e-SKILLS AND ICT PROFESSIONALISM

Fostering the ICT Profession in Europe

Final Report

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Research Team

Stephen McLaughlin
Martin Sherry
Marian Carcary
Conor O'Brien

Fiona Fanning
Dimitris Theodorakis
Dudley Dolan
Neil Farren

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European Commission

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The views expressed in this report are those of the authors and do not necessarily reflect those of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the information provided in this document.

The study team

This study was conducted by:

Innovation Value Institute (IVI)
National University of Ireland
Maynooth
Ireland.

Tel.: +353 1 708 6931
Fax: +353 1 708 6916
Email: IVI@nuim.ie
http://ivi.nuim.ie/
Stephen McLaughlin, Martin Sherry, Marian Carcary, Conor O'Brien.

And

Council of European Professional Informatics Societies (CEPIS)
Avenue Roger Vandendriessche, 18
B-1150 Brussels
Belgium.

Tel: +32 2 772 1836
Fax: +32 2 646 3032
Email: info@cepis.org
www.cepis.org
Fiona Fanning, Dimitris Theodorakis, Dudley Dolan, Neil Farren.

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1 Executive Summary

1.1 Context

This research project, launched by the European Commission Directorate General for Enterprise and Industry as part of the European Commission's on-going e-skills agenda is aimed at helping to mature the ICT profession within Europe. This objective of maturing the ICT profession is not unique to Europe: indeed, the project reflects parallel efforts to mature the ICT profession in other parts of the world, such as TechAmerica in United States and ITA in Japan.

This current project is aimed at supporting the development of a European framework for ICT professionalism, with the goal of enhancing professionalism and mobility across Europe. The project also incorporates proposals to support the development of a European training programme for ICT managers.

There are strong motives for maturing the ICT profession:-

- **ICT Skills Gaps** - Skills gaps of up to 13% are forecast over the period 2010-2015[1], potentially acting as a brake on European competitiveness and recovery given ICT's role as an enabler of business value
- **Poor image of ICT profession** – A poor public perception of the ICT profession is impacting on the numbers entering the profession
- **ICT Knowledge Deficiencies** - Low levels of ICT knowledge amongst ICT practitioners, and/or knowledge silos, preventing a view of the "big picture" of ICT, its interconnectedness, and its role in enabling organisational capability planning. In this respect, a 2011 CEPIS survey suggested that "79% of respondents may not have the breadth of e-competences required by their role"[2]
- **Traditional focus and reliance on Computing Science degrees** – Tertiary education providers need to adapt in order to meet the growing industry demand for ICT professionals; moreover, industry demands people from alternative professions/disciplines
- **ICT Project Failures** – Recent research from Saïd Business School[3] identified cost overruns in 8 out of 10 ICT projects, and a disproportionate

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[1] Empirica (2009). Monitoring e-skills demand and supply in Europe. Available at: http://www.eskills-monitor.eu/documents/Meskills%20Scenario%20and%20Foresight%20report_final.pdf

[2] CEPIS (2011). CEPIS Survey of professional e-competence in Europe. Available at http://img8.custompublish.com/getfile.php/1727380.1488.wvrvfxpfcy/CEPIS+Professional+e-Competence+European+Report.pdf?return=www.dataforeningen.no

http://www.cepis.org/media/CEPIS_Prof_eComp_PanEU_Report_020920111.pdf

[3] Flyvbjerg, B and Budzier, A (2011). Why Your IT Project may be riskier than you think. Harvard Business Review Magazine (September 2011). Available at: http://hbr.org/2011/09/why-your-it-project-may-be-riskier-than-you-think/

number of so-called “ICT black swans”, with one in six projects experiencing a cost overrun of 200%.

The most important reason for change however, stems from the extent to which ICT has the potential to harm society. Professions have traditionally emerged when failure to apply domain-specific knowledge successfully would have had an adverse impact on society. As we now enter the next wave of computing, known as pervasive computing, the extent to which ICT is embedded in society will inevitably grow. If we fail to take steps to mature the profession now, it is likely that the risks to society from ICT will grow to unacceptable levels – as such, the call for action is clear.

The project work was undertaken in two phases: phase I comprised desktop research and analysis, combined with a survey of over 300 ICT experts and practitioners, in order to create the synthesis report on the state of play of ICT Professionalism. In contrast, the second phase focused on the preparation of detailed proposals for a European framework for ICT professionalism, based on the desktop research and analysis, and iterating these proposals with relevant stakeholder groups, the results of which are contained in this document.

1.2 Defining the ICT professional

Across Europe, there currently is no common understanding of the term “ICT Professional”: in some countries, the term is accepted to mean someone who has acquired relevant qualifications and competences; in other countries, individuals can practice as an ICT professional with scant knowledge and experience in the area. For this reason, as part of our research, we developed the following definition for ICT professionals, as stated below:

ICT Professionals:

- possess a comprehensive and up-to-date understanding of a relevant body of knowledge[4],
- demonstrate on-going commitment to professional development[5], via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education;
- adhere to an agreed code of ethics/conduct[6] and/or applicable regulatory practices and,
- through competent practice[7] deliver value for stakeholders.

[4] The term “relevant body of knowledge encompasses the requirement for a broad and deep knowledge base which is up-to-date, accommodating both a common ICT body of knowledge, and pertinent specialist knowledge and skills.

[5] Professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. keeping abreast of latest technological trends) as well as non-technical aspects (e.g. developing better presentation skills).

[6] Professionals are accountable to themselves, the ICT Profession and society, through an agreed code of ethics/conduct or applicable regulatory practices.

This definition, which was reviewed and widely accepted by the CEPIS Task Force on ICT Professionalism, and CEPIS Council members[8], reflects the importance of the key building blocks found in other professions : Bodies of Knowledge; Education and Training; Competences and Ethics. These same building blocks constitute the foundations of the proposed framework.

1.3 Framework Proposals

Reflecting the fundamental elements of the above definition for ICT professionals, the key components of the framework are as follows:

European e-Competence Framework (e-CF) – Currently comprising 36 ICT competences and five proficiency levels, the e-CF is a simple framework aimed at providing transparency of ICT competences across organisations and countries. The e-CF allows ICT practitioners to assess their competences and proficiency in an objective and uniform fashion. ICT job roles can be defined in terms of competences and proficiency levels that practitioners understand across Europe and on a consistent basis. Certifications and qualifications can be promoted in terms of the ICT competence improvements that they in turn will deliver. As such, this represents a significant step forward in terms of promoting a common language and shared understanding of ICT competences across Europe.

The engagement of multiple stakeholders in the planned third iteration of the e-CF will enhance the robustness and scope of the framework to support fully the required use-cases, reinforcing its potential role as a Rosetta stone of ICT competences and facilitating the mobility of workers across Europe.

The e-CF is, in essence, only a framework. However, it is a cornerstone around which an eco-system of organisations will develop in order to provide toolsets and services to facilitate its use among user stakeholders (ie the practitioners, employers, education providers and government users). Coordinated and cooperative action will be required within this ecosystem in order to achieve this goal of supporting users in their transition to the e-CF.

Additionally, e-Competences also form the basis for the ICT Professional Profiles project that defines a selection of ICT profiles with their respective e-competences and proficiency levels. In turn, this can be extended to define ICT career streams, providing practitioners with greater clarity over potential careers in ICT and the competences required to achieve this progression.

Foundational ICT Body of Knowledge meta-model – Other professions, such as medicine, engineering and law, require all members to possess a shared understanding and language of their respective domain. This well-established approach allows practitioners to understand the multiple interactions between areas of the domain (i.e. “to see the big

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[7] Competent practice communicates the concept of quality of products and services being delivered by practitioners.

[8] CEPIS Council is the governing body of the **Council of European Professional Informatics Societies (CEPIS)**. Meetings are held twice a year and are attended by representatives from CEPIS Member Societies.

picture"), and appreciate the limitations of their own expertise ("to know what you don't know"). By establishing a common language and level of understanding for all ICT professionals, we would aim to improve communication between professionals, as well as reducing risks within ICT projects.

We therefore recommend the definition and adoption of a foundational ICT body of knowledge that would encompass a broad range of topics (potentially including non-ICT topics); however, recognising the highly dynamic nature of ICT, we would propose a meta-modelling approach to facilitate its maintenance over time (that is to say, we would identify the areas and nature of expertise required, possibly in the form of a syllabus, as opposed to defining the actual detailed content therein). In terms of its adoption by practitioners, we would again propose a self-assessment mechanism; and clearly, employers and HR managers would have an important role to play in promoting the importance of this component.

Multiple educational paths – Industry demands professionals with the "the right skills in the right place at the right time". However, tertiary education providers cannot realistically meet the expected demand for ICT professionals due to the inelasticity of supply. At the same time, many people wanting to progress as professionals have acquired deep expertise in the course of their ICT career, but few formal qualifications. For this reason, we must recognise and support the co-existence of different educational paths (including formal qualifications from a higher education institute, certifications from industry providers, non-formal education facilitated by employers, and informal learning). This is particularly important for the ICT profession, given the rate of change and innovation within ICT, and the need to embrace the skills and knowledge of people coming from outside the traditional computing science graduate career streams.

Ethics – while physicians in most countries are no longer required to take the Hippocratic Oath, there is still a need for physicians as with other professionals to behave ethically. In practice, a single code of ethics for all ICT practitioners across Europe is unrealistic, given the diverse languages, cultures, histories, and values possessed by each country. For this reason, we propose the alignment of national codes of ethics/conduct against a common and core set of ethical issues, as outlined in a meta-framework (e.g. a series of relevant criteria/guidelines). Such an alignment would encourage a shared sense of acceptable behaviour within the profession across Europe, and potentially more importantly, it would help to establish precedents for what could be considered unacceptable behaviour for ICT professionals. Reflecting the split of opinion on the topic of adherence, this report makes no concrete suggestions as to how to enforce such adherence to a code of ethics/conduct. If public opinion on the matter shifted considerably, it is possible that Informatics Societies and/or similar communities of professionals could adopt a role in the areas of monitoring and managing enforcement among professionals, but at present, there does not appear to be a clear demand or appetite for such a function.

1.3.1 Value Driven Framework

Some of the key facets shaping the design of the model are as follows:

Self-assessment: from the perspective of aspiring professionals, the framework is entirely based on self-assessment rather than through the introduction of new regulations; practitioners will be offered the opportunity to self-assess their competences against the European e-CF and their baseline knowledge against the Foundational ICT Body of Knowledge meta-model. There is, currently, no identified requirement for external validation (e.g. peer review of experience and competence); over time, however, some

industries may call for this (e.g. information security) but we see that this would be driven entirely by industry, if at all, as opposed to via legislative channels.

Parity: acknowledging the multiple entry paths into the ICT profession and the importance of life-long learning, equal recognition and importance is given to formal qualifications and certifications as well as non-formal and informal learning. The ICT profession will not serve itself in the long-term if entry is solely restricted to Computing graduates – the profession must recognise the merits that professionals from other backgrounds can bring.

