (IVI), including the IVI’s Capability Maturity Framework.

The goals and projects of IASA, International Association of Software Architects, an organization that is working to build a learned profession of IT architects, are described in "Rise of the IT Architects", by Gar Mac Criosta.

Taking the discipline of Service Science as an example, the paper "Service Science in Academia" by Pere Botella and Maria-Ribera Sancho illustrates how, in the field of Computer Science, the role of universities has to continuously adapt to industry trends and needs.

"The Content of the Informatics Profession: A Personal View", by Fernando Piera-Gómez, examines, from a personal point of view, the origin, evolution and outlook of the Informatics profession.

The author’s view about the use of digital technology and the computing profession problems are examined by the Australian specialist Neville Holmes in "The Evolution of the Computing Profession: A Personal View".

In "Information Technologies: A Profession for Men?" Miren-Idoia Alarcón-Rodríguez and Luis Fernández-Sanz present a brief review of the present situation regarding female representation among IT professionals.

The monograph closes with "IT Profession in Europe: A Trade Union Perspective", by Lorenzo De Santis, that gives an overview of the situation of professionals in the ICT industry from the perspective of the trade union UNI europa ICTS, representing more than one million workers across 41 different countries all over Europe in ICT industries.

To finish this presentation, let us express our gratitude to the authors for their valuable contribution and to the editorial teams of CEPIS UPGRADE and Novática for the opportunity offered of editing this monograph, whose contents we hope will be of interest for our readers.
Promoting IT Professionalism in Europe:  
CEPIS Vision and Action Plan

CEPIS Professionalism Taskforce

Based on the work of the CEPIS Taskforce on Professionalism this paper examines many difficult questions that are fundamental to establishing and promoting IT Professionalism in Europe including: What is IT? What is Professionalism and what are its characteristics? Where is the benefit from a defined IT Profession? What is the value of IT Professionalism? The paper presents the CEPIS vision of IT professionalism in Europe over the coming. Experts from many CEPIS societies contributed their expertise to this work, much needed because Europe’s society and economy are both heavily and increasingly dependent on reliable ICT services and products, and IT professionals play a key role in these fields.

Keywords: Benefits of Professionalism, CEPIS Professionalism Taskforce, CEPIS Professionalism Vision, Characteristics of Professionalism, IT Professionalism, Value of IT Professionalism.

1 Introduction

The concept of Professionalism has been widely accepted as a key issue for all informatics societies that form the members of Council of European Professional Informatics Societies (CEPIS). Since 2007, the CEPIS Professionalism Taskforce has been engaged in a range of deliberations, consultations, and meetings to build the foundations for a coherent strategic approach to the topic. This paper aims to outline the foundations of such an approach. The Taskforce on Professionalism has proposed a common definition of Professionalism as it relates to IT, and elaborated the benefits of Professionalism. This paper sets out the CEPIS vision regarding Professionalism and details the steps that will be taken in the short to medium term to promote Professionalism and its benefits to individuals, organisations, and policymakers in Europe in the coming years.

What is IT?

An area that is so broad, is interconnected with so many different spheres, is almost ubiquitous (is certainly endemic) and at the same time is so rapidly evolving, defies neat definition. Attempts at definition generate much – sometimes heated – debate, and fall foul of boundary issues. Both the Profession itself, and the Quality it espouses, are subject to continuous evolution, and corresponding definitions must be adaptable. The definition cannot be too broad, lest it become misleading (is the use of a spreadsheet IT?), nor can it be too narrow, lest it result in loss of relevance.

All definitions create boundaries, and it is clear that the boundaries of IT pose difficult challenges. The Taskforce took a view that it is desirable, at this stage in the development of the IT Profession, to eschew the boundaries, and to consider in reality what IT is at its core; the Taskforce therefore offers the following definition of the essential substance of IT, as the foundation for further debate:

"IT, or Information Technology, is the study, design, development, implementation, support or management of digital information systems (particularly software applications and computer hardware), and by them solving stakeholders’ problems through the management, manipulation, storage and processing of data and information by..."
An IT Professional, then, is a person whose work is defined as in the domain of IT, and in whose work is exhibited the characteristics of Professionalism as described in this paper.

It is important that definitions perhaps need to be cautious, so as to not hinder progress (e.g. consider Tim Berners-Lee – inventor of the Web – who by most extant definitions could not qualify as an IT Professional).

There is always the challenge of "domain crossover", exemplified by the interconnected and multidisciplinarian nature of IT, as it interacts with other spheres. A typical example is the IT Project Manager, who faces a split between being a professional Project Manager who specialises in the field of IT, or an IT Professional whose main practice is in Project Management.

2 What is IT Professionalism?

The Taskforce has developed a description of Professionalism, as being the exhibition of six common characteristics that are required to be demonstrated by an individual if they are to be described as a "Professional": This definition is specific enough to allow consensual progress toward common goals while broad enough to encompass different emphases that existing across the member societies of Europe.

It is important to highlight the clear distinction between the IT Professional and others who work in IT, referred to as the IT Practitioner. A practitioner need only derive his or her living from the sector and may or may not possess other attributes, whereas a professional must draw together all of the common characteristics. It is important that the IT Profession can clearly articulate the benefits of being an IT Professional, and offer suitable opportunities to IT practitioners to gain sufficient appreciation of the common characteristics to allow them, where appropriate, to progress to being someone who meets all the requirements of being IT Professional.

A professional is said to be professionally competent if he/she exhibits these six characteristics. These characteristics have been defined in the following way.

**Common Characteristic of Professionalism**

**Knowledge**

For the IT Profession, there is a common body of knowledge that should be known, which is supplemented by more specific knowledge and skills associated with the Professional’s area(s) of specialism. As it is necessary for knowledge to be continuously maintained and developed, several tools and framework have already been defined to assist in this task, including the European e-Competence Framework, CEPIS’s EUCIP programme, and other national level frameworks such as SFIA (UK), AITTS/APO (Germany) and CIGREF (France).

The IT Professional demonstrates and develops their knowledge through university education, third party certifications, and continuous professional development and on the job training.
Quality

Quality in IT can often be measured against pre-defined standards, such as assurances contained within a service level agreement, adherence to a customer service charter, or quality in terms of meeting the requirements of an externally set standard such as ISO, for example in a software development environment. Quality can also contribute to innovation, through continuous improvement of processes and development methods. Quality cannot be considered by the fixed concept, but is relative depending on a range of factors, including budgetary constraints, mission criticality, and customer expectations.

The IT Professionals’ commitment to quality can be measured by their adherence to quality standards in place in their organisation, through their commitment to offering customer service against agree metrics, or through their adherence to service management criteria, such as those specified in ITIL1.

Ethics

Ethics in the IT Profession frames the boundaries of relationships with customers, colleagues and society. The ethical characteristic can take many forms, including Codes of Conduct to cover integrity, confidentiality and competence; initiatives around the accessibility of IT or promoting Green IT; or aspects such as safeguarding against the spread of software piracy.

The IT Professionals’ commitment to ethics can be displayed by demonstration of ethical professional practice against an agreed code of conduct or by contributing to initiatives to manage the safe use of IT, to minimise energy wastage or maximise accessibility of IT services.

Accountability

The Professional takes personal responsibility for the quality and effectiveness of his or her work, taking care to produce quality output, and taking action to redress deficit and defect. As with the concept of quality, the concept of accountability is relative, and depends on the context. Accountability is both to others (society, customers) and to oneself.

The IT Professional’s degree of accountability can be identified and measured through their level of responsibility the professional has for a project or development process. Accountability is seen as being proportional to the level of experience and/or the level of seniority of the Professional.

Experience

A Professional is expected to have practical experience of the competence being exercised. Such practical experience is clearly smaller in the recently qualified Professional, and proportionately greater in the senior Professional. The Professional is expected to leverage this experience to the benefit of the customer, employer and society alike. Since experience is accumulated over time, there must be a proportional relationship between the level of experience of any Professional and the associated level of accountability expected.

The IT Professional’s curriculum vitae should clearly outline experience gained over years of practice, which is often linked to increasing levels of accountability. Experience can also be stored as tacit knowledge which may only become known to others when it is applied in a similar work situation as when it was attained.

Earns Living

The condition that a significant proportion2 of one’s work should be based on practice can be used to define the "true" Professional. This differentiates a Professional from someone whose vocational engagement with IT is partial or peripheral. This characteristic should be sufficiently flexible to accommodate instances when a professional is, for example, engaged in activities such as education for a period.

The IT Professional’s income should be primarily derived from activities relating to IT.

Cui Bono?

Who benefits? Why do we want IT Professionalism? If quality is the central defining characteristic of the IT Professional, then – leaving aside for a moment the choice of definition of quality – everyone benefits. At a more immediate level, the Professional benefits from enhanced reputation. By extension, the customer benefits from the higher quality of the product of the Professional, and so too does the employer, the industry and so on3. Less obviously, there are wide benefits of varying degrees to all stakeholders from greater mobility of workers, transparency of qualifications and standards, ethical awareness, wider discussion of issues, promotion of professional standards, and so on. This is certainly the case with established Professions, and it seems natural that similar benefit should accrue to the IT Profession.

It is important to look at the cost/benefit of Profession-

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2 In the case of the BCS, this proportion is 50%.
3 For an interesting catalogue of risks posed by IT, see Illustrative Risks to the Public in the Use of Computer Systems and Related Technology at <http://www.csl.sri.com/users/neumann/illustrative.html>.
alism. Bearing in mind that competition comes from all across the world, Europe needs to look at maintaining its competitive advantage through producing higher quality professionals, as it cannot hope always to compete on pure labour cost.

A cautionary note, and one worthy of further research: While it can be considered self-evident that a professional approach and a professionally produced product is to be preferred, it remains something of an open question whether or not the market – in the form of employers and consumers – universally expresses a preference for this in its formal sense⁴. The business case for IT Professionalism needs to be made to both the consumer of IT products and services (society), and the consumer of IT labour (industry); demand for IT Professionalism is likely to be balanced between public demand and demand from practitioners.

3 The Value of IT Professionalism

Promoting this multifaceted definition of Professionalism – and more importantly establishing a recognised body of individuals who possess these characteristics – will have a number of tangible benefits that will accrue to the individual, to organisations, and to society more broadly.

Benefits of Professionalism

Quality of Service:
Quality is a central defining characteristic of the IT Professional, and everyone benefits from this – the Professional, their customers, and society at large. The cost of IT failure has been enormous, and well publicised. Avoiding failure – and more specifically delivering a service that meets and exceeds the expectations of customers – is not just important for organisations but can be important at a national and international level. The increased quality of service received by customers will also potentially lead to increased customer satisfaction and contribute to higher customer retention for companies.

Mobility of Labour and Services:
The ability of individuals to describe themselves against a common standard and for organisations, large and small, to have clarity about the attributes of potential employees or service providers is essential. A shared and well articulated definition of Professionalism delivers on this. It will assist Professionals to move within organisations, sectors, countries, and internationally to seek employment and to offer services.

Mobility of labour will contribute to reducing potential shortages of IT Professionals across Europe, which was identified as a potential issue for the industry in research conducted by CEPIS, with possible shortages of up to 70,000 IT practitioners per year in Europe, as supply falls short of demand⁵.

Recognition of Value:
Individuals who can credibly describe themselves as being a Professional will be able to clearly differentiate themselves from others who may, to a greater or lesser degree, be able to describe themselves as practitioners. This differentiation will have benefits in terms of monetary and non-monetary recognition that the services that Professionals provide are valuable and, indeed, essential to organisations and to society.

European IT Professionals will be able to harness this recognition of value to continue to win business when competing in the international marketplace. Within Europe, consumers will have greater confidence in the IT Professional and the products and services they provide.

Promotion of Innovation:
Professionals are in a particularly strong position to drive innovation. They combine experience, up-to-date knowledge and appreciation of the potential of technology, and accountability and authority in a way that allows them to be both creative and proactive in problem solving and implementing change. They understand the challenges and potential of their organisations and customers, and therefore will be a key source of both innovative thinking and practical change.

Fostering an IT Professionalism culture across Europe will contribute to innovation that drives increased value and efficiency for organisations and economies.

A Competitive Advantage for Europe:
Professionalism, mainly as a result of the impact of the other benefits, can give Europe a clear advantage in the global market for IT services. This global market is highly competitive and highly dispersed. It is clear that Europe is best placed to compete for high-value, high-value services. A European IT sector that is built on a foundation of Professionals with a shared understanding of Professionalism will

⁴ A study [13] by the Consultative Committee for Professional Management Organisations (CCPMO) in the UK indicates that, for the management professions at least, there is economic benefit associated with membership of professional institutions, and that employers associated a premium with this. It seems reasonable to assume that there would be a comparable effect for the IT Profession. An economic impact assessment of the CCPMO, Jonathan Chapman, Dr. Gavan Conlon, Patrice Muller, London Economics, December 2008.

have a definite advantage in positioning itself as the leading provider of these services.

4 The CEPIS Vision for IT Professionalism

It is the goal of CEPIS Taskforce on Professionalism to foster a pan-European understanding of the concept of IT Professionalism, and from this to develop and promote a pan-European Professionalism in IT, where achievement of Quality is the core factor, which spurs innovation, and which drives benefit to the practitioner, to the enterprise, and to society. Such Professionals will be ambassadors of the profession to other communities, evangelists of the Professionalism ideal to other practitioners and aspirants, and will drive value and innovation.

This will be implemented by means of engagement with national informatics associations through which an IT practitioner can embark upon a process of professionalisation that will activate a value chain throughout society.

In order to attain this top-level vision, a series of closely linked goals needs to be elaborated that can inform specific CEPIS Professionalism actions over the coming five years.

**Validate and promote a pan-European understanding of IT Professionalism:**

The definition of professionalism proposed here will be articulated and validated both within member informatics societies and to relevant stakeholders, including national and European policy makers, industry, and education. The definition that will be the outcome of this consultation and validation should position IT Professionalism as a set of common characteristics held by an individual or group of individuals that point to how these individuals should be expected to behave and perform.

**Articulate and convey the benefits of IT Professionalism to stakeholder groups:**

The establishment of an agreed definition is an essential precursor for the central goal: communication of the benefits of Professionalism. Its importance may be accepted within the profession, but it should also be appreciated within the broader environment in which the Professional operates, amongst large and small employers, IT customers, governments, and individuals, including Professionals and practitioners. The identification and analysis of the benefits – for example, improved quality, innovation, competitive advantage - and subsequent dissemination will ensure that there is a common understanding of what is expected of an IT Professional, within the industry and beyond.

**Investigate and utilise formal and informal structures to promote Professionalism:**

Several approaches have been devised over recent years to assist in structuring the IT Profession and to give consistency to how it is conveyed in Europe. This has included the development of national and European profiles for the Profession, frameworks to define competences of IT Professionals (e.g. e-Competence Framework), competence development schemes such as EUCIP, as well as national level initiatives within member societies to promote some of the characteristics of an IT Professional. CEPIS will look to collate, catalogue and critique the existing structures that are used in the IT Profession. This will provide examples of current practice that may be able to be adapted for wider use across Europe. In addition, CEPIS will seek to build on existing work to create practical tools for developing and promoting professionalism.
EUCIP and the Pillars of ICT Professionalism

Paolo Schgör and Renny Bakke Amundsen

Professionalism in the field of Information and Communications Technologies, ICT, can be approached from many different angles. Although it is evident that important progress is being made towards a widely accepted ICT-oriented definition of terms such as professions, professionals and professionalism, it is also true that, in parallel, the certification of individual competences is a very effective tool to promote ICT Professionalism. In this context, this article describes briefly EUCIP, European Certification of Informatics Professionals, one of the most recent results of more than 20 years of CEPIS work efforts to come to some standard structure for the ICT Profession at a European level. The Survey of ICT Professional e-Competence in Europe launched recently by CEPIS is mentioned too.

Keywords: CEPIS, Competence Framework, e-Competence Survey, EUCIP, European e-Competence Framework (e-CF), ICT Professional Certifications, Professionalism.

1 Introduction

There are various definitions of professions, professionals and professionalism; these can differ significantly from country to country, as we have widely discussed within the CEPIS Taskforce on ICT Professionalism1.

Nevertheless any definition of professionalism includes the need for a specific knowledge; moreover, most definitions also mention experience as a pillar. Without entering a discussion on words, we might observe that both knowledge and experience are often combined into other terms, such as “skill” or "competence".

Similarly, any definition of professionalism includes some form of recognition of quality associated with the performance you can expect from a professional.

These fundamental pillars of professionalism can certainly be studied in a general theoretical form, but they can also be approached in the specific perspective of the certification of individual competences. Certification by a trustworthy entity is a good way (not the only one!) to allow immediate recognition of quality.

Yet, in order to really certify professional competence, it is absolutely necessary to apply precise methods for the definition and measurement of knowledge and experience.

As presented at IFIP’s World Computer Congress in 20082, EUCIP, European Certification of Informatics Professionals, is one of the most recent results of more than 20 years of CEPIS work efforts to come to some standard structure for the ICT Profession at a European level3.

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The Informatics Profession in Europe: An Overview

Figure 1: Components of the EUCIP Model.

Figure 2: EUCIP's ICT Professional Branches and Profiles.
The Informatics Profession in Europe: An Overview

2 European Certification of Informatics Professionals (EUCIP)

 Appropriately functioning ICT systems are crucial for social and economic development. The EUCIP programme, <http://www.cepis.org/eucip>, is both a professional certification and a competency development scheme, aimed at informatics professionals and practitioners. Developed by CEPIS, it’s also a vendor-, system- and program-neutral framework.

The overall goals of the EUCIP programme are to:
- Define an industry-driven vocational structure and standards for the informatics profession.
- Establish a sustainable European services network for informatics competence development.
- Contribute to closing the ICT professional skills gap in Europe.
- Offer a vehicle for life-long learning and competency enhancement for the ICT profession.

The EUCIP certification offerings include EUCIP Core, EUCIP Professional and EUCIP IT Administrator. In addition, various business services have been development to manage competence analysis and development.

The EUCIP model provides for the definition and measurement of ICT skills, including behaviour skill, and competence. The components are represented in Figure 1.

CEPIS Member Societies in Italy and Norway are making the widest use of the EUCIP model, exploiting its potential as a framework of competence profiles. (See the whole set of EUCIP Professional Profiles in Figure 2.)

On the "certification and services" side, more countries are currently engaged in EUCIP (to various degrees) from offering a single certification (e.g. EUCIP Core or IT Administrator), to offering a range of services: Austria, Croatia, Estonia, Greece, Ireland, Italy, Norway, Poland, Romania and Spain.

3 CEPIS Survey of Professional e-Competence in Europe

In addition to the EUCIP programme development, the ECDL Foundation, CEPIS and some of the Member Societies (such as AICA, BCS, DND...) are giving a significant contribution to the European standardization programmes through voluntary participation in the CEN Workshop on ICT Skills, <http://www.ecompetences.eu/1415,CEN+Workshop+ICT+Skills.html>.

The development of the e-CF is carried out through a series of CEN Workshop projects co-funded by European Commission DG Enterprise and Industry.

CEPIS has used the e-Competence Framework as a basis for a European survey that will provide a unique oppor-
tunity for ICT Professionals to gauge their level of competence against European standard profiles recognized by the labour market, <http://www.cepis.org/index.jsp?p=940&n=2406>.

The screenshot in Figure 3 shows an example of the graphical output that each respondent gets.

This survey will also act as a tool to raise awareness of the need for competence in the ICT Profession, and to provide an opportunity to contribute to the CEPIS commitment to developing professionalism in ICT.

See the dedicated box the law for a summary of research objectives and project guidelines of this survey.
The British Computer Society’s View of IT Professionalism

Adam Thilthorpe

This article describes the approach taken by the British Computer Society, BCS, in order to gain greater recognition for IT professionals, and in particular, for IT to be seen as a profession that is valued and respected for the contribution it makes to society, businesses and individuals. The goals and activities of the Professionalism in IT initiative are explained in this context.

Keywords: BCS, IT Professionalism, Professionalism in IT Initiative, SFIA, Standards.

1 IT Professionalism

The term IT, Information Technologies, is used every day by millions and often to describe systems and processes in common use that are taken for granted. This is as true for individuals as it is for businesses and organisations that often depend on Information Technology for their very existence. The technology underpins systems as diverse as those employed in global financial systems, or found in manufacturing industry and, at a personal level, mobile communications. Indeed, there are growing numbers of businesses that are conducted wholly in a virtual environment.

A survey published earlier this year by Harvey Nash in association with PA Consulting (Harvey Nash CIO survey 2010 - New decade, new opportunities) reporting on data related to 2009 went so far as to say that technology had played an important role in the survival of many organisations during that year.

BCS, the Chartered Institute for IT, <http://www.bcs.org>, has been convinced for some time that those working in this vital area should be recognised as professionals in the same way as accountants and architects are regarded for their contribution to financial or structural security. The Institute believes the causes of failure that often hit the headlines are more often down to management and business issues than technical failings, and is passionate about the ability of IT and business to work well in partnership.

In September 2009 the Institute transformed its operations. One of its aims is to gain greater recognition for IT professionals, and in particular, for IT to be seen as a profession that is valued and respected for the contribution it makes. As IT is a global industry, this vision adds an international dimension for the Institute.

In September 2009 the Institute transformed its operations. One of its aims is to gain greater recognition for IT professionals, and in particular, for IT to be seen as a profession that is valued and respected for the contribution it makes. As IT is a global industry, this vision adds an international dimension for the Institute.

The IT profession is young when compared to others and the Institute began its transformation by consulting as widely as possible with all stakeholder communities. The findings suggested a need to address fundamental issues such as establishing standards for the new breed of professionals that exploit IT to deliver business advantage, and supporting employers as they deal with the challenge of enabling and growing their businesses -often through IT-enabled change projects.

2 The Focus on Standards for Individuals

As the leading professional body for those working in IT and the qualifying body for Chartered IT Professionals, BCS has taken the lead by reviewing its Charter standard to make sure it says something about the holders that employers will value. The process is now more rigorous and demanding to achieve and applicants must now be able to demonstrate:

1. Competence: a period of experience working in IT including a recent period working at SFIA Level 5,
2. Breadth of Knowledge: an awareness of the scope and application of IT exemplified by passing a test against the Core Body of Knowledge.
3. Depth of knowledge: Demonstration of deep knowledge and associated competence at specialist level in one or more specified areas of IT.

The specialist areas are referenced in the Skills for the Information Age (SFIA) framework. Since September 2009 successful applicants also receive a Certificate of Current Competence valid for five years.

Additionally, the Institute is licensed by the Engineering Council and Science Council to confer the awards of Chartered Engineer (CEng) and Chartered Scientist (CSci). CITP, CEng and CSci are equally valid for IT professionals who are differentiated by their particular skills and area of competence.

3 Which Chartered Status

CITP for those who exploit IT to deliver business advantage
CEng for those who apply IT to the solution of engineering problems

Author

Adam Thilthorpe joined BCS as a key account manager in 2005 but now leads the development of the Institute’s professionalism in IT initiative. He speaks regularly at BCS and industry seminars and conferences engaging with companies and organisations that employ IT practitioners. He raises awareness of the changes in the profession; the challenges and the opportunities. Adam gained his early experience in the City of London with financial institutions JP Morgan Chase and Co and Georgeson Shareholder. <profit@hq.bcs.org.uk>
CSci for those who advance knowledge and understanding of computer science

3.1 CITP

The Institute is seeking to establish a group of professionals who are recognised as having the experience and competence to interact positively with business organisations whether those organisations are public, private or working in the third sector.

A group that is equipped to operate at the highest levels and can influence policy and strategy, leading to more successful outcomes for IT-enabled business change projects, will move the profession away from being seen as a mere service provider.

Chartered status provides evidence of professionalism backed by a code of conduct and CITP is a benchmark of excellence that is gaining international recognition. The Institute has received positive feedback from many international customers and IT suppliers since refreshing the standard last year and this recognition is particularly important for IT professionals who are employed by multinational companies and cross national boundaries to work on pan-country projects.

BCS is in the process of establishing a global partnership program for CITP. Interest has been expressed in the US and Europe and the partnership program will allow international partners to operate aspects of the CITP program under license from BCS.

4 The Focus for Organisations

Trends in the profession, such as those reported by the Harvey Nash survey, demonstrate that IT professionals are central to business success and those in leadership positions have to refocus their attention repeatedly to capitalise on new technologies and ways of working.

Fighting on several fronts at once is not unusual and IT functions need to be able to respond positively to any and all challenges to fulfill their role. How to do this is not an insignificant problem and relies heavily on the skills and competence of the workforce.

BCS is committed to making available high quality solutions for the development of IT professionals and has designed a number of structured and highly developed solutions with the SFIAplus framework at their core.

SFIAplus is based on the Skills for the Information Age (SFIA) framework and the tools help organisations build and develop effective plans for future changes through the analysis of the core skills and capabilities needed by employees to complete a project. It enables employers to produce job profiles based on the standard, identify skills gaps and create development lists, objectives and plans quickly. SFIAplus offers organisations a structured approach to development planning for their IT professionals.

SFIA has the backing of the UK Government and is used by IT suppliers, customers and academia across the globe. These are the users who contribute to its regular updating. In June this year skills for Sustainable IT (Green IT) were added. The framework is available in Spanish and Japanese and a translation into German is expected later in 2010.

5 The Future

Greater numbers of businesses are demanding holistic solutions and seeking out the tools to help them enable their employees to meet future challenges. The time is coming as well when those employers will prefer to hire staff with verified credentials, including Chartered status, to provide an extra level of confidence in the individual and their ability to contribute to the business.

The world will reach a point where it values and respects those who develop the technology and apply IT. The Institute wants IT professionals, who have been at the forefront of the change in business and society, to benefit.
EU 2020: Developing the IT Profession to Meet the Vision for Europe

Liz Bacon and Lachlan MacKinnon

This article discusses the issues associated with the upskilling and reskilling of the European active workforce in Information Technologies, IT, and digital technology skills. A rationale is presented to relate this requirement to the European Union target to be the world’s leading knowledge economy by 2020 and a quartile descriptive partitioning of the workforce in terms of IT skills and knowledge, and their use, is presented. Consideration is given to the need to provide articulated and universally accepted skills and qualification frameworks that offer seamless progression through all levels from novice to professional. The key organisations working in this sector, most of which have been established in the last 2-4 years, are also described. The article concludes by stressing the importance of developing a professional IT workforce to compete effectively on a global stage. Fundamental to this argument is the requirement to develop the existing workforce, the majority of whom have already completed formal education, and to provide the tools, frameworks and protocols to achieve this. Finally, the value of successfully undertaking such a development is quantified in economic terms, and a set of actions, some already underway, to achieve the professionalisation of the IT industry are described.