Compatibility: the framework is aligned with and builds on existing national mechanisms. For example, the e-CF does not replace national competence frameworks, but provides a mechanism for translation between countries. Compatibility is an important criterion: Member States have different levels of maturity and different approaches to key aspects of ICT professionalism. Our proposals therefore are based on points of commonality, and seek to provide the desired benefits while respecting the need for national solutions.

Straightforward – A more complex framework might offer more sophisticated functions and value to specific industry segments, but by adopting a straightforward framework, capable of being understood and adopted by individuals, SMEs, corporates and governments, we feel that the framework stands a greater chance of being widely adopted, and therefore delivering on the anticipated benefits.

Sustainability: the proposals are aimed at establishing a profession which is essentially self-sustaining and driven by market demand, rather than developed and maintained through large-scale central investment. Implicit in constructing a sustainable model is the identification of clear value-streams for each stakeholder in order to foster its adoption, as shown at summary-level in the table below.

Stakeholder	Value/revenue stream
Practitioners	• International recognition of ICT competences and knowledge, enhancing mobility and credibility • Improved clarity over ICT career paths and competence requirements
Employer	• Reduced cost, effort, and time to recruit, deploy, train and develop suitable ICT resources, as well as improved capability to align ICT resources with business requirements • Competent professional IT workforce, reflecting industry demand
Education Provider	• Increased market size opportunities resulting from improved transparency and comparability of educational offerings • Improved demand for education to support life-long learning requirements
Local/National/European Government Entities	• Enhanced visibility of supply and demand of ICT skills, helping to provide a robust and granular basis for informed policy setting at local, national and European level • Enhanced competitiveness on a global stage resulting from improved efficiencies within industry
Professional Associations	• Opportunity to mature the ICT profession and boost membership

	• Stronger role in communicating/shaping emerging industry practice
Trade Unions	• Promote interests of ICT workers at organisational, national and international level (e.g. employment prospects, security) • Potential for increased union strength and coherence
Society	• Reduction in risks emanating from an increasingly ICT-enabled society • Improved employment prospects

Table 1 **Summary of stakeholder responsibilities**

1.3.2 Action Points

As part of the project, we identified a series of action points to support the maturing of the profession in the short to medium term.

Action	Description
1	Establish a scalable and sustainable operating model for promoting ICT professionalism in Europe
2	Form/Mobilise ICT Professionalism stakeholder entities at national and European level
3	Establish and promote adoption of a European meta model for a common foundational ICT body of knowledge (BoK), (for use by educational providers)
4	Drive broad adoption of the European e-Competence Framework (e-CF) within education providers, ICT practitioners and employers
5	Develop pan-European ICT professional career streams
6	Investigate synergies between practitioner ICT competency frameworks and organizational ICT capability frameworks
7	Promote confidence in educational mapping to the e-CF through auditing
8	Provide paths for validation of non-formal ICT education and training as well as informal ICT learning
9	Drive adoption among organisations and ICT professionals of national codes of ethics & conduct aligned with a European meta framework of ethical issues
10	Enhance links between ICT professionalism stakeholders within Europe and globally (eg via annual ICT Professionalism workshop)

Table 2 Selected Action Points

1.4 Conclusion

In the course of this project, we have engaged with many experts and practitioners (>300) in order to understand the current state of ICT professionalism in Europe (see interim report: http://ictprof.eu/index.shtml) as well as comprehend what aspects of professionalism are important to different stakeholders. This insight and knowledge has helped to shape the proposals contained in this document and we have continued this dialogue with different stakeholders throughout Phase II in order to continually test and refine our proposals.

The proposals developed are for the consideration not only of the European Commission but also for EU Member States, education providers, industry participants, as well as other

relevant stakeholders. This is an important distinction as the European Commission is only one player in a large-scale change process demanding the engagement of multiple stakeholders. The European Commission can play a vital role in facilitating engagement and collaboration between interested parties, as well as facilitating the development of artefacts which cannot realistically be produced by any single Member State or organisation. However, engagement by national governments, as well as industry and education providers is also essential to support the sustainability of the proposed framework. Moreover, actions must be coordinated and aligned in order to successfully exploit the best practices, and lessons learned.

We believe that this document reflects a rational, pragmatic response to a real-world problem. In reality, however, the true test of our proposals is the extent to which different stakeholders across Europe accept them and adopt the shared goals and approach as their own.

Establishing a profession takes many years. Moreover, as we propose introducing changes to established ways of working, there will invariably be individuals and organisations opposed to aspects of the proposals. We both recognise this as inevitable and in many ways, desirable – stimulating dialogue and engagement was one of the original objectives of this project, and on-going communication, cooperation and collaboration with relevant stakeholders are determinant in achieving the desired goals in the long term.

2 Introduction

2.1 Project Objectives

The objective of this project, launched by the European Commission Directorate General for Enterprise and Industry, is to support the development of:

- A **European Framework for ICT Professionalism** with the goal of enhancing ICT professionalism and mobility across Europe.
- **A European Training Programme for ICT managers** to promote new competences with a view to better address the challenges of ICT driven innovation and the future Internet.

The study, focusing on ICT practitioners and ICT managers (CIOs and their equivalent in smaller enterprises) working in the European economy, serves as a contribution to the implementation of the Digital Agenda for Europe (European Commission, 2010), which was adopted on 19 May by the European Commission.

The study, focusing on ICT practitioners and ICT managers (CIOs and their equivalent in smaller enterprises) working in the European economy, is launched as a follow-up to the Communication on e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs (European Commission, 2007) which was adopted by the Commission on 7 September 2007. It also serves as a contribution to the implementation of the Digital Agenda for Europe (European Commission, 2010), which was adopted on 19 May by the Commission ("Key Action 11: By 2012, develop tools to identify and recognise the competences of ICT practitioners and users, linked to the European Qualifications Framework[9] and to EUROPASS[10] and develop a European Framework for ICT Professionalism to increase the competences and the mobility of ICT practitioners across Europe".

2.2 The Imperative for Change

The need for the ICT profession to mature does not solely stem from a desire to fill anticipated skills gaps or to reduce the number of ICT projects which are late or over-budget – instead, the motives for change are more profound.

Currently, ICT underpins almost every aspect of society in Europe – including finance, health, transport, media, manufacturing, and government; indeed, there are few sectors that remain resistant to its influence. The reach of ICT is vast, mainly due to its role as an enabler - an enabler of efficiency, of communication, of innovation, and of value. However, as the application and adoption of ICT in society grows, so too, do the potential risks to society.

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9 Cf. Recommendation of the European Council and the Parliament on the European Qualifications Framework for lifelong learning.

10 Cf. Decision No 2241/2004/EC of the European Parliament and of the Council of 15 December 2004 on a single Community framework for the transparency of qualifications and competences (Europass).

Professions emerge when practitioners are required to apply specialist knowledge in a chosen field, and where failing to apply this knowledge successfully harms society (for example, imagine the consequences of a layperson operating as a doctor or an architect). ICT is now so embedded in our society that the consequences of its failure now represent real threats to the effective functioning of society. Moreover, as we now embark on the next wave of computing - the appropriately titled *pervasive computing* [11]– the potential risks to society will inevitably grow. If we are to effectively manage the risks posed by ICT to society without impeding progress, the call to mature the ICT profession is clear.

Moreover, the benefits of a mature ICT profession do not solely apply to society at large: practitioners would benefit from a profession by understanding potential paths to progress and to develop personally, as well as gaining recognition for their contribution to the profession and society as a whole; enterprises want competent professionals – it would give them confidence in the quality of the person, and in the quality of their outputs. It would also mean they could plan – to recruit, to deploy, to develop. At a macro-level, the mobility of workers would also contribute to Europe's ability to compete on a global scale.

This project attempts to outline a possible framework to help support ICT professionalism. It should be noted that this is not an academic exercise in defining ICT Professionalism. This is a pragmatic response to a real-world problem. In doing so, we are seeking to understand the needs of different stakeholders and what is important to them, and using this as the basis to identify the key components of a framework and how this might operate in practice.

2.3 Target Audience

Acceptance and adoption of an ICT professionalism framework across Europe will take many years. However, given the increasingly pervasive nature of ICT, it is important to society as a whole that steps are now taken to prevent future generations suffering as a result of inadequate levels of ICT professionalism.

The framework proposed in this paper is targeted at ICT practitioners and ICT managers in all countries in Europe. Recognising the different norms, practices and levels of maturity across the countries of Europe, we have created a solution that encourages practitioners to become part of an emerging profession, and that will encourage cross-border mobility, as well as supporting practitioners in their efforts to improve their competences. We recognise both cultural and legal diversity of European countries in this domain. Our target is to create a solution that will strengthen the profession for all.

2.4 Limitations and Expectations

We should be careful to recognise the limitations of the framework. It is targeted at the bulk of ICT practitioners who want to become ICT professionals. It is not targeted at the exceptions – Steve Jobs and Bill Gates had no formal ICT qualifications (both university

[11] Pervasive computing (also known as ubiquitous computing) refers to the trend whereby computing technology is becoming embedded in virtually every device and moreover, is interconnected with all other devices.

dropouts), they hold no formal certifications, show no evidence of non-formal learning. Nonetheless, no one would question their competence or professionalism in ICT. However, in practice, we cannot afford to sacrifice the good on the altar of the great. This paper therefore sets out a proposal to address the problem of maturing the ICT profession as a whole.

We should also be realistic in setting expectations. Professions take many years to become established. This project represents a bold initiative to act as a catalyst in maturing the ICT profession across Europe but it should be viewed solely as one of a series of steps, rather than an end in itself.

It is therefore hoped that the proposals contained in this document will form the basis for further work and discussion among key stakeholders within Europe and potentially further afield, in order to help shape this emerging profession.

2.5 Steps Achieved

2.5.1 Phase 1

This project's interim report, which constituted phase 1 of this project, provided a view of the "state of play" regarding ICT Professionalism and Training Programmes for ICT Managers. A brief description of the key steps in Phase 1 is shown in the below table.

Phase 1 Project activity	Description
Data Capture	Undertake desktop research, examining relevant academic studies and initiatives
Analysis	Analysis of desktop research to identify key characteristics, barriers, lessons learned and best practices, supporting identification of issues for analysis in interview activities.
Interviews	Gauge opinion of ICT experts representing a wide range of relevant stakeholder communities.
Synthesis	Synthesise all relevant materials and insight to create an interim report.
Inform	Disseminate interim report findings (via dedicated project website).

Table 3 Phase 1 Steps

2.5.1.1 *Overview of Phase 1 Project Activities:*

2.5.1.1.1 Data Capture and Analysis activities:

In terms of ICT professionalism, to date, numerous academic and professional collaborations have considered the fundamental requirements for ICT to emerge as a profession. Our review of this research has identified four key topics that are consistently addressed in these research initiatives, and which we consider as fundamental building blocks or pillars for an ICT profession. These topics are: Bodies of Knowledge, Competences, Education & Training, and Professional Ethics.

The desktop research for these four areas and the analysis thereof provided an in-depth understanding of initiatives to date and identification of key issues, relevant barriers and success factors for existing initiatives.

2.5.1.2 *Interviews*

The background research described above provided the basis for developing a questionnaire to elicit insights from ICT practitioners on these four building blocks, on the importance of developing an ICT profession and on the requirements for a training programme for ICT managers. The intent was to ensure that representative views and concerns were captured and used to shape an effective research questionnaire. This questionnaire was developed, tested and refined. The project proposed to acquire insights from 100 experts; in total 380 experts responded. From the list of respondents, a number of follow up interviews were carried out to probe greater depth of insight in key areas of interest. These follow-up discussions also served as the basis for confirming the data collected via the questionnaire. The interim report incorporates the input of interviewed experts on each of our four building blocks and on ICT training.

2.5.1.3 *Synthesis*

Our combined analysis of the desktop research and data collected via survey/interviews resulted in the identification of recommendations pertaining to each area, which formed the basis for further investigation in phase 2.

2.5.2 Phase 2

Phase 2 of this project commenced in July 2011. Based on our initial research findings from Phase I, we developed, during numerous workshops, an initial proposed framework for ICT Professionalism (see Section 8 and Section 10). During the second phase, the focus of the project shifted fundamentally to one of engagement so that the proposed framework could recognise and support the objectives and needs of multiple stakeholder communities. The related work, which was undertaken to develop proposals for the "European Training Programme for ICT Managers", also helped to further validate the proposed professionalism framework.

Phase 2 Project activity	Description
Formulation	Design tentative framework based on feedback from Phase I for discussion with experts
Engagement	Engage with various experts representing different stakeholder groups in order to obtain feedback on the structure and operation of the framework proposals (Note Engagement was not a discrete step but continued throughout the project, reflecting the importance of acquiring and maintaining stakeholder support)
Synthesis	Synthesise all relevant materials and insight to create a final report.
Dissemination	Develop relevant materials to support dissemination (via project event, video, brochure, final report)
Wrap-up	Close project (Create archive; review lessons learned)

Table 4 Phase 2 Steps

2.6 Document Structure

Reflecting the overall structure of the project, this report is split into two main sections:

Phase I: covering Desktop Research, Interview Methodology, Interview Results

Phase II: covering the Framework proposals and Recommendations

The content for Phase I has been extracted from the published interim report of the project, including the complete set of Country Profiles, included here as an appendix.

3 Scope and Methodology

3.1 Approach

Developing a European framework for ICT professionalism and a European training program for ICT managers involves understanding the key issues that impact on establishing and maturing an ICT profession. An important starting point involves considering what it means to be a professional. An obvious expectation is that a professional will meet high performance levels and make valued contributions to his/her organisation and the profession. This is exemplified in the Chartered Institute of Personnel and Development's (CIPD) discussion of the need for professionals to add value to the organisation in which they are employed. They state that professionals can meet this "value added" expectation by for example offering high levels of expertise in their professional field, working towards the organisation's vision and strategic goals, critiquing the work methods of their colleagues, adopting good practices from outside the organisation, and articulating and developing the values of the organisation, among other ways.

In order to achieve the objectives as set out in section 2.1 the research followed a Design Science Approach. The first phase of the project focused on understanding the European landscape in terms of ICT Professionalism and CIO Education. The second phase of the project (post June 2011) endeavoured to identify and create the necessary artefacts / frameworks / methods through open innovative research collaboration with the key ICT professionals throughout the EU.

In terms of ICT professionalism, to date, numerous academic and professional collaborations have considered the fundamental requirements for ICT to emerge as a profession. Relevant initiatives across Europe and further afield have focused attention on a number of key areas. Our review of this research has identified four key topics that are consistently addressed in research initiatives, and which we consider as fundamental building blocks or pillars for an ICT profession. These include:

- **Bodies of knowledge (BOKs)** - One method of establishing a profession is to define a common body of knowledge and language. Today, there are numerous ICT related BOKs; our efforts in this area have focused on exploring the scope of relevant BOKs so as to encompass an appropriate breadth for an ICT profession and to understand the relevant characteristics of these BoKs. 11 BOKs, which form a considerable repository for the professional knowledge as used by ICT professionals, were examined and evaluated in terms of content, origins, coverage, usage, currency etc. While we are not proposing that professionals be required to possess a detailed understanding of all of these BoKs, we have identified the need for a common level of understanding of the topic, upon which specialist knowledge can be built.
- **Competencies** - An understanding of the capability and competency needs of individuals working in ICT roles is essential for organisations to effectively recruit and develop suitable employees. Understanding the core areas of expertise required by various ICT roles and maintaining appropriate levels of competencies through commitment to continuous professional development is necessary to building an ICT profession. We identify initiatives pertaining to competencies and consider how organisational/national/European competence frameworks could be incorporated within a European framework for ICT professionalism.
- **Education, Training and Certification** – Formal education, training and certifications as well as non-formal and informal education are now regarded as mutually supportive components of an ICT professional's career development. Given

the numerous industry and vendor neutral certifications, academic qualifications and associated quality standards that exist, any European framework needs to effectively accommodate those in order to facilitate transparency of the credentials awarded and their portability across Member States. We identify and review numerous initiatives in this area.

- **Professional Ethics** – A defining aspect of any profession involves adhering to professional ethical conduct. Assuming ICT is to mature as a profession in the same way as many other professions, the need for professional ethics in ICT is paramount, particularly considering the pervasive nature of ICT on individuals lives and issues such as privacy, security, equity of access and so on. Effectively addressing this issue of ethical conduct is critical for the ICT profession to garner positive perception by the public. We examine initiatives pertaining to ethical conduct in ICT, with a view to considering how Codes of Ethics/Conduct could best be accommodated within the EU framework for ICT Professionalism in a sustainable fashion.

Considering these four pillars in terms of the need for professionals to add value to their organisation, as discussed above, we conclude that the combination of all four pillars serves as a solid basis for ICT professionals to meet the "value added" requirement. A shared body of knowledge in a relevant ICT area, serving as the basis for developing certifications/qualifications that are transparent, portable and based on a defined standard, provides evidence of the professional's skills/competencies relevant to a specific job at a specific point in time. Ensuring currency of competencies/skills through engaging in continuous professional development and performing work activities to an ethical standard provides evidence that the professional continues to deliver value in a manner that is acceptable to the organisation and the public.

In terms of developing a training programme for ICT managers, consideration was given to identifying linkages between existing collaborative initiatives between industry, academia, professional institutes, and local governments. In order to frame this programme, research was undertaken to identify best practices in terms of the scope of ICT training programmes currently offered, to identify core curriculum components, and to consider target audience, the nature of training, the modes of delivery, the expected capability on completion, and so on.

The desktop research into the proposed four pillars of ICT professionalism and into current training offerings for ICT managers resulted in a comprehensive overview of initiatives in these areas across Europe and the rest of the world. This desktop research and analysis thereof provided an in-depth understanding of initiatives to date and identification of key issues, relevant barriers and success factors for existing initiatives. This background research provided the basis for developing a questionnaire to elicit insights from ICT practitioners on these four pillars, on the importance of developing an ICT profession and on the requirements for a training programme for ICT managers. The intent was to ensure the most up-to-date thinking and concerns were captured and used to shape an effective research questionnaire. This questionnaire was developed, tested in consultation with a small sample group of experts and refined. This project proposed to acquire insights from 100 experts; in total 380 experts responded. From the list of respondents, a number of follow up interviews were carried out to probe greater depth of insight in key areas of interest. These follow up discussions also served as the basis for confirming the data collected via the questionnaire. This report incorporates the input of the interviewed experts. Through incorporating the input of these groups, we have worked to ensure the research is valid (we asked the right questions), is reliable (the data is representative of the wider community) and is generalizable (the findings can be related to the wider

community). All research conducted for this report adhered to high ethical research standards, thereby ensuring research integrity.

3.2 Stakeholders

Stakeholder groupings for this project are numerous, as outlined in Figure 1. It is arguable that because of the pervasive nature of ICT that all of society has a stake in defining how ICT practitioners are engaged and consulted. For the purposes of this project however we have grouped subsets of the stakeholders into various classifications.

Figure 1 Multiple stakeholder communities involved

For an ICT professional framework to be successful, there is a requirement to better understand the needs of the various ICT stakeholder groupings, including for example ICT practitioners and managers, public and private educators, enterprises, professional ICT associations, government bodies, standards bodies, certification developers etc. Further, there is a need to produce a solution that effectively addresses their respective needs. In essence, any proposed framework must be demand-driven, with tangible benefits for each stakeholder. This is a critical step as without understanding the true nature of what each stakeholder group requires of a framework, and any possible interplay between these requirements, it is likely that the framework will fail to gain the necessary traction to enable successful adoption.

The interviewing of key stakeholders was essential to understanding their requirements and their envisaged benefits from an ICT profession and to ensuring their engagement and commitment to the project. The research endeavoured to ensure that the views and opinions captured were representative of practitioners across the EU, by for example seeking representation from CEPIS Member Societies and the IVI community.

3.3 Data sources

Data sources for the project can be classified under the following headings:

3.3.1 Studies and Reports

The report, particularly those sections relating to Phase 1, has drawn extensively on existing studies, reports and academic papers pertaining to the four pillar of ICT professionalism. These studies reflect past and on-going initiatives within the EU, the United States, Japan and India. An extensive reference listed is included at the end of this report. However, sample studies include for example:

- Bodies of knowledge (Agresti, 2008)
- Certification, standards and qualifications: The CEN "ICT certification in action" interim report (Weiss & O'Sullivan, 2010), the European Commission's "European Qualifications Framework for Lifelong Learning (EQF)" (European Communities, 2008) and the CEPIS "Harmonise" (DG Education & Culture and CEPIS, 2007) study.
- Competencies: The European Commission's "European e-Competence Framework 2.0" and "e-skills for the 21st century".
- Professional ethics: IFIP's "Criteria and procedures for developing codes of ethics or of conduct", IFIP's "Ethics and the governance of the Internet" monographs and "The Ethics of Computing" by J. Berleur and K. Brunnstein.

3.3.2 Interviews

Data gathered from ICT practitioners via questionnaire completion and follow up interviews provided significant insights on:

- Usage of Bodies of knowledge and their fitness for purpose
- Importance of certifications and qualifications, drivers for acquiring them, awareness of frameworks, expected trends and standards
- Usage of competence frameworks and their potential benefits and barriers to adoption
- Adherence to Codes of Ethics/Codes of Conduct, their usefulness, compliance requirements and opinions on enforcement
- Need for CIO training and views on the content required to best equip CIOs to fulfil their role
- The concept of an ICT profession and steps in moving towards establishing and maturing it
- Background details on all participants including for example mode of entry to the ICT profession, academic qualifications and certifications held, organisation type represented, professional areas of activity and membership of professional associations.

3.3.3 Meetings and workshops

Regular meetings between the project team served as a useful basis for discussing existing initiatives and stimulating new ideas in a collaborative setting. Weekly status meetings served as a useful means to maintain visibility on project progress and to discuss new findings, increase awareness of new developments and upcoming events, identify and exchange contact details etc. These meetings were particularly important due to the dispersed nature of project team members.