Keywords: eSkills Development, Global Competitiveness, Knowledge Economy, Professional IT Industry, Reskilling / Upskilling Active Workforce, Skills and Qualifications Frameworks.

1 Introduction

The European Union, EU, has the target to be the world’s most advanced knowledge economy by 2020 [1]. In order to achieve this it is vital that we develop a highly skilled, computer literate workforce that can utilise the benefits of digital technologies across all sectors, and that we also develop world-leading skills in next generation technologies and Information Technologies, IT, services.

Europe has many strengths in digital technologies, for example it is a leader in high technology industries such as micro and nano technologies, optical and mobile broadband communications, security and countermeasures, and creative technologies. It has a high-quality software development community, in applications and services, world leading universities, and a strong research base. However, it has long been a subject of concern within the EU that Europe has not produced a Microsoft or a Google, but Europe has a long-standing and very successful tradition of technology development through the Small and Medium-sized Enterprises, SME, sector, and it is the case that many of the strengths of European research are reflected in SME clusters throughout the continent. It would be foolish to ignore, or indeed to lose, the benefits of this existing capability in seeking to emulate models of technological development and success generated in other countries. Therefore, if we are to develop the world’s most advanced knowledge economy, we should base it on professionalising our workforce and building on the existing strength of our SME culture.

However, we have to recognise that there are a number of steps that we need to take in order to move forward to-
wards this goal. Europe has a high cost base, and currently the off-shoring of entry level jobs disguises a shortage of personnel, reducing the supply of technically capable, experienced staff who can move to higher level positions within the IT industry. We also have a very wide range of training and educational opportunities, certification and qualifications, and professional accreditations, which do not map to clearly established and universally recognised frameworks for professional skills development and certification. Ideally, we would have a single unified skills and qualifications framework that could be applied across the EU, but this is unlikely given national and cultural differences, even apart from different industrial perspectives. Therefore, what is actually happening, and needs to be encouraged, is the development of mappings relating different certification models between professionally supported skills frameworks, the European Qualifications Framework and the credits system. In the last two years there has been an explosion of activity in this area at the higher qualifications levels, leading to the development of a number of new organisations, but this still requires coordination, and the activity is not uniform across qualification and skills levels.

The importance of IT to the development of the European knowledge economy is evidenced by a report by UK IT Sector Skills Council, e-skills UK, United Kingdom, on the IT and Telecoms industries in Jan 2008 [2] which states that "half of Europe’s productivity gains in recent years can be attributed to investments in IT". This report also highlights that "US multinational firms are on average 8.5% more productive than UK domestic owned firms, and 80% of this advantage is explained by better use of IT." This demonstrates the level of the task that faces Europe if it is to become the world’s leading knowledge economy. It is necessary to develop our use of IT more effectively across all sectors of the economy and society, in order to compete globally and overtake our major competitors. European industry requires a workforce with varying levels of IT skills to meet the demands of different types of jobs. In the development of the recently produced Digital Britain report, e-skills UK [3.] identified a quartile partitioning of the workforce in terms of their requirement for IT skills and knowledge, which we can use as a basis for our discussion of the development of the EU workforce towards 2020. The four categories identified by that partitioning are:

1. Digital Literacy – these skills are required by 100% of the population and focus on digital media literacy, digital life skills and digital inclusion.

2. Digital Work Skills – these skills are required by users of IT in their daily work. In the UK, around 22 million workers, 75% of the active working population, are estimated to be using IT skills in their daily work.

3. Digital Economy Skills – these skills are required by the majority of managers and leaders, across a wide variety of industrial sectors, who need a strategic understanding of the implications and potential for the use of IT to promote and develop their organisation. Around 16% of the working population require these skills.

4. Digital Professional Skills – these are skills required for the highly-skilled IT and Communications experts and creative industry professionals, who use these skills to design, implement and derive value from IT and Communications systems and services. These professionals represent around 5% of the active workforce.

The rest of this article discusses these categories in more depth and considers the issues identified relative to qualifications and skills frameworks.

2 Digital Literacy

Digital technologies invade every aspect of modern life and digital literacy skills are defined as those required to engage with society through technology. The first issue that needs to be addressed is access to technology, and this is significantly influenced by the digital broadband rollout across Europe, which has not yet achieved consistent impact in all member countries or set targets for citizen access. However, the vast majority of school age children now have significant exposure to IT, and will have levels of literacy in common with their levels of linguistic and mathematical literacy by the time they complete their basic education. Nonetheless, this does leave a significant adult education requirement, since any adult completing their education ten years or more ago will have had limited exposure to IT during that education.

There are a large number of introductory programs and instruction aids available to introduce new users to software applications, however:

1. Often too much prior knowledge is assumed/expected;
2. The level may be aimed at children and therefore inappropriate for adults in terms of tone, language and motivation;
3. Certification is likely to be either absent, or associated with use of a proprietary tool, rather than skills related;
4. Inclusion is a significant issue given the need to avoid problems related to language, culture or technical expertise.

We suggest that there is a need to identify a certificated model of base-level skills in the use of IT technologies for the general population, and this can be easily modelled and captured for the use of any set of tools, both to provide and support inclusive national and international services, and to open up routes into higher level skills.

3 Digital Work Skills

Taking the UK as an example, we know that the overall population is around 61.8 million, around 29 million constitute the active working population [4], and 22 million of those, i.e. 75% of the active workforce, are estimated to be using IT skills in their daily work. The goal for 2020 should be to get as near as possible to 100% of the active workforce using high level IT skills in their daily work.

The skillsets involved operate within a reasonably well-defined range of activities, but are often conflated with the
use of proprietary software tools. The best-known certification model is the European Computer Driving Licence, ECDL, promoted by the Council of European Professional Informatics Societies, CEPIS; however this is both proprietary and focused predominantly on the use of Microsoft tools. There is a huge range of providers and certificates, and, as a result, confusion within this marketplace in the absence of an accepted industry standard. However, there are examples of good practice, for instance, CompTIA [5] who provide a set of industry supported generic certifications and a mechanism to relate proprietary industry certification into their model, on a skills basis.

The Leitch Review in the UK [6] highlighted the need, already described, to train the existing workforce, but made the point that the majority of those requiring such training will already have completed their formal education. The same situation applies across the EU and in order to be globally competitive, models of adult training including Continuing Professional Development, CPD, need to be associated with a universal skills framework, to support worker mobility and provide support for clear trajectories of skills development.

4 Digital Economy Skills

These skills are identified with the need to understand and manage the strategic implications and potential use of IT in an organisation. In the UK around 16% of the active UK working population (4-5 million people) are estimated to need these skills.

The e-skills UK report [2] states that the number of IT Managers and IT Strategy and Planning Professionals has grown rapidly between 2002 and 2008, with the number of IT Managers having increased by 43% over that period. Their survey also predicts a need for over 40,000 new entrants into these two roles annually until at least 2016.

The challenge for this category of digital skills is that a significant proportion of the staff identified in this sector tend to lack adequate technical skills, so while they may understand the benefits that the technology could bring, they lack the necessary knowledge to specify and/or manage the development to achieve those benefits. In the UK the e-skills report in Jan 2008 [2] reported that 38% of staff in IT management roles identified a technical skills gap. One additional problem is that the same report identified that 78% of large IT companies provided training for their IT professionals in the previous year, compared with only 18% of companies with fewer than 10 employees, a problem which is likely to have more serious impact in Europe given our dependence on a large SME sector. It also noted that between 2006 and 2016, the largest salary and employment growth in the US is predicted to be in management, scientific and technical consulting services, increasing by 77.9%, and we might reasonably anticipate a similar level of growth in Europe if we have the skilled workforce to meet this need.

Efforts to address these deficiencies have often led the sector to concentrate on encouraging those with the technical skills to develop their entrepreneurial, transferable and business skills. Indeed, many large IT companies find it preferable and easier to recruit non-technical graduates who possess good business and transferable skills and train them in IT. However, the evidence outlined above indicates that this is not a successful strategy, with many senior staff left deficient in their technical knowledge. Given the comments made earlier about the EU SME development model, there is a need to ensure that the programmes and courses that are offered to support staff in this area, including everything from CPD to degree-level programmes, provide support for a relevant set of skills that include both business and technical knowledge.

If the EU wishes to compete with the USA and Japan, and compare entrepreneurial activity against those countries, it must not ignore the heterogeneous nature of the EU workforce and the different cultural views of academic/industry interface.

5 Digital Professional Skills

These are required for the highly skilled IT and creative industry professionals who develop and innovate IT solutions. In the UK there are currently around 1.5 million IT and Telecoms professionals who require these skills, representing around 5% of the workforce, and this is expected to grow by 20% over the next 5 years [2].

Almost all eSkills development at this level is degree-based, both undergraduate and postgraduate, and it is noted in the e-skills UK report [2] that UK industry predicts that an additional 86,000 new software professionals are required to enter the IT industry annually until 2016. Although the global recession has provided some relief from this demand, evidence suggests the IT industry has turned the corner and that demand is once again on the increase and, due to the nature of these jobs, one would anticipate that these software professionals would be expected to come primarily from computing degrees as they need high-end technical skills. However, the supply of computing graduates across much of the western world, including Europe, has decreased dramatically in the past 5-6 years. Although the evidence now suggests some recovery in student applications, it will be several years before this is reflected in the workforce.

A key issue of concern is therefore the supply of these highly skilled IT professionals, who are the innovators and creators of wealth, to the workforce. In 2007 there were 18.9 million tertiary students in the EU across all subjects [7], all EU countries having increased their numbers in tertiary education since 2001 (in the UK, a growth of 5.1% was seen). However, this masks a decline in students studying IT related subjects to degree level, which most EU countries have experienced. In the UK over this period the intake to Higher Education Computing fell by over 50% [8], and intake levels dropped to levels similar to those of 1996. Our concern must be that we are not delivering sufficient
graduates to meet the current demand within the IT workforce, and the statistics show that the IT workforce and demand figures both increased during the period while our student numbers have been in decline. However, even if these numbers do now begin to recover, it will be some years before we are in a position to meet current industry demand, far less any growth in that demand. Unfortunately, the decline experienced at degree level mirrors a similar decline in pupils studying relevant secondary level qualifications, and there is a significant gender imbalance that also impacts these figures.

More worriedly, even if the percentage of applications to university for computing from the 18 year old population increases between 2008 and 2020, this will still signal a decline. Apart from Spain, Greece, Iceland, Luxembourg, Netherlands and Ireland (the only country with a significant increase), the number of 18 year olds will fall in every other EU country, a 20% drop being not untypical, 17 countries falling by more than 20%, 4 of these by more than 30% and a further 4 by over 40%. The overall population of IT graduates is therefore likely to continue its decline, and without significant intervention it will probably not be possible to replace or increase, as demand requires, this declining student population by adult learners. The impact on the EU workforce could therefore be significant [9].

6 Qualifications and Skills Frameworks

There have been considerable efforts to develop standardisation agreements and mechanisms, particularly at degree-level, across the EU to enhance mobility and recognition of the equivalence of qualifications. For example, through the Bologna agreement [10], which aims to harmonise degree and quality assurance standards across Europe. At this level, the issues are more related to knowledge and understanding than pure skills, and unfortunately efforts to develop standardised solutions have not yet delivered. The Bologna agreement, which is not specific to IT, utilised and confirmed the future of the ECTS credit transfer system for Higher Education within Europe, providing some equivalence between national higher education systems, but there are still significant differences and issues regarding the knowledge and skills that can be expected in graduates. In terms of eSkills, the major issue at this level is in relating the academic content of higher education programmes to industry skills requirements in a common accepted framework. There have been many attempts to develop equivalence and skills frameworks, some very recent. A brief overview is provided below of a number of key initiatives in this area:

1. The European Qualifications Framework (EQF) [11], agreed by European institutions in 2008, articulates eight levels from the basic knowledge of a subject through to knowledge at the frontier of a field of study. It is not specific to IT.

2. The Skills Framework for the Information Age (SFIA) [12] is an industry-supported framework developed as a not-for-profit foundation by UK professional bodies and industry organisations, backed by the UK Government. It defines seven levels of IT skills identified in a two-dimensional framework with areas of work on one axis and levels of responsibility on the other. Responsibilities range from following at level 1 to strategic/inspirational at level 7. This framework is in already in worldwide use by industry and Government to describe IT skills and has been translated into Japanese and Chinese. The focus is not only on defining the skills an individual has, but its also in establishing a relationship to corporate objectives and can be used to map skill levels for specific qualifications.

3. IFIP’s International Professional Practice Partnership (IP3) [13] aims to provide standards for a global IT profession with the goal of raising the profile of professionalism in IT. It defines a professional as a "practitioner who has specific skills rooted in a broad base, has appropriate qualifications from a recognized body, undergoes continuous development and operates to a code of conduct". IP3™ is an IP3 professional standard, based on SFIA level 5, which was defined in 2007 and accredited its first computer society in 2008. Individuals who have been certified by an accredited organisation can use the IP3™ on their business communications.

4. The Seoul Accord [14], established in Dec 2008, aims to provide mutual recognition of educational programmes in computing and IT-related disciplines with the aim of boosting IT exchanges. It currently has eight members who have "exchanged information on, and have examined, their respective processes, policies and procedures for granting accreditation to academic computing and IT-related programs, and have concluded that these are comparable". Currently the UK is the only European signatory.

5. The European Quality Assurance Network for Informatics Education (EQANIE) [15], founded in Jan 2009, is a non-profit association, which aims to "promote the implementation of quality assessment practice for informatics education systems in Europe and beyond......EQANIE helps to build confidence in systems of accreditation of informatics degree programmes within Europe". It provides an appropriate "European label" for accredited educational programmes in informatics, and facilitates mutual transnational recognition by programme validation and certification. It is a member of The International Network for Quality Assurance Agencies in Higher Education (INQAAHE) [16], whose main purpose is "to collect and disseminate information on the current and developing theory and practice in the assessment, improvement and maintenance of quality in higher education".

6. Engineering Council European Accreditation (EURACE) [17] is a body that provides an accreditation service for engineering programmes across Europe. Formed in 2006, this decentralised body provides a set of QA standards and criteria for equivalence articulation between national standards for qualifications at degree level. The label is administered by the European Network for Accreditation of Engi-
neering Education (ENAEE).

7. European Institute of Technology (EIT) [18] was set up with EU funding in 2008 with a mission "to grow and capitalise on the innovation capacity and capability of actors from higher education, research, business and entrepreneurship from the EU and beyond". "Participating higher education institutions will offer prestigious Masters and PhD degrees which will be encouraged to bear an "EIT" label in order to reflect their high quality and innovative character".

In addition to this growing body of organisations and activities, predominantly focused at degree-level and above, there have been a number of more isolated initiatives at sub-degree level, and there are a number of professional level initiatives. Professional level recognition, accorded through awards such as Chartered Engineer (CEng) and European Engineer (EurIng) afford practitioners the opportunity to maintain a level of recognition of their knowledge and skills throughout a professional career. If properly structured, and regularly updated, such certification offers the route for the professionalisation of the IT industry through the medium of contract sign-off, public liability and professional accountability.

7 Conclusion

In considering the development of the skills and qualifications necessary to professionalise the European IT industry, it is clear that there is a need both to provide clarity in unifying skills and qualifications frameworks from cradle to grave, to support lifelong skills development, and to properly identify relevant skillsets for individuals based on the roles and responsibilities they undertake. As described earlier in this article, we can readily partition the active workforce in terms of their usage of digital technologies, and the skills and knowledge they possess relative to those technologies. We also have the aspiration that 100% of the population of the EU should be digitally literate, and have access to high quality services and facilities on-line.

The evidence suggests that there is a considerable body of work and energy currently being applied in the development of skills and qualifications frameworks and professional certification, with associated QA and standards protocols. However, it is also clear that much of this activity is independent and some is orthogonal to the concept of unified or universal frameworks.

If Europe is to achieve its ambition to be the world’s most advanced knowledge economy by 2020, then these issues have to be addressed. The EU needs to establish effective articulation between the skills and qualifications frameworks, and professional certification to permit seamless progression from base level skills and knowledge through to high-level professional expertise. The various organisations working in this space have to be encouraged to cooperate rather than to compete, thereby achieving a greater synergy for the development of the EU ambition.

At this time, the evidence suggests that the EU, in common with much of the industrialised western world, is rapidly losing the lead in next generation digital technologies to the new giants in India and China and the tiger economies of the Far East and Africa. If the EU does not develop its own indigenous workforce to the highest possible level in the use and development of digital technologies, then this may become an insurmountable gap. It is worth noting that many postgraduate programmes in technical subjects at EU Universities are predominantly populated by international students, which could be viewed as training the competition, and until such time as that population becomes predominantly home students, this will continue to weaken our international position.

As indicated earlier, a key consideration in developing the IT skills and knowledge of the EU active workforce is that the vast majority of that workforce has already completed their formal education. Therefore, if the EU is to achieve the necessary growth in IT skills and knowledge within the workforce, significant developments in the area of adult and lifelong learning need to take place, supported by national government and European funding initiatives. There are considerable challenges in the area of Continuing Professional Development, CPD, for adults and in the upskilling and reskilling of the workforce, where currently the supply of such training can be patchy and almost invariably is reliant on the individual tracking down relevant courses themselves. There is a need to further develop academic-industry-government partnerships, such as National Skills Academies, UK, [19] to try to facilitate a link between the supply and demand for CPD courses. As industry is ever more pressured to compete in the marketplace, there will be an increasing demand for such training to be delivered direct to the desktop.

The importance of developing a high quality professional IT industry in Europe cannot be underestimated, since it will not only support the EU ambition to become the world’s leading knowledge economy but will also provide the focus for jobs and wealth creation in the next decade. The decline in manufacturing industry, particularly in low cost mass production industries such as steel, ship building, mining etc. is predominantly attributable to the European cost base in comparison with emerging economies in other countries. Unless the EU is prepared to see a dramatic reduction in that cost base, and therefore in the income and quality of life of its citizens, then the alternative must be to develop capability and global competitiveness in high cost, high value industries, such as the digital technologies described in the introduction to this article. A report in 2009 by IDC [20], commissioned by Microsoft, identified that the worldwide growth in the IT sector will create 5.8 million new jobs and 75,000 new businesses by 2013. It also identified that the world’s top 52 IT spending countries invested around $1.4 trillion in 2009, and this growth alone generated E 265bn in taxes in Europe. These figures demonstrate the massive importance of the IT sector to the
future prosperity and success of the European economy and Europe will only be able to gain its share, or preferably more than its share, of this bounty by developing its workforce and professionalising its IT industry.

8 Actions

Clearly, the issues and ideas presented in this article lead on to a set of actions necessary to achieve the professionalisation of the IT Industry in Europe, to meet the EU 2020 vision. A number of actions are already underway, with the universities seeking to develop stronger links with industry, and, in particular developing new programmes specifically designed to address the skills and knowledge necessary to professionalise the IT industry. At a European level universities have revised and restructured their degree programmes to meet the Bologna criteria to ensure equivalence, to support student and worker mobility. This will allow industries to expand and relocate, with confidence in the capabilities and knowledge of staff across Europe. Each country in the EU has its own specific issues in relation to the development of professional standards, and the education and training being offered to the workforce. There are a large number of local initiatives designed to address these issues. European organisations such as CEPIS, are seeking to extrapolate the benefits of local activity to a European level in order to disseminate best practice, to improve consistency of performance, and to achieve a level of homogeneity in professional IT services throughout the EU. There are gaps in such provision, and while there is a strong level of activity in terms of the professional and the research community, there is currently a gap at European level for those involved in the management, funding and policy at Higher Education and there are similar gaps at the vocational and school levels.

The authors are currently engaged in the development of a European wide organisation, similar in operation and management, funding and policy at Higher Education and Technology Management for Business, ITMB, degree supported by e-skills UK [23] delivered by a number of universities. The most obvious gap, which requires rapid and coherent action to resolve, is in the digital work skills area. It is not that there is a lack of provision of training or in-house development by industry, but owing to the lack of a coherent skills and qualifications framework on to which that activity can be mapped, the route for progression from novice to professional is neither clear nor simple. It should be apparent from the information presented in this article that a considerable body of activity has already taken place in this area over the last four years, including the development of a number of new organisations. The need now is to ensure that we have a comprehensive coverage of skills needs across all levels, and that the organisations involved in this space interoperate effectively and to the overall benefit of a professional IT industry.

References

Analysis of Non-Technical Skills for ICT Profiles

Luis Fernández-Sanz

Note from the Guest Editors: This article was selected among the ones presented in the First European Workshop on Computing and ICT Professionalism (EWCIP), endorsed by ATI and CEPIS, within the CISTI 2010 International Conference, held in June 2010, in Santiago de Compostela, Spain. See <http://www.aiti.eu/cisti2010/>.

The traditional concept of ICT education and employment analysis has devoted a great effort to determine specific technical knowledge and skills needed for a successful professional career. However, a competency-based approach for Human Resources (HR) management in organizations has finally changed this approach pushing more interest in non-technical skills, the so-called soft skills. This paper presents an analysis of non-technical skills required for a variety of IT (Information Technology) positions and areas based on data extracted from more than 3000 ICT job offers published in Spain in recent years. Requirements are also compared with those expressed as requirements for telco engineers and industrial engineers. We can conclude that soft skills profiles are different for each case and that these data should guide actions in education and career development areas.

Keywords: Advertisements, IT Jobs, IT Professionals, Job Ads, Skills, Soft Skills, RENTIC.

1 Introduction

It is not easy to define IT, Information Technologies, professional thinking in a monolithic profile of positions. As clearly observed in daily practice, the IT profession is continuously evolving and new positions and names are emerging almost each day. This evolution as well as the variety of roles makes it difficult to create a unique profile of skills and competences required for IT professionals. Traditional IT and IS (Information Systems) career paths were easier in the old times as can be seen in [1]: e.g. the traditional path from programmer/analyst programmer to analyst to application manager and even IS director. Even the traditional ACM curriculum for Computer Science [2] had to be split into several branches (Information Systems, Software Engineering, etc.) many years ago to try to better reflect the evolution of the IT profession.

In the literature, researchers have paid much attention to identifying and defining knowledge requirements for IT professionals and engineers both for defining educational strategies as well as for analyzing professional profiles. When dealing with IT professional profiles, it is possible to identify evident parallelism of this attitude in the results of different analyses and studies of the IT labour market. On the one hand, great effort has been devoted to determine if a language X or Y is the market leader or the one which it is worth learning to get the best jobs; in many cases, ranks of technology tend to reflect commercial or market interests (even for FOSS, Free and Open Source Software) or personal preferences to be confirmed by "data". On the other hand, fields like software engineering, where the main part of effort and costs is determined by the participation of IT professionals (developers), tend to concentrate much more attention in "technical" topics than in human factors. Many other areas of computing just ignore them.

On the opposite side, studies tend to emphasize that IT professionals are frequently not sufficiently aware of the need for developing their own skills in relation to the business world, social aspects of organizational life, communication ability to attract managers’ support (speaking the business language and jargon), etc. In fact, an internal marketing study ordered by a Spanish private university to analyze the social and organizational image of professional corresponding to different degrees found that computing people tend to be considered technically competent and efficient but perceived as outliers in the games of influence within the organization (even if they are located in places close to data processing centers, far away from the high luxury rooms of CEOs, CFOs, etc.). In general, HR specialists tend to remark that IT people should improve their assets of personal competencies.

In this paper an analysis of requirements as expressed in IT job advertisements in Spain is presented. The analysis considers technical and knowledge requirements as well as soft skills and personal competences.
as soft skills although special emphasis is put on the non-technical ones.

2 Soft Skills in IT and Informatics

Competence management has been all the rage since the 1990s in the area of HR. This approach highlights general personal skills as the key for success in the professional world in any discipline. Different studies have offered lists of what employers (or people in charge of HR or main areas of management of companies) think are the most adequate abilities for high performance in almost every area of business action. Words like teamwork, leadership, creativity, etc. have been adopted as remarkable attributes of talented people. But, which is the real influence of these concepts on IT professionals? Although personality heavily influences people’s behaviour and it is normally well defined at an early age, humans can work on and successfully improve the so-called non-technical or soft skills, especially during higher education. In fact, industry demands that graduates demonstrate ‘professional skills’ in addition to technical competence: e.g., an analysis of CIO qualification demands for entry-level application developers revealed that while classical technical backgrounds such as Data Structures, Algorithms and Complexity and Programming Fundamentals remain, coping places soft skills such as communication ability, project management and teamwork are amongst those having the most importance [3]. Other studies [4][5] also highlight the demand for soft skills which are defined as the cluster of personality traits and attitudes that drive one’s behaviour. Obviously soft skills complement the technical skills requirements of a job.

It is not strange to realize that in a discipline as technical as computer science (which still has a fast evolution and a lot of stunning acronyms) the really decisive factor is people. This was a lesson learnt in the area of computer security: so many firewalls, antivirus devices, cryptographic methods and so on...but in the end the real thing is that social methods of hacking exploit the “human factor” i.e., tricks to convince people to reveal keywords, to follow unsafe ways of action, etc. Fans of technology (and even freakish people who are proud of, or at least characterized by, the lack of social abilities) had to recognize that everything is measured in terms of human beings.