Several workshops between the project team members, focused on the four pillars of ICT professionalism, were held. These served as a useful source of data gathering and debate on desktop research findings. Discussions between project team members and external experts served as a further mechanism for gathering insights related to these four areas. A number of workshops focusing on iterative questionnaire design and refinement were held; and were critical in ensuring that appropriate questions were incorporated and worded in an unambiguous manner; and in ensuring that the value of incorporating each question was considered. Project team representation at the CEN workshop on 14/04/2011 served to gather further input on this questionnaire design.

During Phase 2, the level of engagement with external stakeholders increased substantially, with presentations to the CEN Workshop on ICT Skills, as well as presentations to national policy makers and related workshops on e-Skills organised by the European Commission. Further one-on-one interviews were also held with a selection of experts from industry, academia, government and professional associations in order to obtain feedback on the proposals and iterate them further.

3.3.4 Website

The dedicated e-skills and ICT professionalism website (www.ictprof.eu) publicises the research to the public. It focuses on communicating the importance of the research undertaken with a view to engaging with its target audience. The website requests and welcomes submissions from the public, on individuals' thoughts on the concept of ICT professionalism, on the four proposed pillars and on CIO or ICT manager training.

3.4 Defining the ICT Professional

Our views on the definition of an ICT Professional evolved over the course of the project and it is worthwhile indicating the manner in which the definition changed and the causes of these changes.

3.4.1 Original definition (Phase 1)

CEPIS has fostered the concept of ICT Professionalism among the many Members which it represents from across Europe and has an active and broadly supported ICT Professionalism task force dedicated to developing the concept. Through an extensive consultative process, CEPIS had developed an agreed definition for an ICT professional that had been approved by the CEPIS Member Societies' populations.

This definition (that was also used in phase I of our project) is as follows:

A professional is said to be professionally competent if he/she exhibits all of the following characteristics:

Knowledge:	***of a common body of knowledge, supplemented by more specific knowledge and skills related to the area(s) of specialism***
Quality:	***commitment measured by adherence to quality standards (internal and/or external)***
Ethics:	***commitment displayed by demonstration of ethical professional practice against an agreed code of Ethics or code of conduct***

Accountability: ***the Professional takes personal responsibility for the quality and effectiveness of his/her work***

Experience: ***practical experience of the exercised competence***

Earns living: ***the ICT Professional obtains income from ICT related activities***

Given the widespread acceptance of the CEPIS definition by a number of professional bodies representing many thousands of practitioners, we used this definition on the project as our main working definition during Phase 1.

3.4.2 Updated definition (Phase 2)

As our research in this area progressed, we derived a new definition, as shown below:

ICT Professionals:

- possess a comprehensive and up-to-date understanding of a relevant body of knowledge[1],
- demonstrate on-going commitment to professional development[2] via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education;
- adhere to an agreed code of ethics/conduct[3] and/or applicable regulatory practices and,
- through competent practice[4] deliver value for stakeholders.

1. The term "relevant body of knowledge encompasses the requirement for a broad and deep knowledge base which is up-to-date, accommodating both a common ICT body of knowledge, and pertinent specialist knowledge and skills.
2. Professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. keeping abreast of latest technological trends) as well as non-technical aspects (e.g. developing better presentation skills).
3. Professionals are accountable to themselves, the ICT Profession and society, through an agreed code of ethics/conduct or applicable regulatory practices.
4. Competent practice communicates the concept of quality of products and services being delivered by practitioners.

This new definition builds directly from the earlier definition used in Phase I. In constructing this updated definition, we benefitted greatly from the input and feedback from the CEPIS Task Force on ICT Professionalism. This updated version was reviewed and given broad acceptance from the CEPIS Council.

The changes can be summarised as:

1) Switch from a cost/time-served focus to one of value being delivered
2) 'Earns a living' was removed. Some contributors, particularly those with experience of operating in open source/free software environments, felt that the original requirement to "earn an income" was not relevant. For this reason, this clause was removed. However, there is in its place, the expectation that value will be delivered for stakeholders.
3) Quality commitment measured by adherence to standards was replaced by the phrase "competent practice" which encompasses not only the products and services being provided but includes the manner in which they are provided.
4) Ethics statement was expanded to include the notion of regulatory compliance as this is more applicable in some countries.

5) The notion of accountability was explicit in the old definition. Accountability is encapsulated in the "adhere to an agreed code of ethics/conduct and/or applicable regulatory practices.
6) Include reference to the identified building blocks of the ICT profession – namely, bodies of knowledge, education and training, competences and ethics.

3.4.3 Rationale for the changes to the definition

In recent years, there has been an increasing emphasis placed on the importance of generating value from the application of ICT, and therein the work of ICT professionals[12]. Similarly, the growing number of practitioners involved in the Free and Open Software movement (FOSS) and the usage of this software in commercial (i.e. non-hobbyist) environments suggests that "earning a living" should not be a pre-requisite for being defined as an ICT professional.

Reflecting these trends, we have proposed to amend the project working definition over the course of the project – switching the focus from "earning a living" to "delivering value". In most instances, practitioners would be financially remunerated for the value which they have contributed, but the nature and quantity of remuneration should not dictate one's classification as a professional or otherwise.

[12] IT-CMF and VAL-IT are examples of the changed focus from cost towards the value generated by the function.

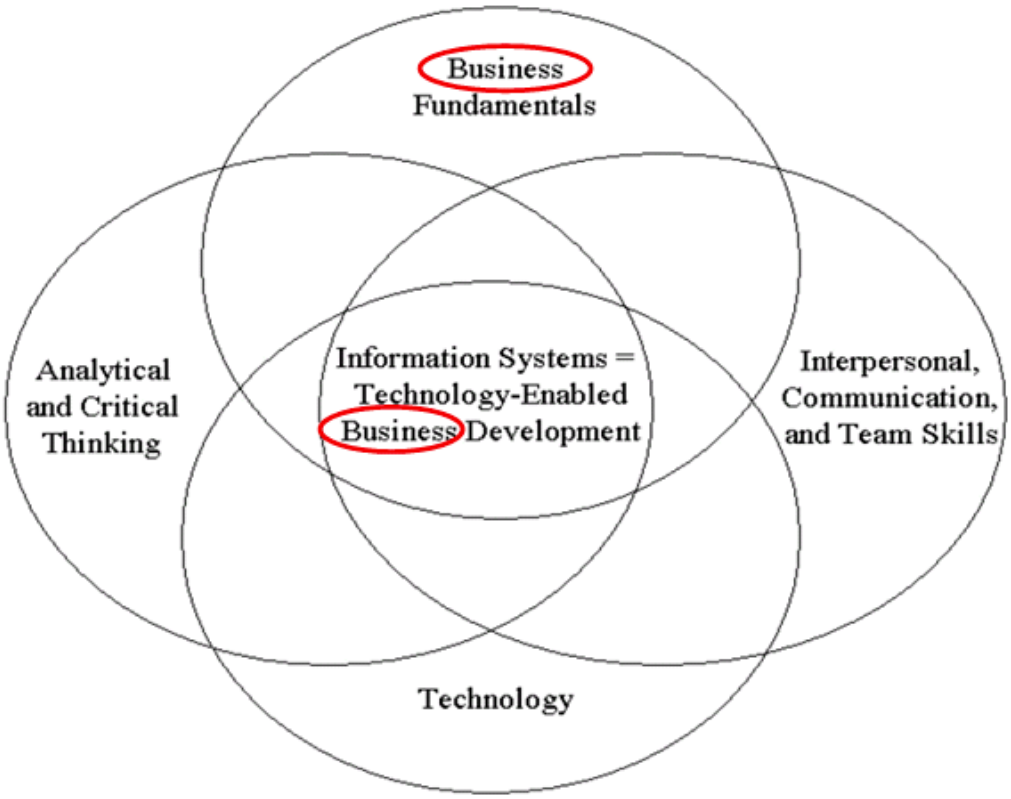


Figure 2 ACM Computing Curricula[13] IS Professional

From the desktop research that we have undertaken, there is a growing recognition of the importance to reflect a need to encompass practitioners outside of the traditional ICT operations environment. The diagram in Figure 2 shows the broad range of IS activities encompassing business, analysis, technology and communications skills – all of which are pertinent within the ICT domain. ICT practitioners may reside in any of the circles or any of the overlaps.

Due to the complexity of the ICT area, few individuals can aspire to demonstrate depth of knowledge across all areas. Looking at other complex knowledge areas, we noted in particular the approach used in medicine. Here, end users can approach a general practitioner in the first instance and be referred to more specialist practitioners if required.

Similarly, there is a need for ICT professionals who can provide a generalist service (e.g. supporting the broad range of basic services required by an SME) as well as ICT specialists (excelling in tackling extremely complex problems in, say, information security within a financial services environment). ICT needs its general practitioners and specialists just like medicine. This we see as perhaps being reflected in the concepts like breadth and depth of knowledge.

To facilitate wider adoption of the definition, we also feel that it would be useful to amend the wording so as to make it more succinct but without changing the essence or meaning of

[13] http://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf page 8

the CEPIS definition. To this end, we have focused on including reference to the related artefacts or building blocks of an ICT professionalism -namely, knowledge bases; competences; certifications, qualifications and standards; and ethics.

These changes were reviewed and broadly accepted by professional societies around Europe (as part of the CEPIS Council), pathing the way for an improved level of acceptance of the definition.

Project Phase 1

4 Desktop Research

4.1 Bodies of Knowledge

One method of establishing a profession is to first define a body of knowledge around the area and then use the body of knowledge to set standards and certification processes (Agresti, 2008).

A *body of knowledge* is more than simply a collection of terms; a professional reading list; a library; a website or a collection of websites; a description of professional functions; or even a collection of information. It is the accepted ontology for a specific domain.[14] The Project Management Body of Knowledge (PMBOK®) from the Project Management Institute states that it documents "generally accepted good practice".

Thus, the documented, verified, validated and approved concepts are typically referenced in bodies of knowledge. This addresses the needs of the vast majority of ICT practitioners. Today the bulk of activities are about maintenance and enhancements of existing systems. For those companies that are at the vanguard of technology adoption, the well-established industry recognized bodies of knowledge constitute a subset of the knowledge needed.

Bodies of knowledge can be expressed in many ways. They can be expressed as facts, processes, methods or recipes. A body of knowledge could equally be defined as a set of inputs and outputs as in a black-box description where the input and output artifacts are clearly described. A body of knowledge may simply be an index to the wider societal knowledge base on a subject or domain. A body of knowledge may be expressed as a syllabus either with or without supporting bibliographic detail. Knowledge can be captured and communicated via maturity models and associated assessment frameworks. The most widely available are still good textbooks either paper or digital.