In fact, non-technical skills have been concentrating great attention in the area of engineering education since the end of the 20th century (even the presence of soft skills as explicitly included within the programs in the curricula seems to help to retain students in IT majors, especially in the case of females [6]). Human resources management based on competences has been implemented in a large proportion of companies and this has boosted the interest of educators when trying to adapt teaching methods to employment reality. Although traditional curricula in computing have been focused on technical knowledge [2], even students are convinced of the importance of developing these skills for their successful performance in professional life. As a good example, reference [7] reflects the importance of non-technical (Soft) skills for students when they adopt the role of people in charge of hiring computing professionals: 88% and 84% for project managers and software developers. Of course, as observed in this study, technical proficiency is a need but non-technical skills have conquered the second place and appear as the differentiating factor in candidate selection. Even more, different studies [5][8][9][10][11] have revealed the growing importance of the mix of technical and non-technical skills in different computing positions while other [12] insist on technical knowledge. There is some evidence that soft skills are not so appreciated by Small and Medium-sized Enterprises, SMEs when compared with what happens in big organizations [13].

3 Analysis of IT Job Ads

One of the problems with different studies is the lack of evidence of quantitative basis. The common characteristic for this group of studies is they are generated mainly by processing information from interviews or questionnaires sent to experts, Delphi methods, etc. IFIP (www.ifip.org) has published in 2008 a document, Characteristics of the IT profession and IT Professionals v3.0, where a Skills Framework for the Information Age (SFIA) is included. Concepts like capacity of influence, management of complexity, autonomy, etc. are considered essential for professionals but there is not an evident basis of quantitative data.

Different studies [9][10][14] have been carried out to characterize requirements for different computing positions or for general IT job skills analyzing job market. In our case, we have analyzed 3064 computing job advertisements in the main national newspapers of Spain and specialized job services of professional association from 2001 to 2008. This series of studies named as RENTIC (in Spanish, Requirements for Employment in New ICT) covers technical knowledge, soft skills, language and training requirements with a deeper level of detail and wider set of items and categories than equivalent studies [14]. In fact, it also includes conditions (salary, etc.) offered to selected candidates.

From 1998 on a regular basis (there are also data from 1993), the RENTIC series of studies on IT job requirements has been analyzing which are the qualities employers include as entry conditions for candidates in job advertisements published by the main newspapers in Spain. RENTIC addresses eight areas of technical knowledge/expertise (databases, programming languages, ERP and environments, communications, hardware, software engineering, operating systems and a miscellaneous one) and also three additional areas: degrees and educational requirements, foreign languages and personal skills and conditions.
### Table 1: Sample Distribution for RENTIC Studies.

<table>
<thead>
<tr>
<th>Sector</th>
<th>% offers</th>
<th>Position</th>
<th>% offers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computing services</td>
<td>51.4%</td>
<td>Programmer</td>
<td>12.7%</td>
</tr>
<tr>
<td>IT providers</td>
<td>5.1%</td>
<td>An/Programmer</td>
<td>7.6%</td>
</tr>
<tr>
<td>Tech. /Electronics/Aerospace</td>
<td>4.8%</td>
<td>Consultant</td>
<td>4.5%</td>
</tr>
<tr>
<td>Telco</td>
<td>4.6%</td>
<td>Project leader</td>
<td>4.4%</td>
</tr>
<tr>
<td>Consultancy</td>
<td>4.4%</td>
<td>Analyst</td>
<td>4.3%</td>
</tr>
<tr>
<td>Industry</td>
<td>3.7%</td>
<td>System technician</td>
<td>2.7%</td>
</tr>
<tr>
<td>Finance</td>
<td>2.8%</td>
<td>Systems admin.</td>
<td>2.5%</td>
</tr>
<tr>
<td>Building/civil eng.</td>
<td>2.3%</td>
<td>Others</td>
<td>61.3%</td>
</tr>
<tr>
<td>Government</td>
<td>2.2%</td>
<td><strong>Areas</strong></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>2.0%</td>
<td>Software dev.</td>
<td>42.6%</td>
</tr>
<tr>
<td>Health</td>
<td>1.7%</td>
<td>Systems</td>
<td>14.0%</td>
</tr>
<tr>
<td>Retail/distribution</td>
<td>1.1%</td>
<td>Consultancy</td>
<td>13.7%</td>
</tr>
<tr>
<td>Transport./logistics</td>
<td>1.0%</td>
<td>Management</td>
<td>9.1%</td>
</tr>
<tr>
<td>Others</td>
<td>12.7%</td>
<td>Others</td>
<td>20.6%</td>
</tr>
</tbody>
</table>

### Table 2: Comparison of Soft Skills for CIOs and Software Programmers (% of offers which mention each item).

<table>
<thead>
<tr>
<th>Item</th>
<th>CIOs</th>
<th>Programmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proactivity</td>
<td>9.76%</td>
<td>7.17%</td>
</tr>
<tr>
<td>Team management</td>
<td>9.76%</td>
<td>0%</td>
</tr>
<tr>
<td>Leadership</td>
<td>8.94%</td>
<td>0%</td>
</tr>
<tr>
<td>Teamwork</td>
<td>6.50%</td>
<td>7.17%</td>
</tr>
<tr>
<td>Communication skills</td>
<td>6.50%</td>
<td>2.51%</td>
</tr>
<tr>
<td>Management capacity</td>
<td>5.69%</td>
<td>2.87%</td>
</tr>
<tr>
<td>HR management</td>
<td>4.07%</td>
<td>0%</td>
</tr>
<tr>
<td>Capacity of analysis</td>
<td>4.07%</td>
<td>1.08%</td>
</tr>
<tr>
<td>Decision making</td>
<td>4.07%</td>
<td>0%</td>
</tr>
<tr>
<td>Customer-oriented</td>
<td>4.07%</td>
<td>3.94%</td>
</tr>
</tbody>
</table>
### Table 3: Comparison of Soft Skills for Industrial, Telecom and Computing Engineers.

<table>
<thead>
<tr>
<th>Soft Skills</th>
<th>Industrial</th>
<th>Teamwork</th>
<th>Telecom</th>
<th>Computing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity of management</td>
<td>9.3%</td>
<td>11.8%</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Proactivity</td>
<td>8.2%</td>
<td>10.2%</td>
<td></td>
<td>7.1%</td>
</tr>
<tr>
<td>Teamwork</td>
<td>6.2%</td>
<td>9.4%</td>
<td></td>
<td>6.7%</td>
</tr>
<tr>
<td>Customer-oriented</td>
<td>6.2%</td>
<td>8.6%</td>
<td></td>
<td>5.8%</td>
</tr>
<tr>
<td>Management of HR</td>
<td>4.1%</td>
<td>6.3%</td>
<td></td>
<td>4.6%</td>
</tr>
<tr>
<td>Planning ability</td>
<td>4.1%</td>
<td></td>
<td></td>
<td>5.5%</td>
</tr>
<tr>
<td>Negotiation skills</td>
<td>4.1%</td>
<td></td>
<td></td>
<td>3.9%</td>
</tr>
<tr>
<td>Communication skills</td>
<td>4.1%</td>
<td></td>
<td></td>
<td>3.1%</td>
</tr>
<tr>
<td>Sample</td>
<td>97</td>
<td>125</td>
<td>1311</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4: Comparison of Soft Skills for Five Typical IT Positions.**

<table>
<thead>
<tr>
<th>Soft Skills per Position</th>
<th>Systems Technician</th>
<th>Programmer</th>
<th>Analyst</th>
<th>Consultant</th>
<th>CEO or similar managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork</td>
<td>13.0%</td>
<td>20.6%</td>
<td>10.6%</td>
<td>17.4%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Dynamic/proactive/initiative</td>
<td>10.7%</td>
<td>20.6%</td>
<td>9.4%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Customer-oriented</td>
<td>4.6%</td>
<td>7.6%</td>
<td>2.8%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Autonomy/independence</td>
<td>3.8%</td>
<td>2.8%</td>
<td>2.8%</td>
<td>2.8%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Ability/motivation to learn</td>
<td>3.1%</td>
<td>1.7%</td>
<td>2.0%</td>
<td>1.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Communication and relationship skills</td>
<td>2.3%</td>
<td>0.6%</td>
<td>4.3%</td>
<td>2.9%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Analysis ability</td>
<td>2.3%</td>
<td>1.1%</td>
<td>3.1%</td>
<td>6.4%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Management/organization skills</td>
<td>0.8%</td>
<td>7.6%</td>
<td>2.8%</td>
<td>2.6%</td>
<td>16.2%</td>
</tr>
<tr>
<td>Self confidence</td>
<td>0.0%</td>
<td>1.9%</td>
<td>1.6%</td>
<td>1.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Creativity</td>
<td>0.0%</td>
<td>6.9%</td>
<td>2.0%</td>
<td>1.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Communication ability</td>
<td>0.8%</td>
<td>0.6%</td>
<td>2.8%</td>
<td>6.7%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Flexibility</td>
<td>0.0%</td>
<td>0.6%</td>
<td>2.4%</td>
<td>2.4%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Results oriented</td>
<td>0.8%</td>
<td>0.9%</td>
<td>2.0%</td>
<td>3.6%</td>
<td>7.7%</td>
</tr>
<tr>
<td>HR management</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.8%</td>
<td>2.9%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Team management</td>
<td>1.5%</td>
<td>0.4%</td>
<td>1.2%</td>
<td>0.7%</td>
<td>20.4%</td>
</tr>
<tr>
<td>Leadership</td>
<td>0.8%</td>
<td>0.4%</td>
<td>1.2%</td>
<td>2.1%</td>
<td>12.0%</td>
</tr>
<tr>
<td>% of ads with soft skills</td>
<td>20.6%</td>
<td>14.6%</td>
<td>23.6%</td>
<td>33.7%</td>
<td>59.2%</td>
</tr>
<tr>
<td>Job ads analysed</td>
<td>131</td>
<td>465</td>
<td>254</td>
<td>419</td>
<td>142</td>
</tr>
</tbody>
</table>

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10th Anniversary Issue
Requirements for candidates are determined by analysis of descriptions of job advertisements. The main difference with other studies is the quantitative foundation of results: data from up to 3000 different offers of specific IT jobs with the chance of getting profiles for each one.

One of the evident results of RENTIC is the high number (more than 250 in the different areas: software development, systems management, etc.) of different positions for IT jobs, new ones are always appearing, confirming one of the observations of Liu [15]. It is a clear symptom of the fast evolution of computer science and the growing field of application to business, social and personal life. It also highlighted its transversal nature: although the main source of employment recorded at the database is located at IT services companies (41.3%), IT professionals are required in almost all types of organizations, from NGO to consultancy or industrial ones. See Table 1.

One may wonder which specific technical knowledge or experience are most required. During these years, data from RENTIC have confirmed the evolution from traditional environments related to Euro and Y2K effects to Internet-age systems as well as the creation, disappearance or renaming of technology and brands. Obviously, the technical profile is highly dependent on the position.

However, the most interesting result is not concerned with technology: soft skills are the hallmark of success. It is tempting to answer the question of which skills are most important for an IT professional with a simple answer but the reality is not so simple. It clearly depends on the position [14]. Thus for CIOs (or equivalent denominations as director of data processing, etc.) the required skills are clearly different to those for a programmer (see comparison with a subset of data from 2006 in Table 2). Moreover, 36.85% of offers for CIOs require at least one soft skill whereas those intended for programmers only show this requirement in a 16.1% of total (in the case of analyst the percentage is 25%). In general, soft skills have increased their presence in the descriptions of requirements for candidates during these years: during 2008 and 2009 they were present in 47.3% of the total while only 31.3% is observed from 2002 to 2005.

Anyway, general data reveals that 43.2% of job offers require some kind of personal competence or skill: teamwork ability leads the ranking with presence in 10.44% of the total (14.67% of those which require any type of soft skills).

Of course, many people may think these skills are not exclusive to IT professionals and are common to other types of engineers. To analyze this, although not within the scope of the RENTIC studies, an analysis of personal competencies based on a smaller sample of job advertisements for other types of engineers was carried out during years 2005 and 2006. The results revealed similarities (common soft skills) but different level of importance allocated to them in the three types of general engineering branches considered, i.e. (a) industrial engineering (a wide range of specialties: mechanics, electronics, electricity, automation, energy, etc.), (b) communication/telco engineering (radio,
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voice, signal, physical support of networks, etc.) and (c) IT. The detailed results for the three types of engineers are shown in Table 3. The presence of creativity and the absence of capacity of management in the computing profile reinforces the idea of a persistence of "special" engineers as mentioned above, seriously engaged in creating and solving technical tasks but reluctant to deal with corporative management life. Maybe the images extracted from movies of obsessive computing personality types still influences the professional environment even when dealing with requirements for job openings.

These results are interesting specially because there is a good sample of job offers. However, what is really outstanding in the RENTIC studies is the possibility of getting specific profiles of requirements for up to 254 different names of positions. We will present results for typical positions (which can be named with several denominations). Several examples are presented below according typical positions like programmer, analyst, system technician or consultant or high manager/CIO. Results are calculated using the widest range of easily manageable data from 2001 (so some results differ from previously shown from 2006) because I worked with a total set of 3165 job advertisements in the database. Table 4 shows a synthesis of the results expressed as soft skills required by employers for candidates applying to five mentioned well-known positions. In all cases, senior and junior positions as well as the different subtypes were considered for collecting data. Skills listed in Table 4 correspond to the combined set of the most frequent ones for each position. In addition, the number of job advertisements analysed per each position as well as the percentage of advertisements which mention at least one skill as compulsory or desirable feature of applicants are also included in the bottom two rows.

It is clear that higher level positions tend to highlight soft skills as the differentiating factor for qualification as shown in Figure 1. It also emphasises the need to explore the specific needs of soft skills for each position rather than merely trusting in a general list of desirable soft skills. Of course, a common subset of them is always present at the top of skills lists for almost all positions so it could be used as overall reference for general IT education.

Finally, if we look at the presence of soft skills in the different functional areas (as established in RENTIC studies) within the IT activity, some significant differences appear as shown in Figure 2.

4 Conclusions

Soft skills are playing an important role in the qualification of IT professionals. This has been stated in a number of reports and contributions both in research and professional publications. Although studies tend to rely on sur-
veys and panels of experts, it is necessary to collect more quantitative information from employers using indirect observation rather than requesting directly opinion to avoid biasing results. Analysing job advertisements provides a reasonable method for this.

As shown by RENTIC studies, specific positions and functional areas have different profiles of skills. In general, the higher the level of the position, the more are soft skills mentioned by employers as qualifying characteristics for candidates. These data should serve as basis for actions in different areas such as education, career development, vocational and life-long training, etc. Analyses of data, as expressed by these queries to RENTIC databases, lead us to express some observations which might be useful for different lines of action:

- Profiles required for different positions and areas reveal common soft skills as well as different ones (at least regarding their importance). Both groups can help educational managers to devise more accurately activities and programs for helping students to boost their abilities for professional success. However, although some skills are quite common in educational literature and well-known methods are available for teachers, an important number of the most mentioned skills are not usually present in the repository of educational resources: e.g. customer orientation, results orientation, etc.

- These data might help to design in-company training and mentoring programs to serve additional guidelines for career development. Traditionally IT professionals tend to show some lack of soft skills development but they have to face this and other non-IT technical aspect when aspiring to climb to higher levels of responsibility in organizations.

- It is not usual for educational institutions to declare in detail which are the specific positions or profiles which serve as inspiring goals for their programs (at least in a consistent way in a study in Spain [16]), even when dealing with technical curricula. At least, when managing the design and review of curricula, academic staff in charge of degrees should devote more time to the real objective of education for each degree in terms of employability. They should also address the design of a parallel soft skills promotion curriculum incorporated in the traditional technical program.

Soft skills represent the key for professional success as a study (based on opinions of chief recruiters of well known HR companies like Adecco, Page Personnel, etc.) published in 2007 by a Spanish newspaper revealed: "Soft skills have more influence on salary than majors" is one of the main conclusions. This could be even clearer in IT where two factors have strong influence: a) there is still a weaker results orientation, etc. biasing results. Analysing job advertisements provides a reasonable method for this.

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- Profiles required for different positions and areas reveal common soft skills as well as different ones (at least regarding their importance). Both groups can help educational managers to devise more accurately activities and programs for helping students to boost their abilities for professional success. However, although some skills are quite common in educational literature and well-known methods are available for teachers, an important number of the most mentioned skills are not usually present in the repository of educational resources: e.g. customer orientation, results orientation, etc.

- These data might help to design in-company training and mentoring programs to serve additional guidelines for career development. Traditionally IT professionals tend to show some lack of soft skills development but they have to face this and other non-IT technical aspect when aspiring to climb to higher levels of responsibility in organizations.

- It is not usual for educational institutions to declare in detail which are the specific positions or profiles which serve as inspiring goals for their programs (at least in a consistent way in a study in Spain [16]), even when dealing with technical curricula. At least, when managing the design and review of curricula, academic staff in charge of degrees should devote more time to the real objective of education for each degree in terms of employability. They should also address the design of a parallel soft skills promotion curriculum incorporated in the traditional technical program.

Soft skills represent the key for professional success as a study (based on opinions of chief recruiters of well known HR companies like Adecco, Page Personnel, etc.) published in 2007 by a Spanish newspaper revealed: "Soft skills have more influence on salary than majors" is one of the main conclusions. This could be even clearer in IT where two factors have strong influence: a) there is still a weaker relation between professional profiles (rapidly changing and evolving) and traditional academic programmes and b) a non-trivial percentage of professionals are recognised as technical freaks with obvious lack of social skills and appearing far removed from effective corporate circles of power and influence. It is time to effectively address soft skills for IT both in academia as well as in long-life learning programmes.

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Effective Value through Relevant Innovation:
The Challenge to IT Professionals

Martin Delaney

The Innovation Value Institute (IVI) presents a challenge to ICT managers and Professionals: and a solution. Increased maturity in the practiced management of IT will deliver greater business value to the business. Striving for that increase is supported through the IVI’s Capability Maturity Framework. The ICT professional has access to the direction, practices, and skills that are needed to meet that challenge.

Keywords: Capability Maturity Framework, Effective Value, Innovation, IT Professionals, IVI.

1 The Innovation Value Institute Background and Foundation

The Innovation Value Institute (IVI) was formed to collect and develop a comprehensive framework of best practices for the management of all aspects of ICT. It was created in 2006 by Intel and the National University of Ireland Maynooth, who recognised that ICT practitioners faced a substantial challenge in deriving maximum value from their organisation’s investments in ICT. It is a non-profit research organisation, and is supported by a growing membership of international companies, institutes and organisations that together form a consortium that governs, funds, and contributes actively to the Institute. the IVI is focused on ICT effectiveness, building a strong body of knowledge across the full spectrum of ICT management, and disseminating this knowledge through seminars, internet, direct education, assessment, and member collaboration.

To deliver on its objectives, IVI has formed a membership network of companies, government bodies, and academic institutions and professional organisations. The operating model of the IVI is based on the very active contribution of our members. These organisations have provided members of their staff to work directly on the research programmes within IVI. This ranges from four or five people on a full time basis, to part-time contributions, and has been flexible as different aspects of research opened and closed. More than 80 organisations have been involved to date, across the full spectrum of industries, size, and geography. IVI is experiencing an increase in interest internationally with over 50 enquiries since its June 2010 Summer Session and expects this interest and membership levels to rise significantly.

In June 2010 IVI announced the release of version 1 of the IT Capability Maturity Framework (IT-CMF), following 4 years of research and development and over 60,000 man hours of contribution. The IT CMF is an accumulation of the best practices across the 32 critical processes that together comprise effective ICT management. They are presented across increasing practice maturity for each of the 32 processes, and are used by organisations through assessment of current maturity levels, improvement planning, educational support on practice improvement, and subsequent re-assessment. Organisations will ‘embed’ the use of IT CMF into their continuing management of ICT, establishing management improvement objectives of increased maturity, and a programme of extensive employee education and development.

Individual employee education follows the definition of the required ICT company practice, and the clarification of the role design in support of process execution. There is typically a strong correlation between the maturity levels that exist in a company and the employee skills levels.

2 The Emergence of the IVI’s IT Capability Maturity Framework

In developing the IT–CMF the IVI is addressing a long standing and significant deficit in the ICT Profession and its management practice. During the last 40 years that Information Technology has grown rapidly - becoming a core component of all business life - it has been dominated by continuous technology maturity, and there has been a much
lower focus on the management of ICT as a component of the business.

Across that overall business landscape management thinking, research, and best practice has matured and we find great guidance for Engineering, Finance, Marketing, etc. We have established roles that we support with professional University Degrees and community associations that control competency standards, and police consistent performance. Many aspects have reached legislative compliance levels, esp. in Governance and finance.

ICT has trailed behind, and we still find a considerable range of practices, structures, job titles/roles, and most crippling, a poor profile with many CEO’s and general company employees that are the customers of ICT organisations. But most importantly, it is the value to the business that ICT have failed to excel in. The combination of the increasing potential for ICT to further enable business opportunities and the relative current underperformance and therefore missed innovation, is a significant loss in productivity and business performance. This is now being recognised at EU Government levels also.

The IT–CMF is the accumulation of a body of research that seeks to address the management of the broad range of areas that ICT needs to tackle to be effective. The IVI consortium has collaborated over the past 4 years to build this Body of Knowledge and begin the process of communication, dissemination and education.

The approach has been to take content that already exists today on effective ICT process management definition and build these into an overall coherent framework. There are over 80 frameworks coordinated, including some of the better known; ITIL V2 and V3, CMMI, TOGAF, COBIT, and ISO Standards. They are presented in five levels of maturity that allow an organisation to assess their current capability, to factor in the relative prioritization of low maturity, and to use IVI’s guidance and recommendations on how to improve maturity through a change programme.

The availability of on line assessment tools that start at the high level, cross ICT organisation ‘heat map’ is the most common approach; then, following a review of the findings, companies complete a ‘deep dive’ assessment on selected prioritised Core Processes. These highlight in detail the recommendations for improvement.

The availability of educational material supporting the up skilling of ICT professionals is a core objective for the IVI. These will be designed to be on line and modular for "as needed" access. They will also build to recognisable University credits, following assessment.

3 The Scope of the IT-CMF

The scope of the IT–CMF is the most comprehensive available to ICT Professionals. All aspects of the management of ICT are addressed: the core operational deliverables upon which IT builds confidence and effectiveness for the company, the financial management, and then the harder to achieve aspects of Innovation and Business value are comprehensively presented.

The approach used in building the Body of Knowledge (BOK) is facilitated through solid academic rigor, and uses ‘design science’ as the research methodology. Each of the

<table>
<thead>
<tr>
<th>Maturity Levels</th>
<th>Managing the IT Budget</th>
<th>Managing the IT Capability</th>
<th>Managing IT for Business Value</th>
<th>Managing IT like a Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Optimizing</td>
<td>Sustainable Economic Model</td>
<td>Corporate Core Competency</td>
<td>Optimized Value</td>
<td>Value Centre</td>
</tr>
<tr>
<td>4. Advanced</td>
<td>Expanded Funding Options</td>
<td>Strategic Business Partner</td>
<td>Options and Portfolio Management</td>
<td>Investment Centre</td>
</tr>
<tr>
<td>3. Intermediate</td>
<td>Systemic Cost Reduction</td>
<td>Technology Expert</td>
<td>ROI &amp; Business Case</td>
<td>Service Centre</td>
</tr>
<tr>
<td>2. Basic</td>
<td>Predictable Performance</td>
<td>Technology Supplier</td>
<td>TCO</td>
<td>Cost Centre</td>
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<td>1. Ad Hoc</td>
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Figure 1: The IT Capability Maturity Framework. Source: Curley (2004).
32 Core Processes is approached in a similar fashion, and through content and review work groups, a world class BOK has been developed.

The IT-CMF presents a framework that helps IT to be used as an Innovation resource and enables a CIO to be perceived as a Chief Innovation Officer, helping improve the probability, predictability and profitability of IT enabled Innovations. The IT-CMF describes five different maturity levels and four inter-related macro-processes which facilitate the better use of information technology for creating value. Using the IT-CMF as a design pattern (see Figure 1), CIOs can help drive four different types of improvement shifts for IT capability:

- Moving the business model of the IT capability away from a cost centre towards a value centre
- Moving the IT Budget from a runaway cost scenario to a sustainable economic model
- Moving the value focus from simply measuring total cost of ownership to demonstrating optimized business value
- Moving the perception of IT from being perceived as a supplier to being that of a core business competency.

4 The ICT Professional’s Challenge in delivering Value to the Business

Information Technology is emerging as one of the most dominant forces changing business and society today. Increasingly we are seeing the collision of Moore’s law with all types of business producing great entrepreneurial and business opportunities. Although technology, following Moore’s law, is advancing at a very fast rate, the management practices used to manage and apply IT appear to be lagging significantly. Despite Nicholas Carr’s assertion that “IT doesn’t matter” many firms are increasingly using IT to create and sustain competitive advantage. However the challenges of technological complexity, demand growth, security, budget and many others, make the use and conversion of technology into value unpredictable and risky.

The IT profession is currently in a “catch 22”: IT departments are underperforming and company management is unwilling to invest in increasing performance (in fact, less funding is the dominant strategy these days). CEO’s invest in those areas of the business that contribute to the core objectives of the business, typically looking for growth and margin, or new successful products and services. IT departments consume so much of their available resource just keeping the current levels of performance (and not always succeeding) in play, that there is little capacity for investing in innovation. This can continue to be a constantly downward spiral, unless IT can move from a reactive to proactive posture.

The core issue is that IT management processes are fundamentally undefined at an international, intercompany and profession level. ICT departments have developed their own processes to deliver their responsibilities. They use best practice (but still point-solutions) like CMMI and ITIL in

Figure 2: The IT Value Proposition. Source: Cooney. European e-Skills Conference Brussels, 20 November 2009.
some process areas, but mostly depend on the intelligence, background experience and heroic efforts of their management and best people.

As the industry matures it needs to standardise on what is expected of IT executives, professionals and indeed users of IT. The lack of adoption of a clear, internationally accepted, e-Skills competency framework is leading to inefficiencies in the growth and utilisation of both the potential of Information Technology and the IT talent pool. Given that there is a global shortage of appropriate talent, Europe cannot afford to allow this kind of inefficiency to continue.  Thus a competency framework coupled to a maturity framework is required. This will enable schools, tertiary education establishments, employers, training companies and recruitment agencies to operate in a more joined up manner.

Despite the complexities of IT, in some ways the formula for success is quite simple. The core competencies required to deliver across the spectrum of IT management need to be understood and practised by the IT department. The IT team members need to be trained and capable of executing these IT management processes.

For any IT organisation to demonstrate its capacity to deliver business value and use IT to build innovative business wide creativity, it must establish a foundation of solid compliance and effective delivery. There exists a mandatory level of performance from IT that must be satisfied constantly before IT can move up that value ladder within the organisation. The diagram below captures this model. For IT to achieve at the CEO level, and add the value to the business that should be expected for the proportional cost it incurs, IT must operate at the highest levels of performance. Both IT professionals and IT departments can capitalize on the available knowledge provided through the IT’s IT-CMF. (See Figure 2.)

The role of the CIO is of pivotal importance. Both the business community and the company internal IT community look for the leadership to direct IT to that elusive high performance contribution. The absence of an acknowledged educational and experiential progression path makes the capability development for senior IT managers somewhat ad-hoc. Other professions are so much better supported, with consistent role and responsibility expectations and definitions, accompanied by well-engineered educational and certification programmes. This scenario has greatly contributed to an industry wide under achievement report for IT. The key for longer term sustained and industry wide improvement is in the maturing of IT skills.

IT as a discipline is still in the early stages of maturity, and yet as we see the pace of technology evolution and change accelerate. We can observe an increasing gap between the potential of IT and our collective ability to turn this rapidly evolving technology into value. The absence of real value measures around IT solutions and services deployments causes a credibility gap and also leads to a gap in improvement efforts as no baseline exists. In addressing the value deficit a key action is to take an overarching managing IT for business value approach (see Curley, 2004, in Sources). By taking a process and competency improvement approach organizations can move from being reactive to proactive and deliver IT innovations which are more predictable, probably and ultimately profitable. Industry has a growing dependency on IT and is a serious competitive variable for companies. It is also a major competitive variable at the European Union level. Research into the demand for IT skills in the coming five years clearly points to a shortfall.

‘Bonn, Milan, Brussels, 3 December 2009 - empirica and IDC EMEA Government Insights anticipate that the EU labour market may face an excess demand of 384,000 ICT practitioners by 2015. The number of ICT professionals in Europe was 4.7 million in 2007 and is forecast to be between 4.95 and 5.26 million in 2015 depending on five foresight scenarios. Accordingly the e-skills gap, or unfilled vacancies, will amount to between 1.7% and 13% of the existing occupations by 2015.’

Source: empirica and IDC, e-Skills Monitor 2009

5 Implementing IT CMF in Organisations

The effectiveneness of organisations deploying and embedding IT CMF into their management of ICT is now starting to produce numerous case studies. The following are some experiences:

Company A. Large 10,000+ ICT organisation. This company started with an assessment of their Enterprise Architecture area and following the information provided from the assessment embarked on an improvement plan, yielding significant results. This experience supported both the understanding of the capacity of IT CMF to support their awareness and improvement planning, but also informed a much wider ICT group of the existence and potential of IT CMF. In the past year this organisation has established performance objectives for their Architecture management based on achieving increased maturity. This, in turn, has started the process of embedding the education of all concerned on IT CMF. They are now approaching their third assessment run.

Company B. A very large pharmaceutical company focused specifically on the Innovation capability of their ICT organisation. Following a ‘deep dive’ assessment across several world-wide divisions and the subsequent understanding of their current maturity levels, they crafted their specific improvement planning with surgical precision and the implementation was acknowledged as a major success, through to CEO level. They continue to repeat the assessments and tune their performance.

Company C. A major hospital focused specifically on Programme Management and following a ‘deep dive’ assessment of their current capability, understood several weaknesses in their practices. They revised their project review and business alignment process and ran their port-

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10th Anniversary Issue  

CEPIS UPGRADE Vol. XI, No. 5, October 2010 35
folio of projects against more appropriate business value measurements and this moved many new projects into a ‘go’ mode. A&E admissions down to 3 minutes is an example of the result of one specific recalibrated project implemented rapidly executed because it was now aligned to a key organisational KPI -Patient satisfaction.

Company D. A company preparing to significantly increase the proportion of outsourcing of its ICT operations completed an assessment of its capability in the two related IT CMF critical processes that focus on outsourcing and found that their maturity was significantly low and that they were not in fact in an sufficiently strong enough position to effectively progress with that outsourcing strategy until they implemented the necessary improvements to increase sourcing maturity.

Companies E to J. We have several scenarios where companies in similar sectors and size are willing to, and have, participate in comparative benchmarking exercises. These have focused on chosen areas of ICT management, for example: Enterprise Architecture, Governance, Sourcing, Technology Infrastructure Management. The benchmarking exercise focuses on the selected ICT processes, and on selected business value measurements. The comparison focuses on the relative maturity of the processes and the variations found in the business measurements. Valuable correlations are found and while a group may compete in the market place, all stakeholders are better off as improvements found and shared, and implemented.

6 The IVI Contribution to Member Organisations

There are effectively three services that IVI provides to its members, as follows:-

- Assessment service: providing a range of assessments ranging from ‘Executive Assessment’ through to Critical Process ‘deep dive’ assessment. These are structured to support member companies in understanding their current levels of capability on all aspects of ICT management and practice. This informs improvement planning and employee skills needs and planning.

- Educational services: proving a range of classroom courses and E learning options for member employees to bring their e skills to match and deliver ICT performance improvements. At the right level these are University accredited.

- Community collaboration: Connecting up the different interest groups and sharing research and finding. This includes benchmarking against a growing data base, and industry sector and ICT role connectivity and cooperation. Education is crucial. The development of educational content directly from the Body of Knowledge is a core objective. IVI has a number of programmes in place and has graduated over 150 ICT professionals to date. The educational offerings are being expanded to meet a growing range of demands, from the one day overview to the 2 year Masters level programme, with many interim levels, some directed at knowledge acquisition of discrete in-company practices, and others with a University level qualification. Connections have been established with other universities to date and this will be greatly expanded. All the educational material will be provided free of charge to other universities. IVI’s strategy is to build demand from members companies, which will in turn drive international University interest in IT CMF, and then adoption into their programmes.

In the management of people skills for the delivery of effective ICT services within an organisation, the different European programmes have focused on the individual as the basis of skills needs and acquisition planning. This is not a sustainable model because the scope of skills needed at different times and for different demands has resulted in an unmanageably large catalogue and the relative maturity of the organisation requires a vast range of skills to be monitored, framed, and supported.

Instead, ICT skills management needs to be based on the enterprise’s current and forecast demand for skills. The ‘economic model’ must play the leading role in skills demand and development. As an organisation determines its priorities supported by greater awareness of their weaknesses and priorities through deployment of the IT CMF, they immediately look to the supporting skills of their ICT staff to lead and drive that improvement plan. The ICT staff needs to respond and quickly make available these skills and knowhow demands the most out of ICT. That demand translates into a set of skills and capabilities that must meet the organisation’s focus at that time.

There are several aspects of the IVI’s structure that support a capability to deliver an effect output to organisations world-wide, as follows:-

- The IVI Consortium of members is a highly active group and central to the operation of IVI. They will be a key channel for us to complete the required research. The terms of the contract that each sign explicitly focuses on their commitment to a contribution into IVI. This is widely practiced across our membership and will be greatly exploited in completing this programme for the EU Commission.

- The IVI was established as an Open Innovation Institute and this attracts and encourages open dialogue and contribution between members. A powerful operating value.

- IVI is dedicated to the development of effective ICT management Practice. It is what it does and exists for. The definition of effectiveness is dictated by measured value from ICT into the business. Current research very much aligns with the overall challenges of determining the optimum management approach to ICT Professionalism management.

- It is a research entity in full collaboration with the ICT practice community. Our model is to continue to be connected into the ICT community constantly pulling in
feedback on ICT practice effectiveness, from which IVI will continue to enhance the body of knowledge.

- Research is grounded in company ICT practice. The programme over the previous 4 years has extracted the best practices and tested these vigorously. The world of ICT effective practice is emerging from the disconnected efforts of many CIO and practitioners world wide, who have little relevant education in effective ICT practices, but yet are charged by their host institutions to deliver maximum value from ICT investment. ICT as a profession is poorly supplied with coordinated and integrated programmes. IVI’s contribution is being very positively and enthusiastically received by Industry and ICT management. It is therefore hugely logical to channel this body of knowledge into the EU Professionalism agenda.

At the core of IVI’s vision is a determination to act. This needs to be shared with ICT practitioners world-wide. IVI presents a call to action for all, touching on one or many of the following suggestions:-

- Train IT leaders to be business leaders – this means that IT leaders need to learn, acquire and demonstrate business acumen so that IT investments deliver real value to the end user and customers. The IVI has developed several professional diplomas around Managing and Measuring the Business Value of IT and has begun pilot collaboration with EFMD (European Foundation for Management Development) to diffuse these courses to European business schools.

- Application of a maturity model approach (such as the IT-CMF) to stabilize and control the processes to deliver and operate leading edge IT solutions. Such approaches as the IT Capability Maturity model removes the need for IT fire-fighters and replaces this with a need for skilled IT professionals who operate in a rigorous, disciplined and professional way.

- As the IT Profession matures more opportunities will arise to move IT from the backroom to the boardroom; and as IT has a horizontal view of all function in a business we should see more opportunities for CIOs to function at the board level. In fact the profession needs “celebrity” CIOs who actively promote and advance the brand of the IT profession through their demonstrable acumen and influence.

- In IT we need lots of skilled professionals and managers who can solve problems and deliver solutions using IT but as importantly we need IT leaders who can identify what problems should be solved and what opportunities should be seized using IT. It is in appropriately training IT leaders, producing professionals who have the appropriate mix of technology, business, inter-personal and communications skills, which will lift the quality of the profession and lift the quality and value of the solutions delivered.

- The EU, and the IT Profession, needs greater structure and organisation to deliver the increased capability needed. The EU can be a leader and innovator in playing a significant coordinating and brokering role, including a push for standardization. The IVI can be the source of knowledge, and be a key player within this model.

- An IT organisation can leverage the IT-CMF through developing the skills of its practitioners, and they in turn implement the processes, and continue to ratchet up the maturity of the IT processes. This competency development of the IT team is essential to sustain improvements. The IT personnel can grow and develop through this knowledge acquisition in a systemic and measured manner.

- The IT professional needs specific capability development. Ideally this dovetails with the company’s need for his competency development. However, the effort to personally develop needs to be motivated and rewarded through recognised academic achievement. The University infrastructure needs to be a component of our EU IT professionalism solution design.

- This competency challenge for IT is world-wide. For the EU we need a coordinated solution. This starts with defining a clear mandate from the Directorate.

7 Final Comments

We are often faced with the challenge to become accurately aware of our circumstances. To know the difference between what average and excellent look like, therefore enabling and motivating improvement. The effective management of ICT has suffered more than most professions without this calibrated difference in performance, aggravated by testing better performance in terms of increased business value to the host organisation and not an internal possibly irrelevant metric.

The IVI has delivered an instrument in the IT CMF that can now be used to great effect in calibrating and guiding current and improved practice and behaviour. As the IVI research deepens we will deliver more and more accurate correlations between higher maturity of management practice and positively impacted business metrics. These will be published case studies and continue to inform ICT management. This body of knowledge is being converted into consumable education for existing and future ICT executives, and ICT practitioners.

It is entirely conceivable that CEOs will start to ask CIO’s for the maturity levels currently in operation within a company’s ICT division, as the awareness of IVI and IT CMF grows. IVI will greatly be enabling this increased awareness. We need to ensure that the CIOs are supported to satisfactorily respond.

Within the IVI we are committed to providing the support and knowledge necessary for organisations ICT groups to deliver that demanded maximum business value.

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Rise of the IT Architects

Gar Mac Criosta

This article describes the goals and projects of IASA, International Association of Software Architects, an organization that is working to build a learned profession of IT architects.

Keywords: IASA, Career Path and Skills, Certification, Governed Profession, IT Architects, Standards.

1 Introduction
The International Association of Software Architects, IASA, is working to build learned profession of IT architects. A profession is as much about its clientele as it is about its members. From a client’s perspective professions are trusted, professions define the value proposition the professional will deliver to the client. Clients can be quite clear what a professional is responsible for. From a members perspective the profession creates a mechanism that removes the need to consistently invent your own career and a way to explain to the world at large what our value proposition as IT architects is. A profession brings recognition.

IASA’s mission is to deliver a truly global professional organisation that will enable professional’s to successfully manage their entire IT architect career and professional growth and provide a practice model that will allow free movement of professionals between jurisdictions under a globally recognised and agreed on professional standard.

IASA helps IT architects answer the following questions:
- What should we know?
- How do we measure and demonstrate our value?
- How do we build trust?
- What are we responsible/accountable for?
- How do we grow?
- How should we engage with our clientele?

2 History
IASA, <http://www.iasahome.org>, is a not for profit professional association for IT Architects founded in 2002 in Austin, USA. No true IT Architect profession exists; IASA has been working to build the programs to support a global profession e.g. education programs, a body of knowledge, certification at multiple levels (foundation, associate, professional, master), continuous professional development programs, regulation, research & development. IASA is now entering a second phase of development rolling out education and certification services to IT architects across the world.

3 IASAs Vision for Europe
IASA Europe a regional headquarters for IASA global is currently in development. The vision is to create the preeminent European professional association of and for IT architects. IASA Europe will function as the authoritative voice for IT architecture in Europe through

Innovation
- Research
- IP Creation

Community
- Professional body
- Networking
- Events

Advocacy
- Public policy
- Promotion & representation
- Recognition

Responsibility
- Ethics
- Social obligations
- Governance

Education
- Skills development
- Certification
- Body of knowledge

IASA Europe is in a good position to support many EU initiatives; supporting and developing the eCompetencies framework; building smart economy programs both through the creation of high-skill jobs and through demand creation. Building a profession also creates a marketplace for tools and a demand support structures for that profession. A profession clearly identifies a career path that can be pur-
sued which in turn supports initiatives to attract more people into technology related careers.

Initiatives like EUCIP, SFIA, AITTS/APO and CIGREF have helped create support structures for the industry at large. IASA can support this strategy by supporting the growth of the IT architect profile within those frameworks.

4 Regulation
IT is an unregulated industry and regulation is coming sooner rather than later. IASA Europe can ensure that the regulation of architects is driven by practicing professionals through pan-European professional organisations.

IASA is providing a global association with global recognition of certification delivered through a chapter network in each jurisdiction e.g. IASA Ireland will own the profession in Ireland, IASA UK, IASA Sweden etc. IASA Europe will be the governing body for Europe. What’s interesting about this is to look at how other professions work on a global level. Organisations and alliances have been created to support cross recognition and portability of credentials e.g. International Federation of Accountants, <http://www.ifac.org>; what makes IASA different is a global focus with regional and local delivery. The importance of a global portable certification has been highlighted recently by the Irish Law Societies difficulties with the UK Solicitors Regulation Authority1. In this case Irish lawyers can no longer practice in the UK without having to complete a Qualified Lawyers Transfer Test, Qualified Lawyer Transfer Test2. IASA as an organisation can ensure that an architect in Brussels, Dublin, London, Abu Dhabi or Sydney are all equally qualified but also that their qualifications are portable and transferrable.

5 Challenges and Trust
IT as an industry has struggled to build a trust relationship with its clientele - customers, stakeholders, shareholders, citizens. A recent IPSOS Mori 2009 survey3 on trust relationships with professions in the UK again showed that doctors remain the most trusted profession with 92% of people saying they would generally trust doctors. Unfortunately IT professionals do not appear in this survey; our inability to deliver has created a reputation for a lack of transparency and delivery resulting in an lack of trust (see Standish Chaos Report 2009 report4).

6 Role Description
The term architect has been heavily overloaded within the industry. A multitude of definitions exist5 while each has its merits it makes it unclear to a layperson what an IT architect does; this has led to much confusion. IASA defines the profession as the “the art and science of delivering valuable technology strategy”. IASA has developed a complete competency6 taxonomy describing the skills an architect must have and the areas of specialization that architects practice in.

Another issue we face is that the architect is seen as a ‘senior’ role and is financially more rewarding. This led to a mass upgrade of CVs transforming senior development or systems administration jobs into architectural jobs. This has again diluted the meaning and confused the industry. IASA will be pushing the mantra of architect = business technology strategist. IT architects are the bridge between the business and technology. The goal of the IT architect is to improve business technology alignment and therefore to deliver value from technology investment.

7 Lack of Resources
Architects are faced with a lack of resources to assist them in their daily job. IASA is addressing these both through education programs7 and through the creation of a body of knowledge8, knowledge communities9 and a Foundation Reference Model.

8 Public Perception
Doctors, accountants, teachers and architects have one thing in common; the understanding of what they do is hardwired into modern society; this is not so for IT architects. The introduction of titles software architect, solutions architect, security architect, enterprise architect do little to help us improve the situation. While these are valid distinctions within a profession to the world at large we need an IT architect that is as easily understood as a doctor. This is summed best by an analogy Paul Preiss (IASA Founder and CEO) uses, “If you’re out having dinner and someone starts choking you don’t stand up and say ‘Is there an ear nose and throat specialist in the house?’ You say ‘Is there a doctor in the house?’”. The general professional title of IT architect needs to be meaningful before the specialisations can become meaningful. Without this understanding the other definitions become nothing but more than noise in an already jargon heavy environment.

9 Skills Taxonomy & Career Path
The Skills Taxonomy Project is an IASA Project to define the skills an architect should possess. There are 250+ skills defined within the taxonomy that break down into 5 foundation pillars:

- Business Technology Strategy
- IT Environment


**IASTA's Skills Taxonomy**

IASTA's Skills Taxonomy is by far the most comprehensive definition of what an architect should be. We recommend that if you are interested in becoming an architect start here, this taxonomy alone will give you an understanding of what it means to be an architect. Once the skills are understood the next stage is shaping your career. IASA will assist members in all phases of their careers from the aspiring architect who is on a journey of discovery to the master IT Architect who is a thought leader in the profession.

Providing the career path and skills along with training and certification changes the game for companies and organisations who have struggled to provide career opportunities for valued employees. Typically what happens in non-technology companies is that an individual will progress from a technical position into a mainstream management position managing technical resources. At that stage most techies are faced with a dilemma, either take the money and hope for the best or leave and find another position. IASA will be working hard to provide information on engagement models for professional IT architects within organisations. We believe that this has the potential to change the face of how IT careers are shaped. (See Figure 1.)

**10 Certification**

High quality IT Architects have become the backbone of a sound technology strategy which supports and enhances an organisation’s business advancement. Organisations face challenges in developing quality IT Architecture programs to meet this demand. The IT industry today cannot cope to meet this demand due to limitations in the professional body of knowledge. The CITA (Certified IT Architect) Certifications are based on the IASA Skills Taxonomy of over 250 distinct skills that comprise the body of knowledge for IT Architects. In fact, IASA has been planning to have IT Architect Certification since 2004 and realized that unless there is a body of knowledge that can be used to certify an IT Architect, that certification will have no professional value at all. It took IASA almost 5 years to prepare the body of knowledge and to launch the certification. Figure 2 describes the body of knowledge.

The IASA (CITA) is about quality. CITA provides hiring organisations with the assurance that the architects they employ are able to meet the needs of even the most demanding architecture projects at the software, infrastructure, information and business levels. The program is the culmination of thousands of man hours of development. CITA is the first global industry architect certification which is completely vendor independent and run only by practicing architects. CITA provides practicing architects with career objectives that define your progress through the architect profession.

IASTA has identified four levels in the career and capabilities of an IT architect where certification applies. These levels represent points in the career path of an IT architect where their skills and level may be formally evaluated for the benefit of the individual and employers.

- **IASTA Foundation** - The foundation level of certification applies to individuals who are familiar with introductory concepts in IT architecture.
- **IASTA-Associate** - Associate certification identifies individuals who have a full and detailed understanding of the five pillars and their chosen specialisation. Associate architects have a fully rounded education in all primary and secondary skills necessary to prepare for practical experience.
- **CITA-Professional** - As a CITA –Professional archi-
tects are fully qualified to lead large projects and corporate initiatives within the industry and their specialisation. They have demonstrated knowledge in practice over numerous projects and years.

- **CITA-Master** - Only a few select IT architects can reach the pinnacle of the profession and be recognised for their individual capabilities and thought leadership. CITA-Master recognizes those few architects in the world that have demonstrated excellence over many years of practical leadership and who have in addition developed and contributed significantly to the industry.

11 **CITA-Professional Board Certification**

In professions where experience based certification has emerged as necessary, board certification is the mechanism of choice. Board certification involves interviewing candidates based on their professional experience. The interviews are conducted by practicing certified professionals to expose the actual capabilities of the candidate. Professions such as medicine and engineering use board certification to ensure that individuals cannot reach full professional status without significant experience. For the purposes of certification IASA recognises the following specialisations:

- **Infrastructure**
- **Software**
- **Information**

The business architect certification will be coming on stream shortly and other specialisations are being considered by the IASA Certification & Education Boards e.g. security. A CITA-P certification board is constructed to ensure the 5 core skills pillars are tested along with the candidate specializations.

12 **Certification Overview**

The certification process is designed to be as streamlined and transparent as possible. The work involved from a candidates perspective is sufficient in order to validate that the candidate is operating at a professional level of certification. IASA need to ensure that the candidate will be a positive representative of the community of certified CITA-Professionals.

12.1 **Certification Preparation Process**

Preparation for the certification involves preparing a detailed résumé, completing the skills self-assessment document and 2 standard documents. The documents cover firstly your ability to demonstrate competency of the IASA Foundation Pillars (Business Technology Strategy, Human Dynamics, IT Environment, Design Skills, Quality Attributes) plus your specialisation Infrastructure, Software, Information.

The second document details the highs and lows of your architect career demonstrating where you started, where you excelled and where you failed.

12.2 **Interview Process**

The interview process lasts 2 hours, candidates will present to the board for 30 minutes followed by 90 minutes of questioning. The panel score you independently and the scores are tallied by the Certification facilitator.

12.3 **Scoring**

There are 10 proficiency levels that IASA has described from entry-level through mastery. To achieve the CITA-Professional certification you should be operating at the Professional level described in Table 1.

13 **Why are IASA doing it?**

*Why are we doing it?* We’re doing it because we want to shape the industry we work in, we want to work in a recognised well governed profession and finally we want to own our own careers.

What we are striving for is to ‘raise the bar’ both globally and in Europe. In the history of the American Institute of Architects founded in 1857, the 13 founding members of the AIA gathered in 1857 with the aim to "elevate the standing of the profession" and out of frustration that "anyone who wished to call himself or herself an architect could do so... masons, carpenters, bricklayers...No schools

<table>
<thead>
<tr>
<th>Certification Level</th>
<th>Proficiency Level</th>
<th>Description of Level</th>
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<tbody>
<tr>
<td>Foundation</td>
<td>1</td>
<td>Awareness</td>
</tr>
<tr>
<td>Associate</td>
<td>2</td>
<td>Basic Information Demonstration</td>
</tr>
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<td></td>
<td>3</td>
<td>Individualized Knowledge</td>
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<td></td>
<td>4</td>
<td>Practice</td>
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<tr>
<td>Professional</td>
<td>5</td>
<td>Delivery</td>
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<tr>
<td></td>
<td>6</td>
<td>Connectivity of Ideas</td>
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<td></td>
<td>7</td>
<td>Enterprise Level Leadership</td>
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<td>Master</td>
<td>8</td>
<td>Mentorship</td>
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<td>9</td>
<td>Research</td>
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<td></td>
<td>10</td>
<td>Industry Leadership</td>
</tr>
</tbody>
</table>

Table 1: IASA’s Proficiency Levels.
of architecture or architectural licensing laws existed to shape the calling.” That’s the state of the IT architecture profession today both globally and in Europe. We have the opportunity to change that and create a new chapter in the history of IT architecture. The status of some professions is enshrined in the law. To make a false statement is illegal; this doesn’t apply to IT.... at the moment! The downturn in the economy has brought the word regulation to everyone’s lips. IT will ultimately be regulated; one way or another. Our belief is that it’s better to develop these structures now, together; than to wait for regulation to be imposed.

As the role of the IT architect continues to grow in importance and as technology dominates our daily lives; IT architects and the technology they employ have become integral parts of our government, companies and of our own day-to-day lives. Architects are entrusted with human safety, financial security, government effectiveness through their work and yet we do not have a way of ensuring that everyone who calls themselves and IT architect is truly a profession. More and more the work of architects is having a direct impact on entire societies. If we can produce doctors and provide them with the tools they need then we should certainly be able to support IT architects.
Service Science in Academia

Pere Botella and Maria-Ribera Sancho

Although Service Science is a relatively new concept, that refers to what existing disciplines can bring to the skills required in the service industry, it has entered the academic world with some strength. This is a good vehicle for illustrating how, in the field of Computer Science, academia’s role has to continuously adapt to industry trends and needs. This article begins by with the recommendations that have been made to introduce such a multidisciplinary approach at this university, then presents an overview of what is being done in education and research in the world, to focus on the current situation in our country and to introduce some recommendations and personal opinions of the authors.

Keywords: Adaptation to Industry Trends, Service Science, Service Science Education, Service Science Research, SSME, University.

1 Introduction

Service Science is the short name that IBM introduced at the time as SSME (Service Science, Management and Engineering). This is the original definition given by IBM on its website (not yet active): “Services Sciences, Management and Engineering hopes to bring together ongoing work in computer science, operations research, industrial engineering, business strategy, management sciences, social and cognitive sciences, and legal sciences to develop the skills required in a services-led economy”.

The multidisciplinary aspect of SSME is evident, and also that it is not the name of a new science, but rather that it refers to what existing disciplines can bring to the set of skills required in the service industry.

The Wikipedia definition is also interesting to read: "Service Science, Management, and Engineering (SSME) is a term introduced by IBM to describe Service Science, an interdisciplinary approach to the study, design, and implementation of services systems – complex systems in which specific arrangements of people and technologies take ac-

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tions that provide value for others. More precisely, SSME has been defined as the application of science, management, and engineering disciplines to tasks that one organization beneficially performs for and with another. Today, SSME is a call for academia, industry, and governments to focus on becoming more systematic about innovation in the service sector, which is the largest sector of the economy in most industrialized nations, and is fast becoming the largest sector in developing nations as well. SSME is also a proposed academic discipline and research area that would complement – rather than replace – the many disciplines that contribute to knowledge about service.