Knowledge management is an essential activity for all but this is more complex and dynamic in the technology innovator and early adopter companies (Hargadon, 1997). The innovative and transformative nature of ICT has to be harnessed and managed. This very often has to be done at speed to stay ahead of the competition. The new sometimes unproven technologies and the associated haste does mean that it is a high risk venture. To leverage off new technologies, one has to understand their capabilities and the ease or complexity of integrating them into an existing suite of technologies or how it might facilitate the launch of new businesses. Many leading companies form partnerships with their suppliers, universities; join and participate in forums and consortiums to manage and shape the roll out of new concepts.

Technological change, like all change is about more than just technology. It involves people, business processes, attitude and expectations management as well as risk with the potential

[14] http://en.wikipedia.org/wiki/Body_of_Knowledge

for high rewards. It is more difficult to be effective at change management in the absence of reference sites and demonstrated benefits for the stakeholders.

Knowledge management is an exceptionally wide topic and is outside the scope of this research. However, for the purposes of this research our references to a '**knowledge base**' should be considered as inclusive of the bodies of knowledge and all necessary current information as is appropriate to the business and its technology management positioning; as an innovator, early adapted, early or late majority or laggard positioning (Hargadon, 1997).

With reference to Figure 2, the scope of the knowledge areas is very wide and encompasses business, technology, analysis, process, communications, negotiation, design, and change management to list some. The ICT team needs to be competent in all these areas.

Presently, there are many bodies of knowledge (BOKs) associated with ICT related activities. There does not appear to be an all-encompassing body of knowledge. The review in this section does not attempt to analyse the content of each of these BOKs. It looks at who generated them and how they are maintained.

The BOKs identified for this analysis include:

- PMBOK®
- SWEBOK
- CIPS Body of Knowledge / BCS Diploma Syllabus / ACS ICT Profession Body of Knowledge
- ITIL
- COBIT
- ACM/IEEE Computing Curricula
- CMMI
- Prince2
- IT Security Essential Body of Knowledge
- APM BOK (Association for Project Management Body of Knowledge)
- TOGAF

Several of these bodies of knowledge have common ground and have over lapping features. For example, APM BOK, PMBOK and Prince2 all deal with project, programme and or portfolio management.

4.1.1 Project Management Body of Knowledge (PMBOK®)

4.1.1.1 *Brief description*

The PMBOK covers the concepts of project management. PMBOK divides the knowledge into nine knowledge areas:

- Quality
- Scope
- Time
- Cost
- Human resources
- Communications
- Risk Management
- Procurement
- Integration

Projects have a defined life cycle that the standard divides into 5 phases:

- Initiating
- Planning
- Executing
- Monitoring & Controlling
- Closing

4.1.1.2 *Origins*

The origins of the PMBOK can be traced to the foundation of the PMI in 1968. The first PMP certifications were issued in 1984 and the first draft of the PMBOK was available in 1986. The document is now in its fourth edition and it continues to be maintained.

The PMBOK has been augmented with publications on sizing and estimation, risk management, program management, portfolio management and special areas like construction and government.

4.1.1.3 *Education and training*

Courses and textbooks on the PMI material are available from a wide variety of commercial suppliers as well as universities and colleges. Once certified, practitioners must remain active in project management and be re-certified by having attained a number of professional development units (PDUs).

4.1.1.4 *Coverage*

Project management, program management, portfolio management, earned value management, risk management; work breakdown structures practices, scheduling practices, sizing and estimation practices are all covered in the Project Management Institute's materials.

4.1.1.5 *Currency*

The Project Management Institute has hundreds of thousands of members worldwide and funds significant on-going research from its resources. The PMIs material is current and maintained by its member community.

4.1.1.6 *Usage*

PMBOK is widely used by project managers around the globe. Certification in project management is normally a requirement to work as a project manager.

Note: Most jobs specify that a project management certification is required but do not specify whether it should be Prince2 or PMP. Most employers will accept all of the certifying bodies.

The PMBOK is used as a basis of establishing a common language. This is an important aspect of international and trans-national projects. The PMBOK is used in construction, government (US & Canada in particular), IT and businesses of all types. NGO's and not-for-profit organisations are also using PMBOK. The PMI has active chapters in the following regions and countries:

Asia Pacific

Australia, Bangladesh, Hong Kong, India, Malaysia, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Indonesia, Japan and South Korea

Europe, Middle East, Africa

Austria, Bahrain, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Jordan, Kuwait, Lebanon, Luxembourg, Morocco, Netherlands, Nigeria, Norway, Oman, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United Arab Emirates, Yemen and Yugoslavia

Latin America

Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Paraguay, Peru, Uruguay and Venezuela

North America

Canada, United States and Caribbean

4.1.1.7 *Contact information*

Support organisation:	Project Management Institute
Body of Knowledge:	PMBOK
PMI's EMEA Contact details:	http://www.pmi.org/en/About-Us/Customer-Care/EMEA.aspx
Telephone:	+31-320-239-539

4.1.2 Software Engineering Body of Knowledge (SWEBOK)

An engineering profession is characterized by several components:

- An initial professional education in a curriculum validated by society through accreditation
- Registration of fitness to practice via voluntary certification or mandatory licensing
- Specialized skill development and continuing professional education
- Communal support via a professional society
- A commitment to norms of conduct often prescribed in a code of ethics

The SWEBOK addresses the first three.

The SWEBOK (2004) areas of knowledge include:

- Software requirements
- Software design
- Software construction
- Software testing
- Software maintenance
- Software configuration management
- Software engineering management
- Software engineering process

- Software engineering tools and methods
- Software quality

Software engineering does not exist in a vacuum and must interact with the following related areas outside the scope of the SWEBOK:

- Computer engineering
- Project management
- Computer science
- Quality management
- Management
- Software ergonomics
- Mathematics
- Systems engineering

The body of knowledge resides in the literature that has been generated over the last forty years. The SWEBOK is simply a guide to that knowledge. The SWEBOK does not stipulate vendor specific methods tools or techniques. Nor does it address specialist or research areas. The SWEBOK describes what is generally accepted as good practice.

The Institute of Electrical and Electronic Engineers Computer Society (IEEE) in association with the Association for Computing Machinery (ACM) invited participation from interested parties to form and develop the SWEBOK. The first drafts appeared in 2001 and the final approved document was produced in 2004. Version 3 is currently being drafted and is expected to be ready for review during 2011.

4.1.2.1 *Education and training*

Many university courses have been modified to incorporate the SWEBOK content into their material.

The Certified Software Development Professional (CSDP) is aimed at mid-career software development professionals. The certification meets the ISO/IEC 24773:2008, "Software Engineering – Certification of Software Engineering Professionals – Comparison Framework".

The Certified Software Development Associate (CSDA) is a graduate level certification.

The Institute of Electrical and Electronic Engineer's Computer Society (IEEE CS) also has a certification.

4.1.2.2 *Coverage*

The SWEBOK addresses the requirements through design, coding and testing to deployment and management. It also looks at the process, tools and methods and quality aspects of the work.

It does not address soft skills like expectations management, client relationships or contract and duty of care aspects of the profession.

A separate ethics document has been developed by the IEEE and ACM.

4.1.2.3 *Currency*

The current standard was approved in 2004. It is in need of revision and update. A version 3 of the SWEBOK is in preparation and was expected to be available for review during 2011. Version 3 will rework the document and provide new knowledge areas of Software Measurement and Software Security.

It is developed under a grant from some businesses and with the support of the IEEE CS and ACM.

4.1.2.4 *Usage*

It is used by colleges, education providers, practitioners and employers. It is also being used as a reference against which qualifications can be assessed or compared.

4.1.2.5 *Contact Information*

Support organisation:	IEEE Computer Society
Body of Knowledge:	SWEBOK
IEEE Computer Society contact details:	http://www.computer.org/portal/web/guest/contact
Telephone:	+1-714-821-8380

4.1.3 Canada's Association of Information Technology Professionals (CIPS BOK)
British Computer Society (BCS) IT Diploma Syllabus

In February 2005, the CIPS National Board ratified the following motion: *"The British Computer Society (BCS) Professional Examination Study Guide Syllabus Diploma level (Core and 11 specialist modules) be adopted as the Body of Knowledge (BOK) for CIPS."*

The BOK is comprised of a core and ten technical knowledge areas:

- Core Module: Professional Issues in Information Systems Practice
- Architecture
- Networks
- Databases
- OO Programming
- Project management
- Service management
- Software engineering
- Systems Analysis
- Systems Design
- The Internet and the WWW

The British Computer Society (BCS) is maintaining the syllabus and has dropped knowledge areas in 2010 and added some new ones in 2010 and 2011. The list above is current as of February 2011 and does not show the areas dropped in 2010.

The British Computer Society has 70,000 members worldwide. CIPS, BCS and the Australian Computer Society (ACS) are all founding members of IP3.

The International Professional Practice Partnership (IP3) is a global initiative that was adopted by the International Federation of Information Processing (IFIP), at the IFIP General Assembly (GA) in 2006. IFIP is a United Nations founded/UNESCO association, with 60+ Member Societies. IP3 counts 9 professional IT associations across the globe as its members who share a common vision to establish IT as a profession that is recognized and valued globally and has the same key strategic features that are common to most established professions; IFIP provide accreditation for organisations; thus far, two organisations have been accredited.

4.1.3.1 *Education and training*

This BOK is basically a syllabus that has been adapted by many UK and Irish colleges. Further, many colleges recognise the BCS based certification as qualifying criteria for further training at university. Courses are also available in Canada and Australia based on the BCS Diploma Syllabus.

Standards and candidate guidelines have been issued by the Information Systems Examinations Board (ISEB). The ISEB has a portfolio of qualifications that it oversees.

Certified trainers exist in: Germany, Netherlands, Australia, UK, Denmark, Canada, Finland, Ireland, Singapore, USA, Sweden, India, Belgium and Malaysia. The countries shown are typically where the training organisation is based and many operate worldwide.

4.1.3.2 *Coverage*

A core module and ten technical areas of knowledge are covered in the syllabus for the diploma course.

4.1.3.3 *Currency*

The BCS is maintaining the body of knowledge and it is being kept current. The BCS is funded by its membership and education activities.

4.1.3.4 *Usage*

The BCS Diploma syllabus is used in UK, Canada and Australia. It is also used to a lesser extent in North Western Europe, India, Malaysia, Singapore and the USA. It is used by educators and professionals.

4.1.3.5 *Contact Information*

Support organisation:	**Canada's Association of I.T. Professionals**
Body of Knowledge:	CIPS BOK
CIPS Contact details:	http://www.cips.ca/contactcips
Telephone:	+1-877-ASK-CIPS (275-2477)
Support organisation:	**British Computer Society**
BCS Contact details:	http://www.bcs.org/content/conWebDoc/34404
Telephone:	+44 (0)1793 417417

4.1.4 Information Technology Infrastructure Library (ITIL)

ITIL has primary publications in the areas of:

- Service Strategy
- Service Design
- Service Transition
- Service Operation
- Continual Service Improvement

Note: More details available at: http://www.itil-officialsite.com/Publications/Core.aspx.

The UK's Central Communications and Telecommunications Agency (CCTA) published ITIL between 1989 and 1995. Version 2 was published in 2004 and gained worldwide acceptance. 2007 saw version 3 being delivered.