This definition deals with the interdisciplinary (or more accurately: multidisciplinary) aspect as well. There is another important point: the "call" to academia, industry and governments to put a focus on a systematic way of innovating in the services sector.

A Services and Information Systems Engineering department, ESSI, was created at the Universitat Politècnica of Catalonia, UPC, Spain, in November 2009. It brought together the discipline of Service Science, Management and Engineering, SSME, and the computing disciplines of Information Systems and Information Technology. This article is based on the authors’ experience here and concentrates on how to include that call to action in the academic field with the aim of adapting to the emerging services-led economy.

Continuing with terminology, it should be noted that sometimes a D appears at the end, i.e. SSMED [1]. This new letter refers to "Design", an aspect that the authors want to highlight. We think that in the European context, in contrast to what is understood in the United States, "design" is an integral part of "engineering" and need not be mentioned explicitly.

For brevity, and also because academia prefers disciplines to be named with no more than two words (e.g. one = mathematics, biology, psychology or two = computer science, mechanical engineering), we use the term Service Science, understanding the term "science" as a discipline (as in "management science"), and as is also done in the "Cambridge whitepaper" [2] (also in [3], in Spanish).

This paper contains some recommendations for the academic world (Section 2), discusses current work in educational and research programmes (Sections 3 and 4), what is the current situation in Spain (Section 5) and concludes with some recommendations and conclusions from the authors (Section 6).

2 The Recommendations

The book "Service Science, Management and Engineering: Education for the 21st century" [4] includes contributions to a conference organized by IBM in 2006 on Service Science education and research. The book’s introduction mentions that three years earlier no-one had even heard of the concept, but the many contributions included remain current and relevant and give a comprehensive overview of the topic. We recommend this book to academics interested in implementing Services Science courses. Since then there have other publications in the same line (see [5] as an example) that we have often recommended.

Dr. Liba Svobodoba, from the IBM Zurich Research Laboratory, in a seminar given in Brno, November 2007, said:

- SSME is a multidisciplinary application of science, management, and engineering disciplines to services:
  - Science is a way to create knowledge through tools and methods studying Services
  - Engineering is a way to apply knowledge produced by science outputs and create new value
  - Management improves the process of creating and capturing value
- The promise of SSME is that the study of service systems, their design, evolution, processes and data, will increase our understanding of the services business – how to increase productivity, improve quality, control risk, innovate for growth and operate in dynamic environments
- SSME needs to be developed as an academic curriculum and research area

One of the elements appearing frequently in the recommendations for the university, is the need to educate students to be so-called "T-shaped" professionals, i.e. training graduates broadly and deeply at the same time to speak the "language" of various disciplines (broad) and be experts in at least one of them (deep). This recommendation is consistent with the views and opinions from service companies expressed to the authors of this article during their respective tenures as dean of the School of Informatics Engineering at UPC (Pere Botella 1992-1998, and Maria-Ribera Sancho 2004-2010). In essence, technical education given to the students is very good, but they require more ability to integrate themselves into multidisciplinary teams and work side by side with other engineers or in the field of management and administration (it is very common for our engineering graduates to complete their training with an MBA, or with some postgraduate training in IT management).

The well-known Cambridge whitepaper [2], one of the reference documents in Service Science, contains recommendations for education, research, business and government with the goal of success through service innovation. We strongly recommend strongly reading the original reference and the complete explanation of the recommendations. Due to limitations on space, we only list those related to the academic world here:

- For education:
  - Enable graduates from various individual disciplines to become T-shaped professionals, adaptive innovators with a service mindset who can make early contributions to the service-driven economy
  - Promote SSME education programmes and qualifications as a way of developing a service mindset, in conjunction with industry recognition and recruitment of SSME qualified graduates
  - Develop a modular, template-based SSME curriculum in higher education, add new materials and refinements as research develops over time and then extend this to all lev-
els of education
- Explore new teaching methods for SSME related education
  - For research:
  - Develop an inclusive interdisciplinary and intercultural approach to service research
  - Build bridges between disciplines through large research challenges
  - Establish the service system and value proposition as foundational concepts
  - Work with practitioners to create data sets to better understand the nature and behaviour of service systems
  - Create modelling and simulations tools for service systems

We should perhaps, at this point, introduce the concept of "service system" in the SSME context. It is a configuration of people, technologies, and other resources that interact with other service systems to create mutual value [6]. It is important to pay attention to how this definition of service system relates to the classical concept of "information system" [7]. We will come back to this later on.

3 Educational Programs

Education is also a service, and perhaps the most important in the sector [8]. Therefore, the design of an education programme must be conducted in a systematic and rigorous way, as described in the development of a curriculum at the University of Berkeley in [9]. There is currently a proliferation of educational programs in service science, especially at the master’s level but also at the undergraduate level (bachelor), which we will examine in this section.

So who is introducing these programs in universities? [7] mentions an aspect that seems important to note. Despite the multidisciplinary attribute claimed for Service Science, and partly as a result of its early development (from 2004), there are just two disciplines that act as tractor driving force: Management or Business Administration within the service sector domain and Computing, in what is already known as SOC (Service Oriented Computing), referring to Web services, service-oriented architectures, etc. In business schools, Services has traditionally focused on human interaction, especially in relationships with customers, but in recent years they have incorporated IT as facilitator of the modern service industry. Moreover, in computer engineering, everything related with the SOC (Web Services, SOA), the new concept of "Software as a Service", SaaS, and technology that facilitates the "cloud computing" have appeared in strength. In both domains research networks or technological platforms appear, but have little contact between them, even today. On the business management side, we have networks like RESER, <http://www.reser.net/>, or interest groups like AMA – ServSig, <http://www.servsig.org/>, and Informs Service Science, <http://service-sci-section.informs.org/>. On the Computing side we find technological platforms like the European NESSI, <http://www.nessi-europe.com/>, or the Spanish INES, <http://www.ines.org.es/>, and research networks such as S-cube, <http://www.s-cube-network.eu/>.

These two academic worlds (management and information technology), both drivers of Service Science, work in parallel, but with little real contact but much goal intention. During a recent conference (IESS 1.0, International Conference on Exploring Services Sciences, Geneva, February 2010) in which an effort was made to attract both worlds, it was almost comical to see some puzzled faces during presentations, trying to understand the "other" sector. Despite all this, the interdisciplinary contact was necessary and stimulating.

Fortunately, there are already initiatives following the right direction, like the SRII, Service Research and Innovation Institute, <http://www.thesrii.org/>, an initiative of large companies (IBM, HP, Oracle, Microsoft ...) and professional associations (IEEE, ACM, INFORMS, Nesi ...) which was created as an "umbrella" entity of all member societies to harmonise efforts in research and innovation for the service sector. We find another example in the SSME network in the UK, <http://www.ssmenetuk.org/>, inspired by the SSME research center at Manchester University, coordinated by Linda Macaulay (Business School) and Liping Zao (Computer Science School). We should also mention, the master in Services Engineering and Management by the Porto University, coordinated by João Falcão (Computer engineering) and Lía Patricio (Industrial Organisation). Besides all these initiatives we can find many other cases of collaborative management and academic promotion of SSME.

The main purpose of this paper is far from providing a guide or a list of schools teaching degrees related to Service Science, but we will give some examples:
  - In terms of content, the article [7] gives a brief outline of what a course on Service Science could look like. In the book [4] you can find more contributions and examples. For an interesting guide, in more detail, we recommend the "SSME blueprint" that can be found in English on the web, <http://www.ssmenetuk.org/>, under "Downloads" in two documents: "Establishing SSME as a new academic discipline: A Blueprint for UK SSME Education" and a curriculum framework in "A Framework for Service Science Curricula".
  - For course offerings, any list included at the time of writing would immediately be obsolete, but again on the web <http://www.ssmenetuk.org/>(Key Reading and Glossary -> World Class Institution or Programme) there are plenty of up to date references on current courses.

And one last comment about education. In the context of the EHEA (European Higher Education Area) it is recommended to design degrees based on the desirable competencies of graduates, i.e., with rigour and discipline [9]. It is also recommended that these skills are determined, amongst other ways, through interviews with employers, as is discussed in Section 5.

4 Research

If a line of research is active, it can be detected in three ways: publications (journals), conferences and research centres. If this gives the right measure of interest in a sub-
ject in the scientific community, it must be said that the health of Service Science, given its youth, is enviable. As for the items above, two comments: 1) as already mentioned, the recommendations of the Cambridge white book [2], which need not be repeated here, and 2) the same division mentioned in education (computer science, management) is even more apparent in research, where it is more likely to work in silos or closed communities, and unfortunately, there is little tendency towards interdisciplinary adventures, so most of the referenced journals, conferences or centres tend either to the technical side or to the management side, while real integration rarely exists.

These are some reference journals and book series.

**Book series published by Springer**


**Journals**

- IBM Systems Journal, special issue on Service Science, Management and Engineering
- IEEE Transactions on Services Computing
  <http://www.computer.org/portal/web/tsc>
- International Journal of Quality and Service Sciences: <http://info.emeraldinsight.com/products/journals/journals.htm?PHPSESSID=kujbhv71v8kd3qmoatr2heqq7&PHPSESSID=kujbhv71v8kd3qmoatr2heqq7&id=IQSS>

**Conferences**

This is a more fluid area than journals, but there are a few:


**Research Centres**


(This is the centre from which the original proposal for SSME emerged).
- University of California SSME (CITRIS, Center for Information Technology Research in the Interest of Society): <http://www.citris-uc.org/services>.
- KSRI - Karlsruhe Service Research Institute (Karlsruhe Institute of Technology): <http://www.ksri.uni-karlsruhe.de/>.
- Centre for Services Research (Manchester Business School at the University of Manchester): <http://www.mbs.ac.uk/research/csr/index.aspx>.
- Swiss Institute of Service Science: <http://crag.hesge.ch/service-science/>.
- Servilab (IAES, Instituto Universitario de Análisis Económico y Social, Universidad de Alcalá): <http://www.servilab.org/>.

**5 Service Science in Spanish Universities**

We must mention the Spanish SSME Forum, a joint initiative of the UIMP (Universidad Internacional Menéndez Pelayo) and IBM, that has been (and hopefully still is) an area of debate between universities, industry and government, to academically set up Service Science in Spain. The Forum was established in February 2008 in Madrid, then met again in May, September, and November 2008. It involves 28 universities and 14 companies and institutions. Along with the fourth meeting of the forum in Barcelona, the UPC (Universitat Politècnica de Catalunya) and the UOC (Universitat Oberta de Catalunya) organised a course on SSME. We believe this was the first in Spain in this new discipline. A project born inside the Forum was to draft a book on SSME in Spanish Universities. In fact, as the promoters of the forum and the book were the same people, and in 2009 the book absorbed their time, this left the forum in a state of stand-by which we hope will not last much longer. The project was submitted to the Ministry of Education and their agreement was obtained (with the code EA2008-0307). The drafting team was made up of Pedro Lazarro (IBM), Luciano Galán (UAM, co-director of the project), Benjamin Suárez (UPC, co-director of the project) and Alfonso Domínguez (UAM, intern), and was also joined by many other people, from universities and companies (including the authors of this paper).

The book was called "The Science of Services: A challenge for the Spanish university system". If you cannot find it in the references, it is because we have not been able to find it on the Ministry of Education’s web site, which is where it should be. We assume at some point it will be made public. After several interviews with companies in the services sector and a review of the documentation available, the book provides the competencies needed to define the objectives of a Service Science degree, together with the competencies to verify the degrees (60, European Credit Transfer and Accumulation System, ECTS, of basic training, 60 ECTS of common training, and 48 ECTS of specific technology training). The same was done for master’s studies, i.e. the competencies required to define the objectives for 60 ECTS of deep technological training.
Another experience was in May 2009, with the organisation of a first meeting on Services and ICT, geared towards companies and jointly organised by UOC and UPC. One of the objectives of the meeting was to conduct interviews with employers to obtain information on the skills required by potential services engineers. These interviews took place within the European project DELIISS (Designing Lifelong Learning for Innovation in Information Services Science, <http://www.deliiiss.eu/>, involving both universities. That has resulted in a professional oriented executive master course called EMISS (European Executive Master in Innovative Service Systems), with a joint diploma from all the participating universities that will begin in January 2011. The interviews mentioned above and other project activities have resulted in the drafting of "skill cards", or lists of competencies, which have been the basis for the design of the EMISS master course. And this is the process we recommend, like the EHEA does: to start based on these competencies (that already exist, and can be adopted and adapted), and then design the curriculum.

There are already some initiatives in Spain: Máster en Ciencia, Gestión e Ingeniería de los Servicios (University of Alcalá), Master in Services Management (Business Engineering School La Salle). And also a degree: Grado en Informática y Servicios (Escuelas Universitarias Gimbernat y Tomás Cerdá, attached to the Universitat Autònoma de Barcelona, UA). And there are several other projects, but we do not want to provide a list of what is in early stages. In the case of our university, the UPC, and as an example, current projects are: a) The UPC is one of the partner universities in the aforementioned project DELIISS, <http://www.deliiiss.eu/>. The main result is the European Executive Master in Innovative Service Systems, which is scheduled to start in January 2011 and will have meetings in all participating cities; being an executive master course it is intended for professionals with years of experience. It is managed by the UPC School (http://www.talent.upc.edu/) b) Also at the UPC School, starting in September 2010, two executive masters courses named "IT Project Management" and "IT Project Development" with a shared modular offering, will schedule one module (24 ECTS credits) on "Service Management & Engineering"; c) Not yet scheduled, a degree in Services Engineering at the School of Informatics (FIB) is planned.

In terms of research, and returning to the Spanish white paper, one of its proposals was the creation of a joint research centre between IBM and the university, but so far there is no news on the item. The question is, is there services research in Spain?. The answer is easy: of course there is. But the structure of research groups and departments (often isolated "silos" as reported by some authors, like Spohrer, Maglio and Glushko), does not promote or facilitate the necessary interdisciplinary working. There are very strong groups working in the technical field (web services, SOA, SaaS, cloud...), as we have seen recently in the Spanish journal Novática, <http://www.ati.es/novatica/>, from the Spanish society ATI (Asociación de Técnicos de Informática). There are also very strong groups in the field of management, like the group Servilab, mentioned above, and others. But we need to go a little further to achieve a holistic global vision, which requires service science, and it is not easy to achieve this in the current research structures. The bridge is a group of computing and management experts to collaborate on a project.

An initiative in our university (UPC) and involving the authors, has been the creation of the new Department of Services and Information Systems Engineering, <http://www.essi.upc.edu/>. It has not been easy and many obstacles had to be overcome. It has been done with groups of information systems researchers, which in our opinion (and others, see [7]) makes sense. It is indeed the computer science area that, at least technically, has more contact with the organisational aspects. In information systems as well, a system of services includes human aspects. Many authors place information systems at the core of the SSME. But this is not enough, and it is appropriate to initiate a seed in interdisciplinary research. For that, we must have researchers from other groups or departments (business organisation, operations research, artificial intelligence ...) who are interested in the holistic vision that is raised by SSME. This kind of interdisciplinary collaboration should be facilitated by the university chancellor.

6 Concluding Remarks

To summarise, here again are our ideas for promoting service science in a university setting:

- Find a group or research institution that acts as a promoter and umbrella. Without it, groups working in services (whether web services, or marketing in the service sector) will continue without communication.
- Involve the university management team, if there is no involvment by the chancellor or members of his team, not much can be done to foster multidisciplinary.
- In education, it seems more prudent, under normal conditions, to begin with postgraduate (Masters) courses, and once experience is gained, move on to the undergraduate (bachelor) courses. But conditions in each university are not always the same, so in some situations it will be prudent to start with the bachelor.
- Do not just follow the trend. Believe in the issue and have hope: without faith and hope important things do not work.

References


The Informatics Profession in Europe: An Overview

The Content of the Informatics Profession: A Personal View

Fernando Piera-Gómez

In the large amount of literature written about the informatics profession the problem of its contents is rarely dealt with. In this present article the author examines, from a personal point of view, the origin, evolution and outlook of the informatics profession, while also considering the participation of women and taking into account the latest legislation regarding professional associations of university graduates in Spain.

Keywords: History of the Profession, Informatics, Informatics Training, Information Technologies, Professional Women, Professionalism.

1 Introduction

Much has been written about the informatics profession recently, although most of these works in Spain are like an amusement park merry-go-round as they keep on going around the same subjects: professional certifications, professional associations, professional monopolies, etc. But little is said about the content of the informatics profession, about its objectives, what it is good for and whether it is useful: as will be seen later on this article, the informatics profession is really useful and for much more than it would seem at first sight.

In this article, and from a personal point of view, I intend to help clarify this confusion by examining the range of possible professional careers in this field of informatics in which the introduction of the term "Information Technologies" (IT) has simply served to complicate the existing paranoia.

2 Origins of the Informatics Profession

One of the problems which arise when we speak about the informatics profession is to establish clearly what its field of action is. While I do not intend going back to the Hittites nor even to Charles Babbage and Lady Ada Lovelace, it is important to examine what our profession was like and what it consisted of when it started 60 years more or less. We do not, however.

The people that developed the first electromechanical and electronic computers were scientists with a great mathematical and engineering background. We are talking about the 40s and 50s of the last century. Once the first calculators started to appear, it was necessary to make them work. That was called "programming a computer", the calculators of that time. In reality they were machines for solving mathematical calculus problems, something that should not be forgotten. Because of that, the first professionals were the programmers that made the machines perform requested calculations and the computation scientists that designed and built them. In those years these professionals existed in most advanced or semi-advanced countries, which is the case of Spain, where some early computers were built though they never hit the market. As far as I recall, one of those

calculators was built by professor Garcia Santestipes at the Universidad Complutense de Madrid.

When electronic computers appeared, there were already a number of electromechanical machines in existence which were used essentially for accounting tasks, some of which used punched cards, and the famous tabulators which also had to be programmed. But these machines, which were used to solve organizations' accounting problems, were in fact processing the data and handling the information of organizations and enterprises. And it is then when new professional tasks appeared, those of the operators of the machines which later became our present day computer operators. Those computers are now known as "mainframes" and the people who still operate them are very valued professionals in our sector.

By that time, other professionals appeared who were dedicated to the capture of data and information which had to be processed by those machines according to programs developed by programmers. These data capture professionals were called card punchers at the beginning, because what they did was input captured data in the form of holes in thin cardboard cards. And then we had the first professionals who handled information, who decided what types of data should be processed and the intended results, while ensuring the quality of data and information obtained as a result of the processing carried out by programs that were working in those machines, and deciding whether or not they had the minimum quality required by users. By the end of the sixties, this professional began to be called in

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Spain "técnico de sistemas" (systems technician) or "ingeniero de sistemas" (systems engineer) and also "Informático" (in English informatics professional or computer professional, or, more rarely, informatician), because of the then powerful influence of French terminology in Spain.

When the Spanish Ministry of Education and Science created the Institute of Informatics in 1969, the first public educational centre for Informatics in Spain, the educational curriculum established five professional degrees, one per year out of the five years of duration of the complete course. In the first year "applications programmer", in the second year "systems programmer", and in the third year "applications analyst". In that course students who already had a university degree could also be directly admitted. In the fourth year the degree obtained was that of "systems analyst", and in the fifth and final year the degree was that of "systems technician". It should be taken into account that in the last three years there was no training in programming, but they included all subjects concerning the analysis and design of applications and data and information management systems. This structure disappeared in 1974 when the Institute of Informatics was transformed into the first Informatics Faculty at the Universidad Politécnica de Madrid. The curriculum lost any direct relation with the market and was aligned with the university environment.

The appearance of personal or "end user" at the end of the eighties of the last century, with the proliferation of personal computers (PCs) and, later, with the appearance of the Internet in the mid-nineties, brought about the popularization of informatics as users and consumers came into direct contact with computers and networks, both in their organizations and in their personal environment. In terms of image, informatics is now akin to a kind of do-it-yourself where formal or professional education and training seems unable to establish any great difference between the amateur and the professional, the qualified and the unqualified, etc. As an example, the media highlight cases of teenagers and hobbyists who obtain remarkable technical results in this environment. In any case, in Informatics there is a "end user" which distorts the perception of the real work of professionals causing the term "informático" (informatics professional or computer professional, as mentioned before) to be applied without discrimination to any type of activity profile, whether professional or even non-professional. Simultaneously, the media have been magnifying the dangers that, as in any newly implemented mass service, have appeared as Informatics has been introduced into the daily lives of millions of people.

1 For a certain period of time in Spain the term "logical", from the French "logiciel", was proposed as the translation for the word "software" but it failed to catch on. The term "ordenador" (computer) from the French "ordinateur" was accepted into current use, instead of the term "computador/a", which is used in Latin America.
work (Computer Science in ACM).

3. Software engineers, developers of applications.

4. Designers and developers of solutions for the processing of organizational data and information with a very varied denomination of tasks and jobs which is very often confusing. In my opinion, these are the real informatics professionals, referred to as Information Systems specialists by the ACM; they are professionals with a great multidisciplinarity.

Finally we can identify some more modest profiles such as operators, maintenance personnel, and data capturers, the latter being in the process of disappearing, for obvious reasons. It is very important not to mix these professional concepts because the resulting mixture does not work, as can be seen in the present reality.

5 New Realities, New Needs

The pace at which the technologies involved in Informatics and Computer Science are progressing, together with the evolution of the uses of these technologies, causes new needs and problems to emerge while end-users and costumers require them to be addressed efficiently and effectively and at a reasonable cost. Thus Internet technology, together with the evolution of its uses and applications, is creating the need for specialized informatics professionals (aka IT professionals) to design web pages, professionals who require a highly multidisciplinary professional profile.

With these operational needs, new professional specialties are emerging that are not yet either formalized or officially recognized, and whose content varies according to the needs to be met. Thus web page designers need to be trained in knowledge of communications, sociology, art design, in addition to the relevant informatics/IT know-how. But the main question is to determine what the essence of the skills needed in those cases is. We can foresee more specialties emerging in the near future, bringing a dynamism of content to our profession.

In the European context, and without entering into the field of pure electronics and hardware for data computing, "computer scientists" and "computer engineers" have few job opportunities; this situation is worse in Spain, since nowadays, with few exceptions, computers are not manufactured here, neither are operating systems or programming languages developed. Their chances of finding a job increase if they are able to be more multidisciplinary and specialize in, say, automobile control embedded systems, etc. which traditionally have been handled by industrial, electronic and telecommunication engineers. Software engineers and computer scientists nearer to a software solution have more possibilities since the development of application packages are starting to take off slowly but surely in specialized sectors like those of mobile telephones, air traffic control, medicine, automobile, etc.

In Spain, the problem is more acute because there are no major computer companies with multinational operations in the sector, save for some rare cases. But there is an important market for applications programming, for the design and development of solutions, and for the provision of services. Spanish professionals are well prepared, though they might have very varied academic degrees. For example, Spanish professionals in the audiovisual game sector are very successful at an international level.

It is curious to note that nobody in Europe nor consequently in Spain, with few exceptions, has learned to sell, to put the right "wrapping" to application software packages for their global commercialization. The only consolation is that Japan has not been able to do that either, except in the field of games, but that would be the subject for another article.

6 The Task of Defining Informatics Specialties

Given the existing state of confusion regarding the denomination of jobs in which informatics professionals with different specialties can work (besides its clearly transversal nature in all sectors), there is still a long way to go before we can arrive at a clear definition of professional specialties, but that should not stop us trying.

An example worth mentioning is the content definition of 21 profiles performed by the EUCIP programme (European Certification of Informatics Professionals, <http://www.cepis.org/eucip>) of CEPIS (Council of European Professional Informatic Societies), yet CEPIS has still not arrived at a clear definition of the informatics profession. Each European country has its own opinion of the definition and content of the informatics profession and it is very difficult to reconcile 27 professional cultures. Within this context, the European Commission has embarked upon a framework of e-competences (e-Competence Framework – e-CF) as a reference tool that defines 32 competences in the IT field that may be used by all stakeholders in the sector at a European level. Commissioner Neelie Kroes says that the e-CF aims to contribute to the establishment of professional standards for jobs in IT across the borders.

I should mention that, in my opinion, the mobility of professionals does not depend so much on "papers" - that is academic, professional diplomas or certificates - as on their professional curriculum and work experience. Enterprises are much more pragmatic than they may seem when it comes to covering human talent needs.

7 A Brief Reference to the Role of Women in Informatics

Within the study of the informatics profession, we should not leave out the role played by women. Without underestimating the importance of the work done by Lady Ada Lovelace and Rear Admiral Grace Hopper, both pioneers in the profession, in Spain, women have participated as informatics professionals since the very beginning, in the mid-sixties of the last century.

The female sector has been outstanding in mathematics schools and a large number of these graduates became informatics professionals working in important jobs. If we look coolly and without prejudice, women are excellent professionals, but in terms of their university education the
Neelie Kroes, in her recent interview for UP, touched on the issue of women in informatics. She noted that the problem of the much-vaunted crisis at an international level caused by the scarcity of women in the informatics profession should be analyzed very carefully and by specialties in order to see if it really exists and what its possible causes are. There have been broad studies about this problem. In this issue of UPGRADE we publish an interesting article which provides data on the problem of the low levels of university enrollment of women (not only in Spain) in mathematics, in sciences related to health, technology, etc. And at the same time it is necessary to take into account the great mobility that has existed because of the sizable offer of jobs in the informatics sector that has attracted many women to our profession, even though they have not come academically from this discipline. Curiously, these women pursue reasonably successful careers and say they are satisfied with the work they are doing in IT. Nevertheless, the matter is more complex than it seems and a simple analysis is not valid. The problem seems to be a matter of vocation which is the main reason why students choose their subjects.

The European Commissioner for Information Society, Neelie Kroes, in her recent interview for UPGRADE and Novática says that the European Digital Agenda promotes a greater participation of women in IT work forces. But there is a need to motivate these women who are in the job market with an appropriate preparation and knowledge of informatics so that they can become highly trained and skilled IT professionals.

8 Other Current Problems

When talking about the informatics profession it is inevitable to mention the need for a professional code of ethics. At present, some European informatics member societies of CEPIs have their own code of ethics or code of good professional practices, but there is no European code. AT1 is working on a code of this nature which will be submitted for approval by its general assembly of members.

The Information Society Commissioner Neelie Kroes told UPGRADE and Novática that by 2015 there could be a shortfall in Europe of about 700,000 IT specialists, and that it is necessary to encourage young people and women by giving them opportunities and incentives to enter the informatics profession. She says that the sector needs to become more attractive for all these sources of talent by making educational curricula more interesting and of a higher quality. The goal is to avoid a lack of qualified personnel with the consequent paralysis of initiatives and an excessive increase of costs.

The Commissioner considers that it is important for professionals to have a clear vision of their career paths, not only in the private sector which normally pays better, but also in the public sector to make it more appealing.

All of which is hard to disagree with, but with the present economic crisis it is not clear that these aims can be implemented in the short term. Nevertheless, it is clear that there is not much time to address these issues if we wish to see a recovery of employment in the profession, a recovery which all analysts agree, although it may be a long time coming, will be reasonably dynamic when it does come.

Among the challenges of attracting human capital, we also need to consider the changing commercial policies of ICT service companies who are promoting a new image whereby they supply value and not just a service. At the same time they are attempting to attract talent by offering conditions that are not expensive for the companies, such as teleworking (curiously the sector in which teleworking is perhaps easiest to implement is also the sector which places the greatest importance on on-site presence), educational and career development policies, improvement of work methods and project management (avoiding constant emergencies), etc.

I cannot finish this brief article without mentioning the latest new legislation in Spain, Royal Decree 1000/2010 of August 5, implementing Law 25/2009 of December 22 2009 amending various laws to adapt them to the Directive on freedom of access to service activities and their provision, which includes Law 2/1974 of February 13 on professional associations of university graduates ("colegios" in Spanish). Article 2 of this RD establishes the obligatory service certifications to be issued by these associations with a radical reduction of the number of certifications and, as was expected, there is no mention of the need of certifications for informatics projects; logically since the European trend is towards the elimination of professional restrictions, not their creation. It should also be noted that, since this RD is a Spain's national-level legislation, the regional governments have no authority to alter the certification system.

9 Conclusions

After these diverse considerations expressed above I will dare to say that the Informatics/IT profession has a great variety and complexity of contents, and a wide range of academic qualifications and degrees which are, and have always been, fundamental to IT professionals, as they are by nature multidisciplinary, both by academic education and by professional training. It is a profession in constant evo-
olution, developing new specialties as technology advances and as a diversity of users pose new problems requiring new solutions.

The informatics profession has difficulties in terms of its definition and even its nomenclature, not only at national level, but also at European and global levels. Nevertheless, organizations in the public sector and in the private sector apply pragmatic business principles to these problems and, more often than not, though not without difficulty, obtain the professional profiles that they need, based more on the individuals expertise demonstrated by their CVs and experience than on any diplomas or certificates that they may have received, though the latter are still important.
The Evolution of the Computing Profession: A Personal View

Neville Holmes

This essay expresses the author's concern for the role of digital technology in society. Most of the essay describes summarily how the author has seen the use of digital technology growing and changing through the years, and depicts the computing profession as in dire trouble and as socially derelict. The rest suggests how this trouble and dereliction might be overcome.

Keywords: Computing History, Computing Profession, Data, Data Processing, Digital Technology, Education, Informatics, Information, Information Processing, Professionalism, Social Implications, Standard Vocabulary.

1 Foreword

The terminology used in this essay will be unfamiliar to many computing professionals. However, the terminology used in much computing literature is confused and misleading [1]. Professionals should avoid this, as I aim to do here.

Perhaps the most important avoidance lies in making clear distinctions. The most basic and important distinction that should be made by the computing profession is between people and machines. A specific basis for making this distinction was wisely and prominently included in the IFIP-ICC Vocabulary of Information Processing (North-Holland Publishing Company, 1968), a vocabulary that later was given international legal standing [2]. The definitions there are:

A1 DATA A representation of facts or ideas in a formalised manner capable of being communicated or manipulated by some process.

A3 INFORMATION In automatic data processing the meaning that a human assigns to data by means of the known conventions used in its representation.

In essence, these definitions, which have not been substantially changed over the years, state that only people process information and computers only process data. These definitions will be respected here. Curiously, the field of so-called intellectual property has long observed the distinction, though not always using the terminology [3].

The distinction between data and information also renders their phrasal use distinctive. Thus, data systems are technological while information systems are social, data technology is abstract while information technology is psychological, communication of data is technological while communication of information is linguistic, though it might use data communication as intermediary.

The term digital is another very basic and relevant term. A digital technology is a technology that encodes data using a limited number of tokens. Communication systems and computers nowadays almost always use a digital technology, though many forerunners used an analogue technology [4].

There is a similar distinction to be made between different roles of people using computers and other tools. Technologists are data oriented; they focus on techniques and efficiency. Professionals are information oriented; they focus on clients and their social environment.

2 A Personal History

My involvement in the computing industry started in 1959 and was as a participant for the first couple of decades but then as an observer with progressively diminishing direct involvement.

The richest aspect of my experience was involvement with people—both as colleagues and clients. The technology was there, especially in the early stages, but it was always in the background. The recollections that follow are divided into decades that are only approximate.

2.1 Beginnings

As training, and very good training it was, for later assignment to customers as a systems engineer, I spent several years in a data processing service bureau.
Service bureaux had several kinds of customers. Because DP equipment was very expensive small enterprises could get work done on a job by job basis without having to buy equipment and employ operators. Larger enterprises used a service bureau to explore and prepare procedures ahead of installing their own equipment. Enterprises with equipment already installed sometimes used a service bureau to cope with peak loads at month end or at the end of the financial year.

In the early stages of my training the machines in the bureau were all based on punched cards, mostly programmed by plugging wires into control panels. Operators took large files of punched cards from machine to machine, variously sequencing, merging, splitting and printing reports. Any needed multiplication or division used a punched card calculator.

A very important component of the processing was repeated checking of data. For example, original data were keyed into a card twice, the first time on a punch, the second on a verifier that notched cards with a possible error. Original data were batched with control totals that were checked by machine.

Emphasis on checking wherever possible was a feature of my early DP experience and persisted into the early years of stored program computers. Sadly and unprofessionally the emphasis has declined in recent decades and is responsible for many prominent recent project failures.

Commercial work in the service bureau at that time was typically specified by the customer. Master files and transaction cards had certain data, reports had well-defined content. Programs were plugged by the more experienced operators in the bureau, who also designed the formats of the cards and reports in the process.

There were occasional applications, such as exam paper marking, manufacturing job control, and research data analysis, that centred on calculation beyond normal accounting needs. For these I was involved directly with the user, and found the work quite fascinating and rewarding.

Some little time into my direct service bureau experience, the IBM 604 calculator was replaced by an IBM 1620 computer. The main difference, apart from a greatly increased capability, was that the program was read into the computer from a deck of cards prior to running a job, rather than by loading in a plugged panel. Because a stored program was typically much more complex and abstract than a plugged panel, the talents of an experienced machine operator were not always suited to writing them, and the occupation of programmer started moving away from operation.

Scientific work could be done on the commercial DP equipment of the time. Indeed, an engineer at a petroleum company in Melbourne did linear programming on an IBM 604. However, much scientific work outside academia was done on the various personal computers of the time, such as the LGP-30, the Bendix G-15, and the IBM 610. Such work commonly used punched paper tape rather than punched cards. With personal computers, the researcher was both operator and programmer, as a colleague later described to me.

2.2 The 1960s

After a while, a fancier computer was brought into the service bureau, one that used master files stored on magnetic tape. Although original data still came in on punched cards, the effect of magnetic tape was to diminish the need for much of the punched card handling. Even the record sequencing was done through magnetic tape. The work of operators became more menial while the role of programmers became more prominent.

Magnetic tape machines also moved into the commercial world. Digital computers were very expensive, however, and most enterprises leased them rather than bought them. This made it prudent for the lessor to take a leading role in ensuring that the lessee. I moved from the service bureau to partnerships with salesmen. Their job was to deal with customer management, mine to deal with programmers and their managers.

One of the big problems was getting the DP managers to adopt the strategies appropriate to the new and unfamiliar technology. For example, an obvious (i.e., safe) strategy was to hire in the best available programmers. However, experience showed that users familiar with the enterprise and its problems would make more effective programmers and designers than
programmers hired from outside, provided they had the needed talent [5].

A very significant development of the mid-'60s was the increasing adoption of disk drives with removable data packs. One effect was the elaboration of operating systems needed to manage the variety and multiplicity of data files being used. Another was the increasing penetration of computer applications beyond the accounting department [5].

For the computing profession this development led, at least in the government and commercial world, to a distinction being made between programmers and system analysts. The analyst studied the problem, devised a solution, and specified in detail the programs that were to solve the problem. The better programmers tended to be promoted to analysts, but there was usually and properly a close cooperation between those responsible in the two roles. There still is great potential for adopting this dual responsibility approach [6].

Meanwhile, the scientific computing world was keeping to its user-as-programmer approach. Personal computers were still popular, but as many more researchers opted to use them, sharing a large computer was much more effective, computationally and financially. Therefore operating systems supporting time sharing, often through teletype terminals, were developed.

In the academic world computer science departments were being set up to bring scientific minds to bear on the otherwise mundane field of programming.

2.3 The 1970s

Commercial computing technology continued to develop, along with operating systems. DP departments went from strength to strength, both within business enterprises and within government. This had several effects.

At the top level, DP management saw their main objective to be the enlargement of their department’s size and influence. This led to the adoption of larger and larger projects that took longer and longer to implement. At first this was simply an unleashing of technological ambition, but later, and after repeated disappointment with the results, highly qualified people were hired to lend an aura of respectability to new projects.

The nature of these organisation-wide projects was such as to divorce the end user from any role in their design. Managers outside the DP department were involved in devising the objectives of the project, but that’s where cooperation ended. DP management’s objective was to enhance their influence.

System analysts worked from the project objectives to develop highly detailed and complete specifications of the desired system. End users desires were considered irrelevant, and their needs where what was specified for them. Programmers worked strictly to the specifications; they were technicians.

Operating systems used by business and government began to support time sharing through typewriter terminals, but in business and government this was mainly and gladly used to give programmers swifter turnaround.

There were a variety of computers available for small businesses. These were cheap and relied on simplicity to free the owners from having to set up a DP department. Programming and operating these was relatively easy to learn, again for anyone with appropriate talent.

Scientific computing continued, in most cases, to work independently of any control from a DP department. This was often made possible by the availability of relatively cheap and simple scientific computers.

In the academic world, the increasing use of computers in the business world led to the introduction of courses looking to prepare business people for exploiting computers. The courses were usually run by departments with names like Information Systems with faculties of business or commerce. These were quite independent of, even scornful of, conventional computer science departments.

2.4 The 1980s

Two related developments of the ‘80s set a trend against the traditional, and often renamed, DP department. These were the availability of cheap standard personal computers, and of general purpose business software.

Quite early on the Apple PC and its excellent word processing software cut severely into the conventional typewriter market, and its spreadsheet program also made it popular in the business, particularly small businesses. This was followed closely by similar software running on the more successful IBM PC, the 5150.

Users could easily learn to use the software, so that employees like secretaries and accountants could develop their own skills and techniques in dealing with their own office problems.

For a while PCs threatened the control of traditional DP departments. However, they fought back by adopting a system approach that brought all the enterprises data into a central complete database. With networking becoming more widely used, this meant that PCs could be used as terminals for the database systems, and were thus brought back under control of what was by then pretentiously called the Information Systems Department.

2.5 The 1990s and Beyond

By the ’90s I had retired from systems engineering and had taken up teaching on a remote island called Tasmania. I thus became an observer from a distance.

Several phenomena observed from that distance since that time strike me as significant.

One is the burgeoning of the Internet and its World Wide Web. This has greatly affected all parts of society that can afford the relatively cheap equipment needed to use them. The equipment is becoming cheaper and cheaper, and the disposal of out-of-fashion laptop computers and mobile phones has become an environmental hazard.
Another was the obvious penetration of computer usage, not always wise usage, into all corners of our modern society. The significance of this is that skills in the use of computers have spread way beyond the inner coterie of programmers and system analysts. To be respected nowadays, almost every level of education must build skills in the use of computers.

An institutional phenomenon has been the repeated failure, or limping success, of large computing projects in business and government. This has led to a vast increase in the use of consultants. This changed approach seems more intended to avoid responsibility than to adopt a more rational approach to system development [6].

3 Intermission
The developments described above are of course subjective generalisations but I would claim them to have a core of wide-ranging truth.

In the background has been the formation of would-be professional societies. In most cases these have been started in the academic environment as representing a new discipline, though the IEEE Computer Society is an exception.

These computer societies reluctantly took in members working outside academia and this led to oscillation in control and objectives between the two factions. Nevertheless the growth in use of computers meant that membership kept growing until about a decade ago. Since then there has been a slump, or at least a stasis in contrast to the growing number of graduates in computing disciplines.

This is a complex issue. In my view the main factors are as follows.

Firstly, young people are using computers and the Internet both in school and at home. Digital technology has become commonplace in society and is not distinctive as an occupation.

Secondly, digital technology has pervaded almost all branches of higher education to the extent that, for ambitious students at least, formal qualification in computing seems pointless. The result is that the better students tend to avoid computing qua computing, and academic courses in computing struggle to provide studies that will attract students, often by offering training in the development of computer games.

Thirdly, graduates in computing are now taking a great variety of jobs in which they are in effect technicians. They may be well paid, but they are primarily employed to do mundane work simply keeping the computers and networks of their employers in working condition and helping users who have trouble understanding how to use the increasingly complex general purpose software. In this they are having to compete with talented youngsters who haven’t wanted to go on to tertiary studies.

Fourthly, the relevant professional societies do not seem disposed to review the basic nature of the profession they are representing. The technology is overwhelming the practitioners.

4 The Profession
The computing scenario is in some ways a repetition of earlier technological scenarios.

Consider for example the use of electricity. It started small but grew rapidly once it was generally accepted. Also, its most rapid growth came with the construction of nationwide, even international, electrical power grids.

Hence it is appropriate to compare the field of electrical power with the field of computing power, but bearing in mind the standard distinction between data and information.

4.1 Popular Computing
In my primary school we were given practice in crafts such as woodworking and weaving. We were not given any practice with electrical construction, doubtless because it was considered too dangerous, though some of my fellow pupils did build crystal-based wirelesses.

Computing is not physically dangerous, so there is no similar barrier to teaching basic skills with computers, and such training can start very early in school.

Teaching basic skills with computers has two meanings. Indirect teaching uses computers and possibly the Web to inculcate a variety of basic skills. Direct teaching uses computers to inculcate basic skills in using the computer itself.

Indirect teaching has tremendous potential, but must focus both on data and on information. Computer based drill and practice can be extremely effective in using data to improve numeracy and literacy [8]. But such skills must be complemented by the development of social skills and this is best done by using numeracy and literacy as the basis for group activity to exchange and develop information [9]. Music is one such very important activity, and here the computer has great potential [10].

Direct teaching is needed to emphasise to the student that the computer is a useful tool, and that there is a great danger in allowing the computer to take control. One way to do this is to teach symbolic computation [11]. Another is to teach procedural programming [12]. Such teaching is really an extension of numeracy.

4.2 Practical Computing
Back to electricity. Once the use of electrical devices became widespread and electrical wiring became part of the ordinary home, at least in the developed world, skilled people were needed to install and repair electrical equipment and its wiring. Such people are called electricians and the need for their services continues despite great changes in the nature of electrical equipment in use.

The installation and repair of computers, digital networking, and software also needs the services of skilled people [13]. The problem is that, while aspiring electricians have long had formal technical training to qualify them for the various branches of the electrical trade, no such formal technical training has been available for computing technicians. Although the need for such training has been recog-
nised, much of the certification has been specific to the companies marketing the machines and software.

4.3 Digital Engineering
When the use of electrical power started spreading, electrical engineers were needed to design and supervise that spreading. The design aimed to optimise the usefulness of the electrical system and its devices, the supervision aimed to ensure the effective work of the variety of tradespeople needed to build to the design.

Computer engineers (though this terminology has not been widely adopted) thus design computers supervise their manufacture. Communications engineering has developed from both electrical and electronic engineering. More recently it has taken on photonic and digital technologies, the latter linking it closely to computer engineering.

Software engineers, a terminology that has been widely adopted, should therefore design software and supervise its manufacture. To be effective, their focus should be on understanding the problem the software is to solve, designing the software, and making sure the software meets its objectives, both operationally and financially. The more skilful the supervised programmers the more likely the objectives will be met [6].

4.4 Professional Computing
With computer engineering and software engineering separated out of the computing profession, what is left over?

Computer engineers and software engineers are primarily concerned with data processing. Computing professionals are thus left with information processing, which is much more complex under the standard distinction, being concerned primarily with people and society.

Indeed, computer science seems lately to be concentrating on what they call artificial intelligence. This looks more like a branch of mathematics than of practical computing, and should more properly be called, say, algoristics [14].

The point about the computing profession is that, being concerned with information and people, their expertise needs to be in areas like sociology, linguistics and semantics, something of a cognitive engineering.

The people who need their help are the people with problems that might or might not be solved by use of computers. Interestingly, the so-called Information Systems education courses within various Business Schools produce graduates who can properly be called computing professionals as they are described just above. The problem is that they are only taught to cooperate with business or administrative people. A recent item in Nature shows very clearly the need for partnerships with scientists (see <http://tinyurl.com/NtrScPr>).

4.5 Computing Education
With the pervasion of society by networked computers, day-to-day problems can be solved by the users themselves, with or without the help of computing technicians.

The computing profession is a secondary profession. The people who need the help of computing professionals are professionals or technologists in other spheres. If computing professionals are to be effective in another sphere they must be educated in that sphere as well as in computing and information. This can be done, but it requires a complete reform of the tertiary education of computing professionals that recognises the need for professional partnership [15].

5 Conclusion
The reform of the computing profession outlined above is drastic. Therefore it would be very difficult to bring about. However some reform is overdue, and the benefits of this particular reform are many.

One awkwardness, of course, is the very term computing profession. Something simpler is needed. Informatieer practised by informateurs might do, though it’s rather awkward. Incidentally, I remember being told long ago that the French word Informatique was coined at one of the first post-war international data processing conferences. It was held in Paris and the simultaneous translators coined the word in a panic because the literal translation of data processing into French was quite inappropriate. However, what I was told is not confirmed by Wikipedia.

To bring about any significant reform much discussion of and movement towards reform must take place. Recently I have tried to provoke such discussion in my column [16], and have been rewarded by some responses [17]. Any further responses from readers of this essay would be eligible for publication there.

References
This essay being in many ways a résumé of some of my essays published in IEEE Computer Society’s flagship magazine, "Computer", I have used bracketed numbers in the essay to link to a relevant essay listed below. Their PDFs can be got either from the IEEE Computer Society’s digital library, <http://tinyurl.com/cmptrrkyv>, or my archive at the University of Tasmania, <http://tinyurl.com/wnhrkyv>. Where there is a trailing number in parentheses, this gives the essay number in my book "Computers and People" (Wiley 2006). Most of these essays give further links to relevant material.

[1] In praise of professional precision, 2006 April.
[8] Supporting acquisition of basic skills, 2008 March.
[12] Computers, programming, and people, 2002 March (2.5).
Information Technologies: A Profession for Men?

Miren-Idoia Alarcón-Rodríguez and Luis Fernández-Sanz

The authors present a brief review of the present situation regarding female representation among Information Technologies and computer professionals. We comment on some of the data which is relevant to our analysis of this situation along with various studies and opinions from Spain and other countries. Finally we look at the ECWT initiative and the role the Spanish CEPIS society ATI is to play in it.

Keywords: Informatics, Information Technology, Profession, Professionalism, Women.

1 Presentation

The title of this article was intended to draw the attention of readers to the fact that women are currently under-represented in the technical areas of the IT, Information Technologies, profession and in official IT-related studies. In fact, careers in IT have ended up being a predominantly male affair, since the number of women involved is clearly lower than might be expected.

A survey-based study [1] puts female representation in IT jobs in Spain at around 20.4% for technical professionals, although there are greater percentages of women in activities which are not so strictly technical in companies and organizations engaged in information technologies such as marketing or quality. According to the latest study of the sector made in 2009 [2], women represent 36.8% of all employees in 2009 (in 2008 the figure was 35.0%), mainly due to the fact that women only suffered a 1.1% loss of jobs in absolute terms, while men lost 8.3% of their number. As the same study shows, the destruction of jobs was worse among those without a university degree since there have been half the number of recruitments and 10 times the number of redundancies. Since the percentage of graduates is 70.4% compared with 55.7% for men, it is easy to see how the overall percentage of women in the IT profession grew as a result of the lay-offs. In Europe [3], the figure for 2004 varied between 5% and 30% of all professional women in ICT. This figure does not necessarily have to coincide with the number of women included in all areas of the sector as a whole: in fact for Spain in 2004 the figure is 20%, which does not tally with the overall figure of close to 35% included in the AETIC series [2]). More specifically, the INE (National Institute of Statistics) figures referring only to companies included in classification category 72 (Informatics activities) of the CNAE (National Classification of Economic Activities) give the overall percentage as 24.7% while for CNAE 642 (Telecommunications) the figure is 37.1%.

Unlike other professions in which the passage of time seems to help correct possible imbalances of this nature, the informatics profession does not appear to be heading in this direction. Unfortunately, judging by the percentage of female students studying towards degrees in computer science, it would seem that there is little prospect of this proportion changing: INE data confirms that in the academic year 2008-09 only 16.1% of students following computer science degree courses were women, while 14.38% of the new intake of students were female. In the academic year 2008-09 only 16.1% of students following computer science degree courses were women, while 14.38% of the new intake of students were female. In the academic year 1998-99, 20% of enrolled students and 17.18% of the new intake were women. In short, a continuing decline.

In the USA the National Science Foundation found that the percentage of women graduates in IT-related subjects had dropped from 34.5% in 1985 to 22.2% in 2005; apparently this was the only technical field in which the percentage of women students had decreased since the 80s in the last century. In Europe a general problem of attracting young people to scientific and technical subjects had already been detected. Also, according to Eurostat, in the field of science, students pursuing scientific degrees have often shown growing percentages of women from 1998 to 2005, although these percentages are generally lower than those of men. It is also interesting to note that the percentage of female students in IT-related subjects is lower than in other areas of study, with the highest being business and finance, and the lowest being computer science.

In the case of Spain, the INE (National Institute of Statistics) data referring only to companies included in classification category 72 (Informatics activities) of the CNAE (National Classification of Economic Activities) gives an overall percentage of 24.7% for women and 37.1% for CNAE 642 (Telecommunications). This figure does not necessarily have to coincide with the number of women included in all areas of the sector as a whole: in fact for Spain in 2004 the figure is 20%, which does not tally with the overall figure of close to 35% included in the AETIC series [2]). More specifically, the INE (National Institute of Statistics) figures referring only to companies included in classification category 72 (Informatics activities) of the CNAE (National Classification of Economic Activities) give the overall percentage as 24.7% while for CNAE 642 (Telecommunications) the figure is 37.1%.

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ences, mathematics and informatics the percentage of women graduates has fallen from 42.3% to 39.2% (in Spain the decline was greater — from 43.1% to 36% — while in some countries, such as Austria, the proportion has increased). However, limiting ourselves to degrees in computer-related subjects in Spain, and according to data from the National Institute of Statistics, a more detailed analysis shows the following changes between the academic years 1998-99 and 2007-08:

- Higher computer engineering (master’s degree): from 29.5% to 20.41%.
- Computer engineering (bachelor’s degree):
  - Management information: from 31.35% to 25.47%.
  - Systems: from 17.31% to 14.25%.

Conversely, the proportion of women graduates in engineering and architecture has risen from 28.09% to 31.79% for master’s degrees and from 26.52% to 28.43% for bachelor’s degrees: in other words, the percentage of females in this type of subjects has increased, mainly due to subjects such as architecture, engineering, chemistry, and agronomy, for example. Related subjects such as telecom engineering also grew from 23.47% to 27.79% and from 24.45% to 27.48% at the master and bachelor degree levels respectively. If we look at enrolment levels we see that the increase of students in master’s engineering degrees is similar (around 3%) although in the bachelor’s degrees there is a slight drop. For higher computer engineering degrees the decrease is around 0.7% and for the two types of bachelor’s degree once again the drop is around 3%. Although the percentages are not the same as for graduation rates, the problem of falling percentages is centred once again on computing degrees.

This might lead one to believe that the problem stems from the teaching at universities or even of the recognition given to university degrees. However, if we analyse data regarding enrolment in IT-oriented middle and higher level vocational training courses, it seems clear that the situation is general in any kind of IT-related official training. The trend is as follows:

- Higher level vocational training in informatics: from 27.4% female students in 2001-02 to 17.23% in 2007-08 (to 24.45% in 2003-04).
- Middle level vocational training in informatics: from 30.7% female students in 2003-04 (comparable first year) to 13.6% in 2007-08.

In another technical branch of vocational training such as electricity and electronics, there is very little female presence although the figure has remained constant or has fallen only slightly since the beginning of this data series:

- Higher level vocational training in electricity and electronics: from 7.8% female students in 2003-04 to 6% in 2007-08.
- Middle level vocational training in electricity and electronics: 2% female students in 2003-04 and in 2007-08

2 Reasons for an Analysis

Of course, there is no reason why a profession should have to be balanced in gender terms. A recent paper [4] stressed the need to take a fresh look at some aspects which much of the research into this phenomenon has failed to question adequately. It is, in fact, a good work of critical reasoning aimed at avoiding bias in studies by avoiding statements that are unsupported by research or data such as those mentioned in the cited paper: for example, the statements made in [5]. The paper also poses another question: is it so important to try to understand this imbalance when the same thing occurs in other key professions such as nursing or education in which efforts have been made to attract men?

It certainly opens up an interesting line of research which is difficult to cover in a brief article. However, in our opinion as professionals and members of an association of informatics professionals, we believe that, having analysed some studies and papers produced in Spain and in other countries, a number of different factors emerge in the field of informatics which emphasize the importance of this imbalance and make it worthy of closer examination. We provide a number of examples (not intended to be exhaustive) below.