4.1.4.1 *Education and training*

Many large IT service companies have embraced ITIL and support its use through consultancy and training programs. ITIL training is available from many professional educators.

The ITIL V3 Qualifications scheme uses four levels:

- ITIL Foundation in IT Service Management
- ITIL Intermediate Level
- ITIL Expert Certification
- ITIL Master Qualification

Accredited examinations institutes use their own processes. Details of the four levels are available for download.

4.1.4.2 *Coverage*

ITIL takes a customer focused service delivery approach to IT management. It describes service strategy, design, transition and operation in a continuous improvement environment.

4.1.4.3 *Currency*

ITIL is being updated regularly and version 3 is the latest as of (Feb/2011).

4.1.4.4 *Usage*

ITIL is being used by educators, certifiers, practitioners and companies. It acts as a framework to help manage IT services. It has helped companies align their business and IT objectives.

4.1.4.5 *Contact Information*

Support organisation:	Office of Government Commerce (OGC)
Body of Knowledge:	ITIL

UK Office of Government Commerce contact details:	http://www.best-management-practice.com/
Telephone:	+44 (0)870 242 2345

4.1.5 COBIT 4.1

COBIT 4.1 can be found at www.itgi.org/cobit. The framework addresses the issue of governance around IT. It ensures that:

- IT is aligned with the business
- IT enables the business and maximises benefits
- IT resources are used responsibly
- IT risks are managed

The Information Technology Governance Institute (ITGI) was founded in 1998 to advance the governance of IT. It has developed the Control Objectives for Information and related Technology (COBIT®). COBIT is continually being updated and supporting standards like RiskIT and ValIT have been added to the portfolio of solutions. ISACA plans to merge all three into COBIT version 5 which is slated for release in 2011.

The ITGI was formed by the Information Systems Audit and Control Association (ISACA). The ISACA was initially formed in 1967 and has continued to grow since then. ISACA offers a variety of certifications including:

- CRISC – Certified in Risk and Information Systems Control
- CISM – Certified Information Security Manager
- CGEIT – Certified in the Governance of Enterprise Information Technology
- CISA – Certified Information Systems Auditor

4.1.5.1 *Education and training*

Online e-learning courses, books and face-to-face training are available to help students pass the examinations for the qualifications listed in section 4.1.5 above.

Today (Feb 2011) ISACA has over 95,000 members worldwide.

4.1.5.2 *Coverage*

COBIT focuses on five main areas. These are:

- Strategic alignment (business & IT alignment from planning stage)
- Value delivery (ensuring IT delivers on value promised)
- Resource management (proper management and investment in IT resources)
- Risk management (risk awareness and risk acceptance/avoidance guidelines and criteria)
- Performance measurement (strategic, operational metrics and use of balanced scorecards)

4.1.5.3 *Currency*

The framework is actively maintained and ITGI has on-going research to ensure it is kept up-to-date. It is funded by research grants, member subscriptions, and training and certification fees.

4.1.5.4 *Usage*

COBIT is used globally. It has been particularly successful in the financial markets where the concepts of auditing are better understood.

Many businesses have used it to gain control of their IT investments and get a better handle on the management of IT. It is being used as a mechanism to align IT and business at strategic, tactical and operational planning levels.

4.1.5.5 *Contact Information*

Support organisation:	ISACA (formally Information Systems Audit and Control Association)
Body of Knowledge:	COBIT
ISACA contact details:	http://www.isaca.org/About-ISACA/Contact-Us/Pages/default.aspx
Telephone:	+1.847.253.1545

4.1.6 ACM/IEEE Computer Science Curriculum

The Association for Computing Machinery (ACM) and the Institute for Electrical and Electronic Engineers (IEEE) has published computing curricula in 1968, 1978, 1991, 2001 and 2008. The computing curricula are actively maintained and have scheduled period reviews. It can be down loaded from: http://www.acm.org/education/curricula/ComputerScience2008.pdf.

Note: There is an IS Computing Curricula which is located at http://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf. This is maintained by the Association for Computing Machinery (ACM) and the Association for Information Systems (AIS). This is also of a very high standard and is kept current but is not reviewed in this report.

4.1.6.1 *Education and training*

The computing curricula is used and referenced by many universities worldwide. There are a significant number of colleges that provide courses based on the curricula.

4.1.6.2 *Coverage*

The following areas are addressed:

- Discrete structures
- Programming fundamentals
- Algorithms and complexity
- Architecture and organisation
- Operating systems
- Net centric computing
- Programming languages
- Human-computer interaction
- Graphics and visual computing
- Intelligent systems
- Information management
- Social and professional issues
- Software engineering

- Computer science
- Introduction to security
- Parallelism

4.1.6.3 *Currency*

This is a joint effort between the IEEE and ACM who continue to review the curricula.

4.1.6.4 *Usage*

It is in use by colleges and educators. It is used in North America, Europe, Australia & New Zealand.

4.1.6.5 *Contact Information*

Support organisation:	Association for Computing Machinery (ACM)
Body of Knowledge:	ACM/IEEE Computer Science Curriculum
ACM's contact details:	http://www.acm.org/contact-info
Telephone:	+1-412-268-5800
IEEE Computer Society (CS)	IEEE Computer Society (CS)
IEEE's Computer Society's contact details	http://www.computer.org/portal/web/guest/contact
Telephone:	+1-202-371-0101

4.1.7 Capability Maturity Model Integrated (CMMI®)

The Capability Maturity Model (CMM) was developed by the Software Engineering Institute (SEI) at Carnegie Mellon University, Pittsburgh, Pennsylvania. The SEI receives significant funding from the US government and thus its future is secured.

It is a process improvement maturity model that is focused on the development of products and services. It addresses the product life-cycle from concept through development and delivery and the maintenance phase.

The CMMI for development uses best practices of systems and software engineering.

The CMMI can be obtained online at http://www.sei.cmu.edu/library/abstracts/cmmi/.

4.1.7.1 *Education and training*

A variety of courses are available from the Carnegie Mellon University. These range from introductory to detail and are available in tailored form for practitioners and managers. The CMMI framework has sub specialities like development and acquisition. Variants of the courses are specific to the needs of the customer. Courses are also offered to train appraisers. Thus, companies can become self-sufficient in terms of doing larger corporate wide assessments.

Certifications for various roles in the CMMI process improvement exist. These include:

- CMMI Instructor
- People CMMI Instructor
- PSP Developer

- PSP Instructor
- SCAMPIB&C Team Leader
- SCAMPI with People CMM Lead Appraiser
- TSP Coach

A web search for CMMI training will return large numbers of training organisation who support and train the CMMI area.

4.1.7.2 *Coverage*

The CMMI looks at four process areas:

Process management
- Basic process management process areas
- Advanced process management process areas

Project management
- Basic project management process areas
- Advanced project management process areas

Engineering
- Recursive and iteration of engineering processes

Support
- Basic support process areas
- Advanced support process areas

The CMMI looks in detail at 22 process areas and makes recommendations for improvement based on the findings of a capability maturity assessment. The 22 process areas are:

- Causal Analysis and Resolution (CAR)
- Configuration Management (CM)
- Decision Analysis and Resolution (DAR)
- Integrated Project Management (IPM)
- Measurement and Analysis (MA)
- Organizational Innovation and Deployment (OID)
- Organizational Process Definition (OPD)
- Organizational Process Focus (OPF)
- Organizational Process Performance (OPP)
- Organizational Training (OT)
- Product Integration (PI)
- Project Monitoring and Control (PMC)
- Project Planning (PP)
- Process and Product Quality Assurance (PPQA)
- Quantitative Project Management (QPM)
- Requirements Development (RD)
- Requirements Management (REQM)
- Risk Management (RSKM)
- Supplier Agreement Management (SAM)
- Technical Solution (TS)
- Validation (VAL)
- Verification (VER)

4.1.7.3 *Currency*

The CMMI is maintained at the Carnegie Mellon University by the Software Engineering Institute. This organisation gets the bulk of its funding from the US government and is considered financially secure.

4.1.7.4 *Usage*

Large software and product developers were among the first to use CMM. Specific levels were mentioned in NATO, US/UK Government contracts and a minimum level of 2 was normal in the vendor qualification processes of many large companies during the 1990s. This had the effect of accelerating the demand for CMM certification.

Levels 3 and higher bring significant quality improvements and have the effect of reducing overall cost and reduce time to market. This was demonstrated at Motorola where level 2 was found to improve quality but at increased costs. Whilst, level 3 reduced costs and improved quality; levels 4 and 5 again improved quality but at increased cost. Motorola directed all product development groups and software development groups to attain a minimum of level 3. High volume software development sites were asked to attain levels 4 and 5. Specifically, sites whose software would be deployed with or embedded in high volume products were asked to attain levels 4 & 5.

4.1.7.5 *Contact Information*

Support organisation:	Software Engineering Institute (SEI)
Body of Knowledge:	CMMI
SEI's contact details:	http://www.sei.cmu.edu/contact.cfm
Telephone:	+1-412-268-5800

4.1.8 Prince2

PRINCE is derived from the phrase "**PR**ojects **IN C**ontrolled **E**nvironments". Prince2 is used extensively in the UK Government departments. It is also widely used in industry and business in the UK.

The following overview is taken from http://www.ogc.gov.uk/methods_prince_2.asp

PRINCE2 is a generic, sometimes tailored, simple to follow project management method. It covers how to organise, manage and control your projects. It is aimed at enabling you to successfully deliver the right products, on time and within budget. As a Project manager you can apply the principles of PRINCE2 and the associated training to any type of project. It will help you to manage risk, control quality and change effectively, as well as make the most of challenging situations and opportunities that arise within a project.

A PRINCE2 project has the following characteristics:

- *Continued business justification*
- *Learning from experience*
- *Defined roles and responsibilities*
- *Managed by stages*
- *Managed by exception*
- *Focuses on products and their quality*

- *Tailored to suit the particular product environment*

PRINCE2 does not cover all aspects of project management. Areas such as leadership and people management skills, detailed coverage of project management tools and techniques are well covered by other existing and proven methods and are therefore excluded from PRINCE2.

Prince2 documents best practices associated with project management.

4.1.8.1 *Education and training*

Prince2 training is widely available. A number of Prince2 accredited training providers are available and a variety of courses are described at http://www.prince2.com/accredited-project-management-training.asp.

4.1.8.2 *Coverage*

Prince2 can be described in a number of models. The first covers:

- Starting up a project (SU)
- Initiating a project (IP)
- Directing a project (DP)
- Planning (PL)
- For each stage
  - Managing stage boundaries (SB)
  - Controlling a stage (CS)
  - Managing product delivery (MP)
- Shutting down: Closing a project

A second model for Prince2 is called the component model. The components are referred to as the 'what' a project manager does:

- Change control
- Configuration management
- Quality
- Risk management
- Controls
- Plans
- Organisation
- Business case

4.1.8.3 *Currency*

Prince2 is a UK government initiative that continues to get financial support and also derives income from its publications. The initiative is being kept up-to-date.