Generally speaking, professions based on creativity and knowledge are especially reliant on drawing from a wide range of talent in order to achieve the best results in terms of effectiveness and innovation. The work to be performed (of an eminently intellectual nature) does not involve any constraints which might hinder the participation of women, such as activities requiring considerable physical strength, nor is it a profession with a long tradition of having been dominated by men in which there are greater mindset or image barriers to the incorporation of women. In fact, women with skill and perseverance have broken into many traditionally male professions. A case such as information technologies, with a much shorter history than other professions and even than the vast majority of technical disciplines, is especially disturbing: it is gradually becoming a male profession due to female candidates clearly shunning IT as a career since, as we have seen, the percentage differences were not so significant a few years ago.

Also there does not seem to be any pressure to discourage the incorporation of minority groups, rather the opposite. In fact, employers regularly complain of a lack of skilled personnel, now perhaps mitigated by the general crisis affecting Spain (as we mentioned earlier, the job destruction rate in the sector was 5.8% in 2009 [2]). In short, the informatics profession needs new members to meet the needs of companies and society and, conversely, fails to attract (or even retain) in any significant manner half the available population: women. It cannot be enough to console ourselves with the fact that the same thing is happening in other countries, to various degrees and under the influence of different local circumstances. Especially when in those countries, and in general since the creation of the European Union, efforts have been made to analyse and help correct this imbalance, one which has no logical justification beyond factors which could be mitigated or corrected in the various social, educational, economic or political environments. The
possibility of there being an "innate" factor would seem to be ruled out as a single reason (although it would be fascinating to address this aspect as in the study carried out by the researchers Alexander and Hines [6]), since the percentage of women has been decreasing over time from significantly higher levels.

3 Analyses and Studies

A recent study [7] found that in the world in general and in all sectors women have a broad perception of professional success (59%). Surveys conducted late in 2008 on 3,600 professionals of either gender (split 50-50) in 18 countries, with a third over 45 and a third under 30 do not reveal any major differences in the perception of the handling of technology by women compared with men. However, if we focus on the technological sector, this appears to be in contrast to the professional under-representation of women, a phenomenon which is generalized in developed countries and does not seem to improve with the passage of time: in the United Kingdom the percentage of women shrank from 24% in 1997 to 21% in 2004, while in the USA the figure has dropped from 41% in 1996 to 32% in 2004 [8]. We have already commented that a study in Spain [1] revealed that the percentage of women working in the sector was 34.5% (similar to the national average) but concentrated in marketing and customer care, while for technical departments the percentage was only 20%.

One of the problems, therefore, is the difficulty to attract women onto informatics degree courses, while there could also be a high drop-out rate or a lack of performance. It is true that a study in the Universidad Politécnica de Madrid, Spain, in 1993 [9] on academic performance found that there were no practical differences between the performance of male and female students except, strangely enough, in the first cycle of informatics and architecture in which women achieved slightly worse results. However, in a recent study in 8 Spanish universities [10] it was found that there were no significant differences between the academic performance or drop-out rate of the two sexes; the only (slight) success correlation relates to the entry grade. This study confirms the gradual decline in the percentage of female students in each new intake which was seen in an earlier study [11]. Based on personal teaching experience, one of the authors of this article can vouch for the fact that between the years 1989-1994, 25.4% of all students on his computer science courses were women when now (academic year 2008-09) the figure is approximately 16.9% at the same university.

It is odd then that companies complain about the lack of talent or qualified personnel to meet recruitment demands in recent years. Although the current economic crisis may have mitigated this pressing need, the problem is likely to reappear in an even more virulent form once the job market rebounds. In this scenario it is strange that such a large percentage of high-level talent cannot be drawn towards a technological field of such great importance to the development of countries and the economy in general. In 2002 an informal study by the company ABACO Siglo XXI of 3,000 job candidates revealed that the percentage of women candidates ranged from a maximum of 46% in the younger segment (between 22 and 26 years old) to a minimum of 4% in the over 45 year old segment. The study estimated that the situation would correct itself in the next 10 years as the potential of women graduates grew.

Strangely, some experiments with informatics students [12] have revealed that, without access to data identifying the candidate, a female CV is preferred to a male one. Although there are some important exceptions in the senior management of some IT companies (for example, Rosa García and María Garaña at Microsoft Spain or Amparo Moraleda at IBM Spain), it is also true that there is still a need for more women in top management positions in the sector (boards of directors are still only 22% female and executive committees only 19%). However, a study [13] suggests that, in principle, women do not perceive the existence of a generalized glass ceiling so it would be wrong to suggest a dissuasive effect in this respect. On the contrary, and as an example of reports based on findings not supported by data, the report [14] tends to put these differences down to policies which discriminate against women. Nevertheless, it should be remembered that in Spain, although there may be good professional prospects for a specific course (at least compared to other degree courses), students tend to choose their subject mainly (78.9%) on the basis of vocation [15].

In any event some interesting specialized papers [16][17][12] have been published with a view to increasing both enrolment and retention of students until graduation. According to the authors the matter of retention is vital since in a study conducted in the state of Virginia in the USA there was found to be a very significant drop-out rate among female students. The recommendations mooted are very varied and range from working with high school teachers to carry out outreach activities, to the idea of maintaining stability among the teaching staff (!) since statistics appear to demonstrate that an excessive turnover of teaching staff causes a higher drop-out rate (an interesting idea to convey to the heads of certain universities). Also stressed is the need to create a more favourable environment for the women, in such a way that they can look at successful role models in the Informatics industry.

However, such policies aimed at attracting students to computer studies end up adulterating the curricula to make the subject look less like computer science by focusing on its practical applications in other fields and so encourage more women to enrol [18] [19] (although in this case it was a matter of a whole set of activities to pay special attention to the female students enrolled and it succeeded in increasing the percentage from 8% in 1995 to 42% in 2000, although since then this percentage has fallen once again). One of the reasons for the lack of female interest is the gap between what is taught and its application to day-to-day life, a reason which does not apply only to the women but also discourages young males. For this reason the associa-
tion ACM has tried to run awareness campaigns to mitigate the general lack of interest in informatics degree courses. The same thing is happening with degree courses in engineering in general in the USA, which also suffer from low levels of enrolment and female students; they have even created teenage reality shows related to engineering activities with the support of the IEEE.

However, the problem seems to arise earlier, when the potential students are in their teens which is when future study decisions are taken, and tastes and career choices firm up. Among the factors which influence young people’s decision not to choose engineering courses in general is the number of years it takes to complete them in Spain, which seems to have a specially negative impact on the presence of women in the case of computer studies [19]. It would appear that teenage girls start to emotionally reject computer-related courses when they are between 15 and 18 years old when they start to perceive the target professions as male [20].

Some initiatives in the USA include having young graduates give presentations in high schools aimed at providing better information about the informatics profession and related degrees. Although better information does not always have a positive impact on forming vocations, a point raised in [4], this is not an especially important reason to explain the low rate of female enrolment, or even of enrolment of either sex, in informatics courses. Also, the influence of the stereotypical view of computer workers as geeks or freaks (with their general weirdness and traditional lack of social skills or dress sense) can only be a general cause for stunning informatics courses, not exclusive to females, since women have broken into other professions with stereotypes that are socially much less acceptable.

In other cases, this general lack of professionals and, more particularly, of female candidates is put down to the profession’s poor image in terms of working conditions. Although it is true that informatics students and graduates are famed for their "whinging" about pay and conditions (when comparative studies with other degrees suggest that informatics graduates are significantly better off than students of other disciplines, both in terms of job opportunities and starting pay), it should also be recognized that there are real grounds for complaint. In particular, difficulties in reconciling work and home life which are typical of IT jobs and which especially affect women (normally more involved in meeting the needs of family life) due to a more traditional "male" concept of work, typified, for example, by "presenteeism" in the workplace.

We say "typical of IT jobs" because, since the late 80s, the authors have personally had the opportunity to speak to IT professionals and hear their stories in which they mention weekends working at the office to finish a development project, companies which send out for pizzas or call catering firms because their employees need to stay late to finish a project, regular calls at unsocial hours to "put out fires", etc. And on top of everything, all this effort is unpaid and you still have to be at the office the next day at 8:00 on the dot ...

These stories and stereotypes have grown deep roots in our society and even appear in films, TV series, and novels. The atmosphere thus created combines with the awareness that many of these situations occur because there is not enough investment in methodologies, tools and training, and that companies make unrealistic bids to win contracts. Even so, studies sponsored by European authorities (concerned with the great lack of people skilled in technologies) reveal that reconciliation between work and family life might not be such a major problem if women have the ability to manage their own time [21]. IT work actually lends itself better to teleworking but nevertheless has a reputation for requiring long "office" hours because teleworking opportunities are not adequately exploited. Another influence is the syndrome of self-imposed overtime (presenteeism) due to the seductive and exciting nature of working in technology, which women may also suffer from [21].

Working in IT increasingly requires multi-disciplinary teams so intensive training in informatics may not be essential for everyone (although the minimum necessary skills are). In fact, many women whose original degrees are not IT-centric join the profession after career changes and get great personal satisfaction from the work they do and the professional success they enjoy [21], which appears to contradict the problem of attracting women to ICT-related professions. Moreover, the unregulated nature of the profession with a tradition of low union membership and little job protection can also give rise to situations of inequality, especially among minority groups in the sector like women.

### 4 ATI's Standpoint and Future Actions

Although in the previous section we presented some of the aspects which are being examined to understand the reasons behind the low female representation among IT students and professionals, there are no reliable conclusions to be drawn. Once we know these reasons, we can provide the solutions, if any exist, to prevent intellectual female talent from being lost to a discipline and a profession which is destined to play a vital role in the progress of our society.

ATI has naturally wanted to do something to address this situation. As the Spanish representative in Europe of CEPIS, the Council of European Professional Informatics Societies, we have requested and been granted the job of coordinating the national contact point in Spain of the ECWT initiative, European Centre for Women and Technology <http://www.womenandtechnology.eu>, to drive and lead contributions made in our country to increase female presence in our IT and knowledge based economy. With the support of all the members, and in particular the female members, of ATI, our association hopes to be able to provide new solutions and better analyses to ensure that the greatest possible proportion of female talent can take part in the forward movement of the IT profession and its education towards giving a better service to society. Shortly, in the autumn of 2010, the association’s actions and outreach activities will be disseminated to all ATI members and to all the agencies involved in this task.
The Informatics Profession in Europe: An Overview

References


IT Profession in Europe: A Trade Union Perspective

Lorenzo De Santis

An overview of the situation of professionals in the ICT industry in Europe is given in this article, from the perspective of UNI europa ICTS, that is a UNI europa member representing more than one million workers from 150 different trade unions across 41 different countries all over Europe in Information and Communication Technology and Services industries¹.

Keywords: Europe, ICT Industry, Trade Unions, UNI europa ICTS, Union Membership, Working Conditions.

1 European² Employment Overview

1.1 Industry Outlook

In 2007, Information and Communication Technologies, ICT, accounted for over 5% of total employment in the European Union³, slightly higher than the OECD average, and had revenue of €670 bn. Of the 11 million workers⁴ in the sector, approximately 11% are union members.

Historically, rates of both collective bargaining coverage and union density have been consistently high and relatively stable. Today both collective bargaining coverage and union density are declining. Between 1995 and 2006, the past 11 years for which data is available, union density has dropped nearly 8% in Europe. This stretch marks the fastest rate of decline since data collection began. In 2006, union density in the ICT sector in Europe was just under 25%.

Figure 1 illustrates the vast scale of potential membership in the ICT sector in Europe. It highlights the fact that union membership across all industries in Europe – although at its lowest rate since data has been recorded – is more than twice the rate of union membership within the European ICT sector.

1 That includes all workers who were parts of the former UNI Telecom and UNI Industry, Business and Information Technology Services (IBITS) sectors: - Telecom workers include all the employees of telecommunication and related services, including those involved in the transmission and processing of messages and information in any form. - Information technology and business services workers include all salaried and non-manual occupations in the industry, business and information technology services sector, computer and related services, research and development, legal activities, accounting, auditing, market research, advertising (clerical), consultancy services, management services, engineering services and technical consultancy, salaried employees such as clerical, administrative, technical and supervisory staff, and professionals and managers in industry, business and IT services. Engineers, research, scientific and technical professionals and employees in industry, business and IT services are also included in this sector. ² In this section, Europe is referred as the EU27+Switzerland and Iceland.

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1.2 Where are the Current UNI europa ICTS Members?

As illustrated by Figure 2, Sweden, the United Kingdom, Belgium, Denmark and Germany have the highest numbers of current members in the ICTS sector. Figure 3 illustrates current membership by region. In this case, the Nordic countries have the highest proportion of membership (41%), followed by the regions comprising the Benelux countries, France and Monaco (21%), the United Kingdom and Ireland (15%), and Austria, Germany and Switzerland (14%). The Southern Europe region has 7% of the sector’s membership while the Baltic States and Central and Eastern Europe contain 2% of the sector’s membership.

The percentage of female members is far higher (42%) than the proportion of women employed in the sector (30%) and is comparable to the proportion of female workers in Europe (43%).

3 EU 27 is: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, UK, Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia. ⁴ Source: <http://nui.epp.eurostat.ec.europa.eu/nui/show.do?dataset=lsa_egan&lang=en> Since Eurostat includes “the production and distribution of information and cultural products” in its definition of the sector “Information and Communication” we included UNI MEI (Media Entertainment & Arts) members to calculate the union density in the sector.
2 Who is the ICT Professional in Europe?

2.1 Earnings

It is difficult to measure the average earnings of an ICT worker because of great degree of variation within the sector, but it is clear that the average ICT worker earns at least as much as the average EU worker, and some earn substantially more. In 2007, the EU average yearly income was 22,743 Euros. Workers classified in categories\(^5\) where we find ICTS workers earned on average between 22,748 Euros and 40,002 Euros per year which suggests that they are better paid than the average European worker.

2.2 Gender

The ICT sector is highly biased towards male employment. Males represent only 57% of the total European employment, but 70% in ICT. It is unclear whether female workers choose not to pursue careers in the ICT sector due to barriers to entry or whether other factors limit their participation in the sector. What is certain is that women’s representation in ICT work is lower than their representation in the labour market in all countries. Initiatives and policy

\(^5\) Here we used categories I (Transport, storage and communication) and K (Real estate, renting and business activities) of NACE Rev. 1.1. Since these categories comprise other workers than ICTS ones and were available for a reduced set of countries only, they are meant to give an estimate but are not statistically relevant.
efforts to attract more of them have been unsuccessful up to now.

In a report commissioned by UNI global union, Juliet Webster says the sector still suffers from a bad image and research shows that girls "have little awareness of the potential variety of ICT work". Furthermore, employment practices are surprisingly out-dated in the sector with very few examples of firms recruiting women returning to work after a maternity or career break. She also mentioned that the lack of flexible working arrangements makes it very difficult for women with children to enter the industry. The gender pay gap and male oriented work cultures are also quoted as factors impeding women to work in ICT.

2.3 Age

Older workers (50 years of age and over) are underrepresented in ICT work. They represent only 16% of the ICT workforce but almost a quarter of the total European workforce. This is in line with the perception that it is more difficult for older workers to find a job in the ICT industry, and it supports the notion that life-long learning is crucial. See Figure 4.

According to J. Webster, employers use unproven assumptions to discriminate against older workers. They allege that this population has high sickness absence rates, obsolete skills, and an inability to adapt to a young work culture. Companies also use the excuse that older workers are over-qualified and thus too expensive to hire. The lack of flexible working time that would support a better work-life balance and the scarcity of lifelong learning practices are often quoted to explain the under-representation of older workers in ICT.

As for the youngest workers (15 to 24 years of age) they compose 10% of the ICT workforce and 11% the total European workforce.

The majority of ICT workers are between 25 and 39 years old while across Europe, the largest age group of workers is between 40 to 59 years old. These data suggest that the average ICT worker is younger than the average European worker. Workers aged 15-39 comprise 58% of the ICT workforce and only 49% of the European workforce, further reinforcing that this is the case.

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Figure 3: Current UNI europa ICTS Members, by Region. Source: UNI global union (2009).

Figure 4: Age of European Workforce, All Industries and ICT Sector. Source: Eurostat (2008).
2.4 Working Time

The ICT sector has fewer part-time workers (10%) than the European average (18%).

ICT part-time workers work about half the time of those working full-time (41.8 hours/week), a segment who works approximately as much as the EU average (42.8 hours). But a study by the Chartered Management Institute showed that 83% of managers in the IT sector regularly work 1 hour 18 minutes more than their contracted hours, which is equal to 40 days per year!

2.5 Type of Contract and Professional Status

11% of EU workers are employed on temporary contracts, and the same is true for roughly the same proportion of ICT workers (10%), but the situation varies enormously from country to country (see Figure 5). For example, more than a quarter of the ICT workforce is hired part time in Portugal while this is the case for less than 5% of it in the UK or Hungary.

In terms of professional status 10% of ICT workers are self-employed, 87% are salaried employees, and 3% are employers.

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7 The distinction between full-time and part-time work is based on a spontaneous response by the respondent to the Eurostat Labour Force Survey. It is not possible to establish a more precise distinction since working hours differ between Member States and between branches of activity.

8 Temp workers are those with seasonal employment, persons engaged by an agency or employment exchange and hired to a third party to perform a specific task, and persons with specific training contracts.

9 Self-employed are defined as persons who work in their own business or professional practice for the purpose of earning a profit, and who employ no other persons while employers must employ at least one other person to be defined as such.

10 Employees are defined as persons who work for a public or private companies and who receive a compensation for their work.
2.6 Education

Although there is no particular group for ICTS workers in the Eurostat classification for occupations, we notice that the percentage of tertiary educated people in the groups where we find ICTS workers (38%) is significantly higher than the European average (26%).

From the previous analysis, a picture of the average ICTS worker has begun to emerge (see Figure 6). What is important to note is that the average European ICTS worker is different to the average worker in Europe. A worker in the ICTS sector is more likely to be young, male, and more highly educated at least through a tertiary level. In addition, an ICTS worker earns more than the average worker and is more likely to be employed on a permanent full time contract.

In a sector where skills and labour are in short supply and with an ageing workforce, companies must change their hiring methods since targeting primarily young male professionals will not be sustainable in the long-run. A low level of diversity has both financial and quality costs since it is more difficult to attract high-profile workers from a reduced talent pool.

It is an important challenge for trade unions in the sector to push companies to change their prevailing HR policies. More flexible working time schemes and work organization models that allow a better work-life balance, must be implemented in ICT companies to make them better places to work. Unions have an opportunity to help ICT workers by advocating these changes.

3 Trade Union Density and Collective Bargaining Coverage in Europe: The ICTS Sector Outlook

3.1 Collective Bargaining Coverage in ICTS

Low and/or decreasing union density can drive decreasing collective bargaining coverage rates. Collective bargaining coverage is often granted through the political will of a nation. Where trade unions have a weak base of membership, it may be more difficult to justify extending bargaining coverage and unions will have less political power to demand extension. High rates of collective bargaining coverage should not be confused with high rates of union density and power. It is strong union membership which gives a solid, sustainable foundation from which to build bargaining coverage and political strength.

Industrial arrangements in the ICTS Sector and within its sub-sectors are changing. The economic restructuring of the industry is leading to processes of de-regulation, an increased proportion of software and services firms, and a decrease in average company size, all of which are likely to have a negative effect on the rate of collective bargaining coverage in the sector.

3.1.1 Hardware and Manufacturing

Collective bargaining coverage is highest within the hardware and manufacturing sub-sector of ICTS. Many hardware and manufacturing firms in the ICTS sector are covered under industry-wide agreements for manufacturing. Company-level agreements supplement bargaining coverage at the sector level.

The economies of many European countries are shifting from a manufacturing to a service base. It is reasonable to conclude that the hardware and manufacturing sub-sector will play a decreasing role in Europe and that high rates of collective bargaining coverage within the hardware and manufacturing sub-sector will have less impact in ICTS in coming years.

3.1.2 Software and Services

Collective bargaining coverage is very low in the software and services sub-sector of ICTS. Sector-wide collective agreements are rare and bargaining takes place primarily at the company level. Austria, Finland and France are exceptions to this, as each country has an ICTS or IT services sector agreement, and Norway has agreements in data and processing that provide some bargaining coverage to this sub-sector. In some cases there are agreements at company level.

The software and services industry is dominated by smaller firms which are less likely to have their own collective agreement. The influence of US-based companies in this sector is also relevant since those companies have historically exported an anti-union, anti-collective bargaining approach to labour relations.

A low level of collective bargaining coverage in software and services is of particular concern because it is the fastest-growing sub-sector of the ICTS sector.

3.1.3 Existing Sector or Sub-sector Agreements

Some sub-sector agreements which cover parts of the workers in ICTS exist in certain European countries such as Austria, Finland, France, Italy, Norway, Portugal and Spain. Sector-level agreements that encompass the whole ICTS sector are rare. Only Finland has one. When agreements specific to ICTS do exist, they are most common in telecom but software and services are notably absent. As software and services is the fastest growing unit of the sector, extending collective bargaining there is a priority.


For more detailed information on unemployment rates in the sector and across industries, per country, please refer to the Appendix.

Union density is defined as the percentage of employed wage and salary earners who belong to a union.

Collective bargaining coverage is the percentage of employed wage and salary earners who are covered by a wage bargaining agreement.

Hardware and manufacturing agreements, which tend to cover the entire manufacturing industry, have not been included here.
4 Conclusions

The relationship between collective bargaining coverage and union density is similar within the ICTS sector as with the European cross-industrial case. Collective bargaining coverage rates are much higher than union density rates, but both are declining. De-regulation and the industrial shift from manufacturing to service-based firms both contribute to a decrease in average company size, undercutting union membership rates and bargaining coverage. Rates of net union membership are not only declining, but in many cases are low in absolute terms to begin with.

There are many explanations given for the decline in union density in recent years, in Europe and across the globe. Macro-economic and political shifts have an impact. Increasing interdependence of national economies means that the lowest common denominators in wages, working conditions and labour laws become the norm. The influence of weak labour law and union rights protection in the United States in particular, is a factor, due to the prevalence of U.S. firms in the software and IT services sub-sector.

Unions seeking to build their membership, power and effectiveness in the ICTS sector need to be aware of the changing nature of the industry and what this means for workers. Unions should take into account the demographics of the industry – the fact that there are higher numbers of young workers, less female workers, and the tendency for workers to be highly educated. National variations in terms of law and regulation, industry composition and education standards are also important. All of these factors are important in developing a strategy for union renewal in ICTS, for identifying the issues which will motivate workers and bring more members into unions.

ICT employment has not been immune to the economic crisis, but the industry is poised to withstand the downturn better than some industries. Manufacturing has taken a large hit across industries and the same is true in the ICT sector. But layoffs are occurring in the service areas, too, and some firms have plans to lay off more 10% of their workforce. Company insolvencies have also added pressure to ICT labour markets. Comprehensive up-to-date employment data for the ICT sector is patchy making net employment changes difficult to quantify.

Future employment prospects in the ICT industry will require new skills and training. Cloud computing, virtualization, and software on demand are innovations that illustrate how fast the industry is evolving and the need for human capital investments that will allow workers to adapt to these changes. Skills shortages and outsourcing or offshoring may continue to affect the ICT labour market.

Green jobs’ initiatives could provide substantial opportunities for the ICT sector. Recent estimates suggest the green economy could generate 2.5 million new jobs in the EU by 2020. Green ICT will play an important role in this transition, which could provide opportunities for new and future union members.

Industrial and social partner relations in Europe are at a crucial point. Neither collective bargaining coverage nor union density rates are stable at the high levels that they once were. In 1987, union density reached its lowest level since 1960, and has continued to decline. Since 1995, the decline has accelerated and union density in Europe now stands 10% below its level in 1960. This decline, coupled with industrial change within ICT – specifically de-regulation and the proliferation of smaller firms, as well as a shift to the dominance of software and services over hardware and manufacturing – has driven a marked decrease in collective bargaining coverage.

In the ICTS sector, union membership is less than half the rate across industries in Europe. This illustrates the urgency of building union membership in the sector. This article has argued that union membership is the key to increasing collective bargaining coverage, thus securing the voice of workers in social dialogue at the company and industry level, both within individual countries and across Europe.

The mandate for increased union membership presents a challenge, but it also provides an opportunity. Nearly ten million ICT workers in Europe are working without a union. ICT is poised for continued growth – with a strategic organizing plan built around these workers and industry characteristics, unions will be successful in building their membership in the sector and effectively raise working standards for their members.

Additional Info
Risk Management

The Paradox of Uncertainty: When Less Means More?

Darren Dalcher

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Risk has become a recognised pervasive aspect of life, with the management of risk taking over as a dominant preoccupation in many business contexts. In the rush to address the visible aspects of risk, there appears to be a human tendency to ignore the inherent uncertainty of situations preferring instead to focus on more quantifiable risks. As organisations re-structure themselves around governance and risk aversion, the article asks if risk management has paradoxically increased the level of risk we face in the same way that safety engineers have concluded that adding safety devices can contribute to further accidents. The way forward is offered through the adoption of a new “design” culture coupled with a resilient society that actively engage with risk and ambiguity, including those that emerge through the avoidance of other risks.

Keywords: Ambiguity, Design Culture, Governance, Normal Accidents, Normal Decisions, Resilient Society, Risk, Risk Society, Risk Organisations, Uncertainty.

1 Introduction
The 2008 meltdown in Wall Street and other financial centres serves to highlight the flip side of opportunity and potential. On September 29th of that year, following some modest sell-offs in stock markets in Asia, the Dow Jones Industrial Average plunged by 778 points, a 7% drop over the course of a single day. In just over six hours in excess of $1.2 trillion was wiped off the value of US industry – the first ever post $1 trillion loss in a single day and the blackest day since the 1987 Wall Street Crash. The world market followed the US trend showing a daily global loss that exceeded $5 trillion.