4.1.8.4 *Usage*

Prince was initially used internally in the UK government departments. However, the project management principles and best practice were found to be applicable to many areas and not just IT where it originated.

Today Prince2 is used predominately in the UK but is also used in Western Europe, North America and the Asia Pacific Rim.

Prince2 is an effective approach to project management and offers practitioners a solid basis on which to build their careers.

4.1.8.5 *Contact Information*

Support organisation:	Office of Government Commerce
Body of Knowledge:	Prince2
OGC's contact details:	http://www.prince-officialsite.com/home/contactus.aspx
Telephone:	+44 (0) 1494 458 948

4.1.9 IT Security Essential Body of Knowledge

"EBK is a collection of what US government IT security managers believe are the essential technology and management skills an IT staff should have to protect federal networks from cyber-attacks and unauthorised access."[15]

The EBK is the US Department of Homeland Security is the Federal Government's version of the National Institute of Standards and Technology's (ISC)². It was created in 2007.

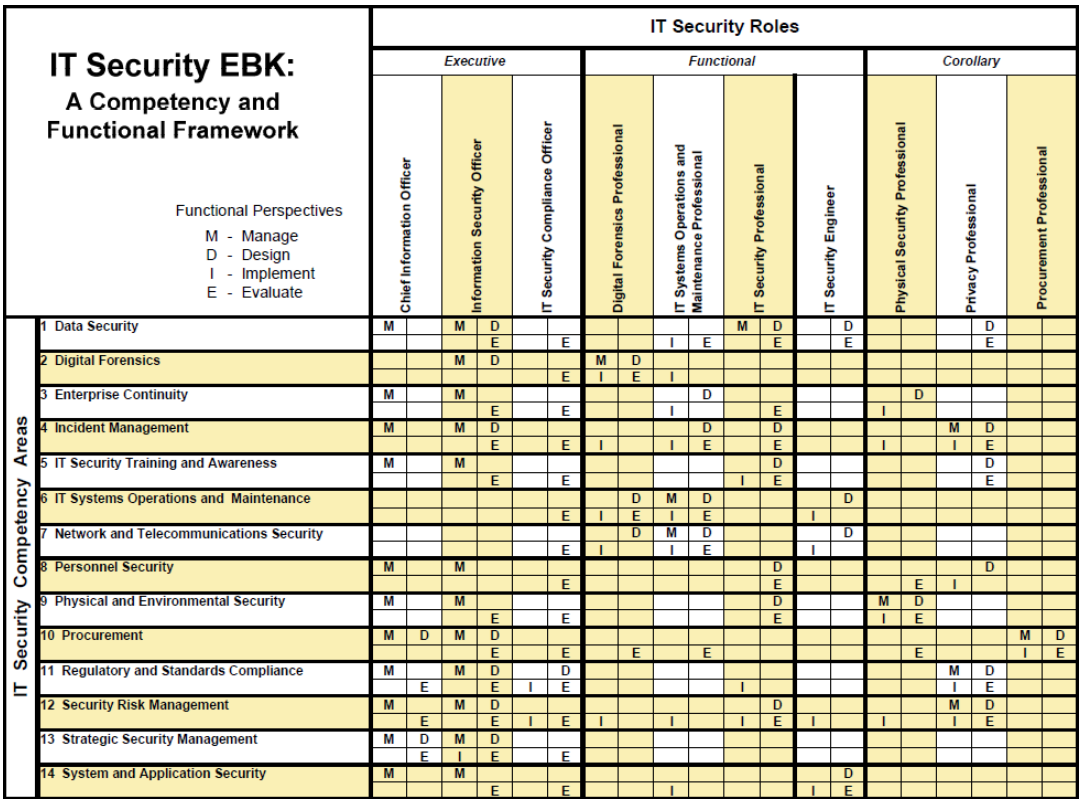
4.1.9.1 *Education and training*

The BOK has a number of roles and certifications associated with it. The following table from http://www.us-cert.gov/ITSecurityEBK/EBK%20Matrix-Sept08.pdf, shown in Figure 2, outlines the role and competency relationships.

The International Information Systems Security Certification Consortium, Inc., (ISC)² has a number of certifications on its related body of knowledge.

- ISC Associate
- Systems Security Certified Practitioner (SSCP)
- Certified Authorization Professional (CAP)
- Certified Secure Software Lifecycle Professional (CSSLP)
- Certified Information Systems Security Professional (CISSP)
- Architecture (CISSP-ISSAP)
- Engineering (CISSP-ISSEP)
- Management (CISSP-ISSMP)

[15]The Basics IT Security Essential Body of Knowledge by Jill R Aitoro see http://www.govexec.com/basics/itsecurity.htm



IT Security EBK: A Competency and Functional Framework

Functional Perspectives
M - Manage
D - Design
I - Implement
E - Evaluate

IT Security Competency Areas	IT Security Roles																							
	Executive						*Functional*										*Corollary*							
	Chief Information Officer		Information Security Officer		IT Security Compliance Officer		Digital Forensics Professional		IT Systems Operations and Maintenance Professional		IT Security Professional		IT Security Engineer		Physical Security Professional		Privacy Professional		Procurement Professional			
1 Data Security	M		M	D							M	D		D				D				
				E		E			I	E		E		E				E				
2 Digital Forensics			M	D			M	D														
						E	I	E	I													
3 Enterprise Continuity	M		M							D						D						
				E		E			I			E			I							
4 Incident Management	M		M	D						D		D					M	D				
				E		E	I		I	E		E			I		I	E				
5 IT Security Training and Awareness	M		M									D						D				
				E		E					I	E						E				
6 IT Systems Operations and Maintenance								D	M	D				D								
						E	I	E	I	E			I										
7 Network and Telecommunications Security								D	M	D				D								
						E	I		I	E			I										
8 Personnel Security	M		M									D						D				
						E						E				E	I					
9 Physical and Environmental Security	M		M									D			M	D						
				E		E						E			I	E						
10 Procurement	M	D	M	D															M	D		
				E		E		E		E						E			I	E		
11 Regulatory and Standards Compliance	M		M	D		D											M	D				
		E		E	I	E					I						I	E				
12 Security Risk Management	M		M	D								D					M	D				
		E		E	I	E	I		I		I	E	I		I		I	E				
13 Strategic Security Management	M	D	M	D																		
		E	I	E		E																
14 System and Application Security	M		M											D								
				E		E			I				I	E								

Figure 3 IT Security roles and competences

Text books and eLearning course are available.

4.1.9.2 *Coverage*

The EBK addresses the following areas:

- Data security
- Digital forensics
- Enterprise continuity
- Incident management
- IT security training and awareness
- IT systems operations and maintenance
- Network security and telecommunications
- Personnel security
- Physical and environmental security
- Procurement
- Regulatory and standards compliance
- Risk management
- Strategic management
- System and application security

4.1.9.3 *Currency*

The body of knowledge is maintained by the US Department of Homeland Security. It is being kept up-to-date and comments from subject matter experts are being solicited every two years.

4.1.9.4 *Usage*

It is recommended for use by all US government departments. It is being used to counter perceived cyber threats. Taken from http://www.us-cert.gov/ITSecurityEBK, the following text outlines some of the reasons for its use.

Potential benefits of the IT Security EBK for professional development and workforce management initiatives include the following:

- articulating the functions that professionals within the IT security workforce perform, in a context-neutral format and language
- promoting uniform competency guidelines to increase the overall efficiency of IT security education, training, and professional development
- providing a content guideline that can be leveraged to facilitate cost-effective professional development of the IT workforce, including future skills training and certifications, academic curricula, or other affiliated human resource activities.

4.1.9.5 *Contact Information*

Support organisation:	United States – Computer Emergency Readiness Team (US-CERT) US-CERT is a part of the National Cyber Security Division (NCSD) at the Department of Homeland Security (DHS).
Body of Knowledge:	EBK
US-CERT's contact details:	http://www.us-cert.gov/contact.html
Telephone:	+1 888-282-0870

4.1.10 Information Technology Capability Maturity Framework (IT-CMF)

The Information Technology – Capability Maturity Framework was developed initially by Intel based on applied research and Intel's own experience in transforming its IT organisation.

The IT-CMF has four macro processes:

- Managing IT like a business
- Managing the IT budget
- Managing IT for business value
- Managing the IT capability

Each of the four macro processes has a series of processes defined. The framework identifies capabilities needed to successfully execute these processes. Its assessment tools allow businesses to assess these capabilities and determine the maturity of the capabilities. The assessment results allow businesses to focus on the practices that make up the process and improve or develop the capabilities further.

The IT-CMF is maintained by the Innovation Value Institute (IVI) based at the National University of Ireland, Maynooth.

4.1.10.1 *Education and training*

The Innovation Value Institute provides a number of professional development courses on IT-CMF. The National University of Ireland at Maynooth (NUIM)) has announced a master's degree course that will use the IT-CMF as its basis. Students will be able to enrol on this course from September 2011.

Other universities in the US and Europe are in discussions on running courses with NUIM.

4.1.10.2 *Coverage*

The IT-CMF is made up of 4 macro processes and 32 processes. The following lists the macro and related processes:

Managing IT like a business

- Risk Management (RM)
- Accounting and Allocation (AA)
- Organisation design and planning (ODP)
- Sourcing (SRC)
- Innovation Management (IM)
- Service Analytics and Intelligence (SAI)
- IT Leadership and Governance (ITG)
- Business Process Management (BPM)
- Business Planning (BP)
- Demand and Supply Management (DSM)
- Capacity Forecasting and Planning (CFP)

Managing the IT budget

- Funding and Financing (FF)
- Budget Management (BGM)
- Portfolio Planning and Prioritization (PPP)
- Budget Oversight and Performance Analysis (BOP)

Managing IT for business value

- Total Cost of Ownership (TCO)
- Benefits Assessment and Realisation (BAR)
- Portfolio Management (PM)

Managing the IT capability

- Enterprise Architecture Management (EAM)
- Technical Infrastructure Management (TIM)
- People Asset Management (PAM)
- Knowledge Asset Management (KAM)
- Relationship Asset Management (RAM)
- Research Development and Engineering (RDE)
- Solutions Delivery (SD)
- Service Provisioning (SRP)
- User Training and Management (UTM)
- User Experience Design (UED)
- Program and Project Management (PPM)
- Supplier Management (SUM)

- Capability Assessment Management (CAM)

4.1.10.3 *Currency*

Version 1.0 has been released and a number of assessments are currently being undertaken by large multinationals, government departments, medical centres and hospitals etc. It has attained global reach via the multinationals and is expanding in the Asia/Pacific Rim along with Australia and New Zealand.

The Innovation Value Institute uses an open collaboration approach to continuously update and maintain the IT-CMF.

Although the IVI receives funding from its members, it remains a non-profit making organisation. IVI also receives grant aid from Enterprise Ireland.