Brokers, traders, bankers and even regulators were caught by a supposedly impossible scenario. According to delivered many keynote addresses and tutorials. He has written over 150 papers and book chapters on project management and software engineering. He is Editor-in-Chief of Software Process Improvement and Practice, an international journal focusing on capability, maturity, growth and improvement. He is the editor of a major new book series, Advances in Project Management, published by Gower Publishing. His research interests are wide and include many aspects of project management. He works with many major industrial and commercial organisations and government bodies in the UK and beyond. Professor Dalcher is a Fellow of the APM and the BCS, and a Member of the Project Management Institute, the Academy of Management, the IEE, and the ACM (For a more detailed bio see <http://www.eis.mdx.ac.uk/ncpm/d_dalcher.html>). <d.dalcher@mdx.ac.uk>
leading economist and mathematician, Benoît B. Mandelbrot, the odds of such a daily collapse using accepted theory are about one in a billion [1]. Yet the collapse did happen; prompting Mandelbrot to point the finger at reckless risk assessment and lax oversight and their reliance on ‘close enough’ approximations of ‘typical’ behaviour.

2 Managing Risk

The management of risk has gradually emerged as a ‘normal’ activity that is now a constituent part of many professions. Indeed, risk management has become a central pillar of effective governance which has been adopted universally by corporations, governments and NGOs. The concept of risk has become so ubiquitous that we continuously search for risk-based explanations of the world around us. Through this pursuit we have developed universal principles of organising and managing through the control of risks.

German Sociologist Ulrich Beck noted in 1992 that risk had become a dominant feature of society replacing wealth production as a means of measuring decisions [2]. The idea of a risk society describes the way that society organises and engages with risk. Indeed some may argue that it reflects our pre-occupation with the future and its inherent uncertainty.

The promise of technology is alluring. In the rush to adopt new technologies and embrace new opportunities we have often shown a reluctance to accept the associated risks. This is often accompanied by the assumption that risks can be controlled through the application of skill.

But what if risk is not our real problem?

3 Risk or Uncertainty?

Risk represents a conventional way of expressing uncertainty about potential outcomes. As uncertainty diminishes, it becomes possible to fully quantify risks. Conversely, as the level of ambiguity, uncertainty and complexity of a system rises, it gets progressively more difficult to fully identify, let alone quantify all potential risks.

Uncertainty can be viewed as a novel situation where knowledge of the past offers little or no value. People are generally uncomfortable with uncertainty; Most of us prefer (known) risks to uncertainty.

For a simple demonstration consider the following situation:

- You have in front of you two urns, labelled urn I and urn II. - Urn I has 100 red and black balls, but you do not know in what proportion. - Urn II contains exactly 50 red balls and 50 black balls.
- I will now offer you three betting situations:
  - Without looking I will extract exactly one ball from each urn.
  - Would you prefer to bet $100 on getting a red ball in BOTH Urns, or on getting a black ball in BOTH Urns?
  - This time you are allowed to take out just one ball (without looking) from either urn. Would you rather bet $50 on finding a red ball in Urn I or finding a red ball in Urn II?
- Once again, you are allowed to take out one ball (without looking) from either urn. Would you prefer to bet $50 on getting a black ball in Urn I or a black ball in Urn II?

The Ellsberg Paradox

The experiment has been conducted with tens of thousands of subjects. It is known as the Ellsberg paradox [3]. The results are almost always the same. Most subjects are indifferent between betting $100 on either red OR black balls in BOTH urns. This is hardly surprising as there appears to be an equal chance of winning in either case.

Most people prefer betting $50 on red in Urn II over betting on red in Urn I. They ALSO prefer betting $50 on black in Urn II over black in Urn I. The typical rationale that is given by subjects is that the precise proportions of red and black balls in Urn II are known and therefore this is a ‘less risky’ bet. The results suggest that people prefer situations of risk (where the proportions of balls of two different colours were determined at fifty-fifty) to those of true uncertainty (where the balls were taken out of a random mixture - thus implying a probability of a fifty-fifty mix). When betting on a particular colour, most respondents chose the determined proportion for each colour suggesting that the probability of either colour is greater than fifty percent (whilst also showing no difference between the colours when asked to bet for one colour in both piles).

This pattern of preference is inconsistent with rational decision making. The implication of what has been termed the Ellsberg Paradox is that decision makers are more comfortable with risk than they are with uncertainty. Interestingly, the amount of money on offer (i.e. the prize on offer) does not alter the choice preference of participants so that the same results are obtained when the gamble offered is for $50 and for $500,000. Nor does the level of knowledge and expertise in decision making appear to change the preferences of subjects, with experts making similar choices to novices.

Other experiments reveal that decision makers will defer major decisions in the face of uncertainty. This applies even when the decisions are not directly linked, showing that uncertainty in one area can impact our performance in other areas. For example, when offered a special holiday package at a greatly reduced price, most students deferred their choice and elected to pay a non-refundable deposit until they found out if they passed their final year exam. Other groups were told their final result and the majority of those who passed and of those who failed elected to take the very same offer (presumably either as a treat or to feel better). I have tried experimenting with similar configurations with professionals who were waiting to hear the outcomes of a major decision regarding project funding or a promotion with identical results. The majority of those awaiting for results elected to defer and pay a deposit, while the majority of those who were given their result, regardless of the outcome, elected to make the same decision.

“We cope with uncertainty irrationally by ignoring it or by worrying” – Detlof Von Winterfeldt.
The paradox and further examples underscore our inability to handle uncertainty. Most of us are uncomfortable in the presence of uncertainty and would prefer some partial knowledge to total ignorance regarding a given situation. As a result, the opportunities that are embedded in uncertain situations may often be sacrificed in an effort to opt for risk as opposed to uncertainty (additional potential benefits may also be lost in a further effort to reduce the level of risk).

The existence of uncertainty and ambiguity is often viewed with discomfort. Uncertainty appears to act as a deterrent and determines where and how we engage with situations. Social scientists Douglas and Wildavsky noted that uncertainty prevents or inhibits risk taking [4]. Indeed, as risk managers and project leaders, most of the time we do not manage risks; we simply try to avoid uncertainties and ambiguities.

4 The Obsession with Risk

In order to tackle uncertainty we expend resources in an effort to reduce the likelihood or the expected impact of some of the risks or to mitigate their consequences. However, complex situations, especially ones with uncertainty and ambiguity, require complex tradeoffs and compromises. Reducing one risk may increase others, or introduce new risks that we are not ready for. Our tendency to avoid uncertainty and control risks is thus translated into the development of mechanisms for the manipulation of risks and the development of safety measures. However safety measures come with a price.

There is also evidence that when some risk is reduced people tend to change their behaviour and behave less responsibly. This is noticeable in terms of where we build houses: As society becomes more adapt at dealing with the outcomes of forest fires or earthquakes, people start building houses deeper into forests and closer to geological faults. Evacuation and rescue in future incidents becomes more and more demanding and increasingly more dangerous for all involved. Moreover the perceived greater safety associated with the area may now encourage chemical plants, nuclear reactors, oil refineries or biological research facilities to relocate to the same areas adding ever more complex interactions, uncertainties and risks. Future incidents and potential disasters thus become more intricate and dangerous. The potential improvement in addressing the risks is thus translated into more reckless behaviour which often undermines the improvements.

Safety specialist Samuel Peltzman demonstrated that safety measures often result in more reckless behaviour as people feel safer. His research suggests that seat belts have made cars more deadly [5]. Edward Tenner in his bestselling book "Why things bite back: predicting the problems of progress" described the ‘revenge effect’ that accompanies the introduction of safety measures [6]. His book is filled with examples of technology encouraging new behaviours. One of his examples is of flood control systems which encourage settlement in flood-prone areas due to the appearance of added protection. Similarly, better warning and evacuation systems can ultimately lead to greater exposure to risk as people feel safer and hence tend to take greater chances.

Safety interventions often manage to re-distribute or transfer the burden of risk rather than reduce it. Direct effort to eliminate or reduce an identified risk can therefore lead to a net increase in the very same risk, or in new risks. The redistribution relates to the feeling of increased safety but also to new mechanisms that need to be integrated into existing systems and procedures and to the need to ensure that they are correctly activated and used as intended. As we have seen over the years with both storms and floods, safety measures can also contribute new modes of failure, sometimes on new and unimaginable scale.

Rather than being more under control, the world seems to be developing into a ‘runaway world’ [7]. New risks and uncertainties, including global warming and financial collapses, affect all individuals whether or not they participate in the events leading to them or in their regulation. Their potential size and impact and the methods for dealing with them are also unknown.

5 Risk Organisations

Humanity has long faced risks associated with natural disasters and survival. In an attempt to improve our natural condition we have endeavoured to create, build and design an improved environment. However a major by-product of the progress made in technology and development has been the generation of the new hazards and dangers. Many of these are large, global and irreversible. They are also not well understood and many are accompanied by new risks.

Our modern society increasingly tries to guarantee secure, controlled environments for its citizens, employees and shareholders. This can be a difficult undertaking given the ambiguity and uncertainty that accompany new conditions.

The tendency to control uncertainty through risk reduction persists. As the scale and scope of the risks increase, attempts to manage risks result in the generation of new structures and procedures concerned with control and governance. One of the responses to the growth in risk has indeed been the emergence of risk regulation, the development of global policies and audit regimes that try to control risks and standardise the responses to risk. This in turn leads to new forms and frameworks of governance.

Over the last ten years risk management has become a core pillar of governance. Governance frameworks enable organisations and parts of society to take action by focusing on accountability and control. They also introduce the structure for organising around risks and uncertainties.

In response to a stream of failures, organisational risk management was devised as a set of practices and regulations that attempt to reduce the uncertainty we face. Reactive measures such as certification and disclosure regimes, exemplified by Sarbanes-Oxley legislation in the USA, offer regulatory control. Every collapse, accident or failure can thus be used as a launch pad for imposing additional layers of control mechanisms, structures and policies. This introduces procedures of accountability and regulatory compliance. In this way uncertainty is gradu-
ally reduced into smaller and better understood risks which can be addressed and mitigated.

Risk has also been elevated to an organisational focus. Many large corporations dominate the global economy, and have a large impact on society at large. Due to the legal and governance frameworks risk management has been rising up the corporate chain and plays a key role in organisational life. Enterprise risk management is growing in many leading corporate organisations. Decisions are often referred to risk committees, Chief-Risk Officers or Risk Management Boards and in some organisations risks may be articulated by the Board of Directors or allocated to specific executives. We have therefore moved from being a risk society which generates new risks through development to becoming a collection of responsive risk organisations closely implementing new governance procedures and structures aimed at reducing variation and providing visibility, control and accountability.

However such structures inevitably give rise to new risks and uncertainties. Governance structures unify and standardise action. Under competitive conditions, and especially in a crisis, they may ensure that all participants will tend to react in the same way thereby exacerbating the crisis. Moreover in common with all safety measures they engender new and unexpected impacts and generate added uncertainty.

One example of a control mechanism devised for mitigating financial risk and alleviating financial panic is the creation in 1913 of the Federal Reserve, the Central Bank of the United States. The Federal Reserve web site states that the “Fed” “provides the nation with a safe, flexible and stable monetary and financial system”. Their success in keeping the lid on the monetary and financial system “provides the nation with a safe, flexible and stable monetary and financial system”. Their success in keeping the lid on the monetary and financial system was in place, and new legislation such as the recently implemented Basel II regulatory framework (meant to provide improved information on exposure to risk and guarantee sufficient capital) would ensure that nothing could go wrong.

The lure of getting something for almost nothing was too tempting the memory of past uncertainties too distant. Indeed in a new development, risk itself was sold as a commodity so that risk exposure was packaged and traded. Bundles of sub-prime mortgages were then chopped up and resold as securities. Risk was thus re-distributed to risk organisations with accountable governance structures and matching legislation - all under the watchful eye of government bodies.

Instead of developing our capability, flexibility and the resilience to deal with unexpected events and fluctuations [8], we often invest in standardised and more universal measures to deal with common aspects as perceived in the light of previous failure episodes thereby providing greater levels of formalised assurance. We thus embody the Precautionary Principle, in trying to act in anticipation of the worst form of harm that is deemed as unacceptable. However in addressing risks we do not wish to tolerate, we often take actions and introduce new measures whose impacts we do not understand. The new uncertainty thus introduced may in some cases prove to be more menacing than the original risks.

The financial crisis of 2008 took everyone by surprise partly because past slumps have been relatively minor events. As we have seen, risk reduction often leads to increasingly reckless behaviour. With no major panic in recent memory, people began to behave as if there couldn’t be one. After all, multiple layers of protection were in place, and new legislation such as the recently implemented Basel II regulatory framework (meant to provide improved information on exposure to risk and guarantee sufficient capital) would ensure that nothing could go wrong.

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6 From Normal Accidents to Normal Decisions

New global threats surround us from all directions. In what would appear to be an increasingly more closely-coupled world, any perturbations in one part will impact on all others. As risk organisations link to others forming extended impact chains, they become more dependent on others and more vulnerable to the new risks. Threats ranging from a tsunami in Indonesia, or a blocking of the flow of oil to Europe, to a border dispute in India, an explosion in Japan or a market meltdown in China can ripple through the global economy affecting supply chains and the flow of money and goods.

The environment within which we operate can be characterised as increasingly more complex and demanding, increasingly global, within high stakes for all participants. Given the many changes, some caused by our responses to risks, knowledge of the environment needs to account for uncertainty, ambiguity and even some ignorance. As we have seen from the financial meltdown example, risk organisations engage in a variety of perplexing problems with social and technical dimensions. Risk organisations play an active part in pursuing their own agendas and shaping both the form and the context of dilemmas and controversies that their actions generate. Their perceptions of risks are shaped by the human content and the social context as well as the technical concerns.

Risk systems entail structures, procedures (including those meant for reducing risks), participants with personal perceptions and risk organisations operating in a dynamic environment. Interfacing with technology in such systems in an effort to reduce uncertainties to risks thus results in messy and complex environments. Adding regulatory risk devices adds to the complexity.

Sociologist and accident researcher Charles Perrow observed that in such environments, characterised by interactive complexity (where two or more failures can interact in unexpected ways) and tight coupling (where parts of the system are intertwined and have major impact on one another) accidents become inevitable, thus introducing his idea of ‘normal accidents’ [9]. Technologies with these characteristics are by their very nature unsafe. The large number of components and the multiplicity of links between them entail many potential ways of interaction. Components can thus affect each other
unexpectedly and are also capable of spreading problems. Adding new safety measures increases the number of potential interactions and therefore also increasing the number of potential ways for something to go wrong. In other words the re-distribution of risk resulting from an intervention, aimed at reducing a known risk, may be uncertain, unpredictable, and uncontrolled.

Progressing our discussion, the implications of ‘normal accidents’ as they relate to the control of risks are that:

- Stakeholders are confronted by unexpected and mysterious interactions among failures (i.e. we can’t always understand how modern failures come about).
- Great events have small beginnings (small changes and interventions may run out of control)
- Organisations and management play a major role in causing, and preventing, accidents and failures (risk organisations, and their risk actions, shape the environment and the organisation itself in turn).
- Fixes as well as safety devices add to the inherent complexity and thereby, to the likelihood of accidents (attempts to reduce risk may have the opposite effect).

We have long known that a system is as strong as its weakest component. Complex systems with multiple components and human participants have multiple vulnerabilities. Targeting specific risks without sufficient knowledge of their connectedness can lead to system failures and accidents. Indeed, many technological disasters and some financial failures can be caused by systemic organisational factors and be exacerbated through action meant to reduce the inherent risks.

Nonetheless, effective management requires crucial decisions to be made. Risk organisations must therefore learn to develop a wider perspective that will enable engagement with the environment and will result in intelligent nor-...
sign, as they are responsible for the generation of insight and sensemaking and ultimately for the aggregate problem formulation. The key to success is in involving multiple stakeholders with different sets of concerns and attempting to reconcile multiple perspectives and rationales in light of emerging insights. Decision making, evaluation and sensemaking are at the hub of such action as we endeavour to make sense of the environment and create workable solutions that satisfy our needs and concerns.

The three cultures, or the three main areas of human knowledge, can therefore be depicted as the scientific disciplines, the humanities, and the disciplines of design. The glue in such a new world-order is derived from the sensemaking process, which pervades all disciplines and offers the requisite and driving tool for intelligent trade-offs between them. This can be depicted as a model linking the three cultures (see Figure 1).

8 Beyond Risk Management

The prism provided by the model facilitates the adoption of a new perspective on uncertainty and its management. Uncertainty has proved to be a defining character of development and growth. As we engage with our environment we must continue to learn and adapt.

Uncertainty itself is complex and multifaceted. Engaging with it reveals some of the contradictions and paradoxes which help to define what can be achieved. This article concludes with some of the contradictions that we need to consider in an age of uncertainty – where risk is never the total solution.

- **Progress leads to new risks**: Through our modern history, innovation and new advances have given rise to new vulnerabilities. As such, many risks are by-products of the advances that created them.

- **Risk management is risky**: Risk organisations that enhance their capacity to govern risk also simultaneously produce new uncertainties. Risk management is often utilised due to our aversion of ambiguity. The solution that it brings may increase ambiguity (thus potentially leading to new responses and new regulations which will themselves lead to new uncertainty).

- **Buying safety is not always safe**: Adding safety devices may actually decrease safety as the new devices interact with the old systems and structures in new and uncertain ways. Buying protection may also have a similar outcome.

While many of our advances over the years have aimed to improve our condition and make us safer, they have also left us more vulnerable. A focus on the elimination and reduction of risk is insufficient. We cannot address what we do not know.

We have only to consider the following example to see the folly of this approach. Recently, Britain’s 400 Coastguard rescue units have been instructed to complete a multiquestion, prejourney risk assessment before they respond to emergency callouts. Coastguard personnel must characterise and quantify the they expect to face, submit an account of the actions they make take to mitigate the risks, and determine whether the overall risk is acceptable — all before leaving the station. Given the fact that the Coastguard units often operate in uncertain conditions, saving lives may thus need to be deferred until speculation about the potential on-scene conditions is completed and translated into a risk score based on the crew’s best guess about a situation they are yet to arrive at!

9 Learning to live with Ambiguity

Courting progress entails a long adaptation process which can benefit from an open stance receptive to the recognition of ambiguities and mismatches. As we realise through our new lens that total anticipation and eradication of risk is not attainable, we can start learning to balance the need to control risks with the need to respond, co-evolve and prosper in an uncertain environment. Creating a resilient society will endow us with the flexibility and the innate capability to adapt and respond whilst maintaining the resources to cope with the unanticipated dangers after they have become manifest. It will also open up the possibility to benefit from new opportunities that were not decimated through our pursuit of controlling risks.

"Love of certainty is a demand for guarantees in advance of action" – John Dewey

In our pursuit of greater certainty we encounter an emerging paradox of the 21st century, showing that the obsession with risk and our organisational and societal attempts to enhance our capability to govern risk can actually produce new uncertainties. In the same way that safety engineers have learned that increasing safety actually contributes to failures and accidents, the risk organisation, which is a new element
in our ‘risk society’, is beginning to recognise that the new uncertainties we encounter are sometimes greater than the risks we thought we left behind.

Our paradox of uncertainty shows that less risk can actually mean more. Risk will remain a consequence of technological innovation. In a society obsessed with the elimination of uncertainty, organisations and their actions directly manufacture and incubate new risks. Consequently, if risk alone is the new measure of wealth, the pursuit of risk reduction may still leave us impoverished and starving.

References
Selected CEPIS News

Fiona Fanning

5,000,000 People to Have the Opportunity to Be Skilled through ECDL Foundation’s Support of the Digital Agenda

ECDL Foundation has launched a campaign to raise the profile of the EU Commission’s Digital Agenda for Europe and commits its support to high-level aims.

In an open letter to the President of the European Commission, ECDL Foundation has specified its commitment to a number of high-level targets to advance the implementation of the Digital Agenda for Europe. The Digital Agenda is a timely and necessary initiative designed to promote economic recovery, and to improve social circumstances through the creation of a more competitive, inclusive, and digitally streamlined Europe.

As the Digital Agenda rightly identifies, improved digital literacy and ICT skills’ development will have a critical role to play in the drive to: invigorate the European economy, nurture an innovative workforce, and to minimise the digital divide, and they will be integral to the success of the policy of smart, sustainable and inclusive growth.

As the leading international digital skills certification authority, ECDL Foundation and its pan-European network of national operators have affirmed their commitment to the goals of the Digital Agenda, and have pledged to support its implementation. Specifically, they have committed to:

- Engage with 5,000,000 citizens to ensure they have the opportunity to acquire digital skills and competence.
- Decrease by 3% the current number of 150 million people who do not have the skills to use the Internet, and promote the use of e-government services and the benefits of e-commerce to these future e-citizens.
- Promote digital skills development programmes at all levels of education throughout Europe to enhance and modernise education systems while providing today’s youth with the skills necessary for mobility in tomorrow’s labour market.
- Take special measures to ensure that marginalised groups such as the unemployed, older people, people with disabilities, and those in remote locations are empowered to participate in the Information Society.
- Work with Member States in the development of long-term digital literacy policies, using certification as a measurable outcome in the return on investment in digital skills programmes, and ensuring that ICT skills are incorporated in national education policies.

ECDL Foundation has launched a comprehensive campaign designed to raise the profile of the Digital Agenda, and pledges its considerable expertise and that of its extensive network of pan-European operators in ensuring the successful implementation of the above goals which support the Digital Agenda.

For more information please visit: <http://www.ecdl.org>

e-Skills Week Reached 65 million Europeans: Key Facts and Figures Published

The European Commission recently published key facts and figures from the successful European e-Skills Week held earlier this year. The report indicated that 65 million people in 35 countries in Europe and beyond were reached via awareness raising activities. The 284 stakeholders that participated in the project, (including educational institutions, public bodies, NGOs, national trade associations and industry) succeeded in organising more than 1,000 events attended by nearly 450,000 people.

The European e-Skills Week 2010 was the first European, multi-stakeholder awareness raising campaign aiming to inform students, young professionals and SMEs about the vast range of ICT-related job opportunities. Following its success earlier this year, a report has been published that presents the e-Skills Week events and activities in a nutshell.

For key facts and figures on the European e-Skills Week 2010 please visit: <http://eskills-week.ec.europa.eu/web/guest/news/-/journal_content/56_INSTANCE_m7wX/10404/31047/NEWS_MAIN_DISPLAY>.

CEPIS UPGRADE Survey – tell us what you think!

As an CEPIS UPGRADE reader, CEPIS would like to get your views on this journal, provide you with an opportunity to tell us what you think of it, and get your suggestions for improvement. Much effort has been put in developing UPGRADE for the last ten years and we would like to hear from you on what you think the next 10 years could bring for this journal.

Your contribution is extremely valuable since it will help improve CEPIS UPGRADE and will impact the future shape of the magazine.

CEPIS would appreciate if you could spend 5 minutes of your time on filling in the survey which can be found at: <http://www.surveymonkey.com/s/TKW3FZ6>.

First Official EQANIE Conference, Vienna, Austria 17th – 18th February 2011

The first EQANIE Conference:
Learning Outcomes and Quality Management in Informatics Education – Training and Exchange of Good Practice will take place at the University of Vienna, Austria on 17th-18th February 2011. The conference is aimed at teachers and students in Higher Education Institutions (HEIs), and any other stakeholders from professional societies and industry, interested in improving the quality of education with a focus on informatics. Issues such as defining learning outcomes and objectives will be thoroughly discussed in workshops throughout this two-day conference.


Find CEPIS on LinkedIn, Twitter and Facebook

The latest CEPIS news and updates can now be found on the new CEPIS LinkedIn Group, via our Twitter account and on our Facebook company page. These will serve as new channels to promote CEPIS activities to members and to the wider public.

Please ensure that you and your society are connected to CEPIS on:

- LinkedIn <http://www.linkedin.com/groups?mostPopular=&gid=1884812>.
- Twitter <http://twitter.com/CEPIS_Europe>.
European Scale Quality Assurance Networks

Generic

**ENQA**
European Network for Quality Assurance

Disciplinary

- **EQUIS/EQUAL/EFMD**
  European Quality Improvement System
- **WFME**
  World Federation for Medical Education
- **EQANIE**
  European Quality Assurance Network for Informatics Education
- **ECTN**
  European Chemistry Thematic Network Association
- **ENAEE**
  European Network for the Accreditation of Engineering Education

- **QA for HE in management and business administration**
- **Regional Offices in all parts of the world**
- **Provides European quality label in Informatics**
- **Provides Eurobachelor-label**
  More than 150 HEIs + chemical societies
- **Provides EUR-ACE label**
  All European Engineering Accreditation Agencies + FEANI, SEFI, etc.

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**EQANIE Goals:**

- Development of criteria and procedures for the evaluation and quality assurance in informatics study programmes and education.
- Development and maintenance of a system for the award of a European quality-seal for informatics degree programmes as well as its protection and continued further development.
- Provision of information.
- Maintenance of contacts and relations to other European or non-European organisations important for the goals of the association.
- Promotion of the development of national and regional accreditation bodies.
- Organisation of events, seminars, workshops and conferences in the field of its activities.

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**Founding Members:**

- **AIKNC** – Latvian Higher Education Quality Evaluation Center
- **ASIIN e.V.** – Accreditation Agency for Degree Programmes in Engineering, Informatics, Natural Sciences and Mathematics
- **BCS** – British Computer Society
- **CEPIS** – Council of European Professional Informatics Societies
- **EAEIE** – European Association for Education in Electrical and Information Engineering
- **GI** – Gesellschaft für Informatik e.V.
- **GRIN** – Gruppo di Informatica
- **GAFIUS** – German Association of Faculties of Informatics at Universities of Applied Sciences
- **INFORMATICS EUROPE** - Research and Education Organisation of Computer Science and IT Departments in Europe
- **SPECIF** – Societe des Enseignants Chercheur en Informatique de France.

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**Membership:**
Open to all institutions within the European Higher Education Area engaged in the development of quality assurance in informatics programmes

Current membership fee: 1.500 € per year

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**Contact:**
EQANIE e.V. (www.eqanie.eu)
c/o ASIIN e.V., Robert-Stolz-Str. 5, D-40470 Düsseldorf, Germany
ECDL Foundation

Enabling proficient use of ICT to empower individuals, organisations, and society.

www.ecdl.org