4.1.10.4 *Usage*

The IT-CMF is aimed at CIO's. The assessment process and tools assist a CIO in determining where his/her ICT function's strengths and weaknesses exist. It is also used by CEO's who want an objective assessment of their ICT function's maturity. The IT-CMF looks at organisation capabilities as distinct from the capabilities of individuals.

It is used as a maturity rating tool with a set of recommendations on the next steps to improve maturity. It is being used on all continents mostly by large corporations. Medium sized companies particularly in the health-care area have also started using the IT-CMF. Usually companies have internally recognised an issue that needs to be resolved and IT-CMF is seen as a mechanism to focus and guide improvement efforts.

It is also used as a metrics tool to help focus improvement. Finally, as the number of assessments grows its use as a benchmarking tool is emerging as a very important feature. Users can compare their maturity with that of similar industries.

4.1.10.5 *Contact Information*

Support organisation:	Innovation Value Institute (IVI)
Body of Knowledge:	IT-CMF
IVI's contact details:	http://ivi.nuim.ie/about/contact.shtml
Telephone:	+353 1 708 6931

4.1.11 TOGAF

TOGAF was developed by the Open Group. The Open Group is a consortium of business and vendors that interoperates with standards bodies to deliver its vision of vision of Boundaryless Information Flow™.

The Open Group also certifies professionals in the use of TOGAF Architecture Development Methodology (ADM). The Open Group launched the first independent IT Architect Certification Program. The program defines global standards for measuring the skills and experience of IT Architects and for the operation of IT practices with an enterprise[16].

The Open Group has over 300 member organisations, with over 6,000 participants 19 countries. Some 47% of members come from North America, 34% from Europe, 12% from Asia-Pacific, and 7% from the Middle East and Africa.

The Open Group is an X/Open company established in England and Wales registration number 2134862.

4.1.11.1 *Education and training*

There are 5,176 certified TOGAF and 2,162 Foundation registered TOGAF practitioners for version 9. Some 8,600+ were certified at version 8.

Training is provided by The Open Group and a significant number of independent training providers. Typical courses available include:

- TOGAF® 9 for Practitioners
  - TOGAF® 9 for Practitioners (Level 1 & 2)
  - TOGAF® 9 for Practitioners (Bridge)
  - TOGAF® 9 for Practitioners (Level 1)
- TOGAF® 9 for Practitioners eLearning
  - TOGAF® 9 for Practitioners eLearning (Level 1 & 2)
  - TOGAF® 9 for Practitioners eLearning (Bridge)
  - TOGAF® 9 for Practitioners eLearning (Level 1)
- Enterprise Architecture for Practitioners
  - Enterprise Architecture for Practitioners (Practitioner)
  - Enterprise Architecture for Practitioners (Bridge)
  - Enterprise Architecture for Practitioners (Foundation)
- Enterprise Architecture for Practitioners eLearning
  - Enterprise Architecture for Practitioners eLearning (Practitioner)
  - Enterprise Architecture for Practitioners eLearning (Bridge)
  - Enterprise Architecture for Practitioners eLearning (Foundation)

4.1.11.2 *Coverage*

TOGAF is designed to support four architectural domains:

[16] See http://www.opengroup.org/itac

- The **Business Architecture** defines the business strategy, governance, organisation, and key business processes
- The **Data Architecture** describes the structure of an organisation's logical and physical data assets and data management resources
- The **Application Architecture** provides a blueprint for the individual application systems to be deployed, their interactions, and their relationships to the core business processes of the organisation.
- The **Technology Architecture** describes the logical software and hardware capabilities that are require4d to support the deployment of business, data, and application services. This includes IT infrastructure, middleware, networks, communications, processing and standards, etc.

The TOGAF Architecture Development Method (ADM) includes establishing an architectural framework, developing architecture content, transitioning and governing the realisation of architectures. ADM architects will produce a number of artefacts that include: process flows, architecture requirements, project plans, project compliance assessments, etc.

The architecture capability of an organisation needs capabilities to be developed in:

- Financial management
- Performance management
- Service management
- Risk management
- Resource management
- Communications and stakeholder management
- Quality management
- Supplier management
- Configuration management
- Environment management

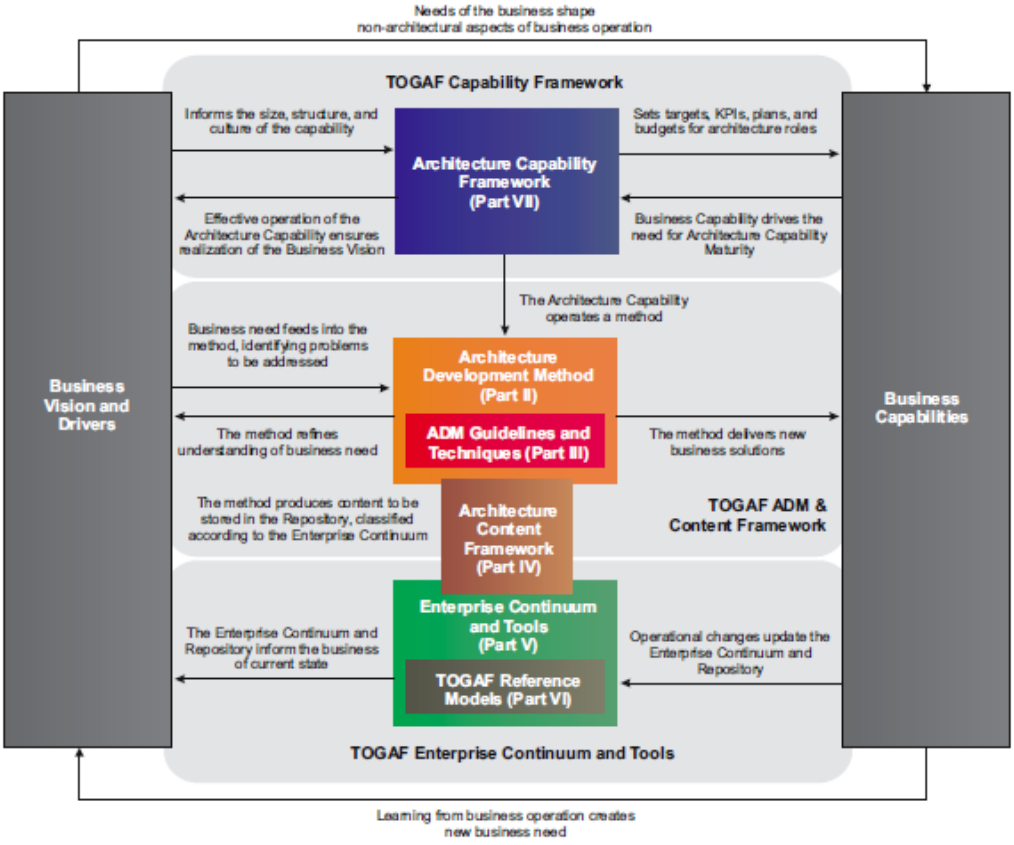


Figure 4 Structure of the TOGAF document (The Open Group, 2009)

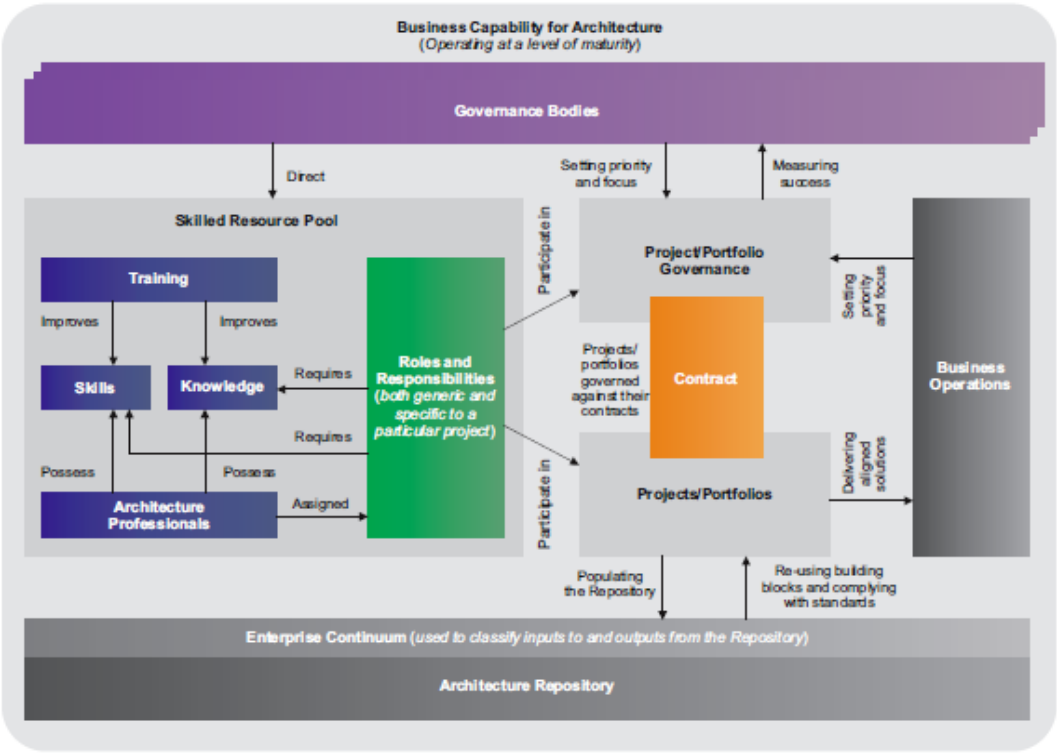


Figure 5 TOGAF architecture capability overview (The Open Group, 2009)

4.1.11.3 *Currency*

Version 8 was released in 2003 and version 9 was released in 2009. The Open Group has active research projects and listens actively to its membership community of enterprises vendors and practitioners. The Open Group sees one of its objectives as facilitating convergence into new or updated standards; emerging new technologies, practices, processes or tools. Thus, the Open Group is taking a pro-active approach to managing change.

4.1.11.4 *Usage*

TOGAF is used primarily as an Architecture Development Framework. TOGAF is also used to establish standards within and between companies working on projects.

4.1.11.5 *Contact Information*

Support organisation:	The Open Group
Body of Knowledge:	TOGAF
IVI's contact details:	http://www.opengroup.org/contacts/
Telephone:	+44-118 950 8311

4.2 Competences

4.2.1 Introduction to Competences

There are numerous definitions of the term "competence" (or competency). Two such definitions of competence are:

- "Underlying characteristics[s] of an individual that [are] causally related to criterion-referenced effective and/or superior performance in a job or situation" (Spencer and Spencer, 1993)
- "a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results." (European e-Competence Framework 2.0)

In many of the definitions of the term "competence" that we examined, they referred to a set of characteristics which demonstrated ability to deliver improved performance for a given job role.

The importance of ICT workers possessing inadequate competences should not be underestimated: for example, Lee and Lee (2006) stated that "The skills possessed by IT managers in an organisation reflect the degree to which the organisation can transform its IT investment into competitive advantage and new strategic opportunities. However, some organisations have complained that their IT managers do not possess the skills required for such opportunities." Thus, without continually developing relevant competences in workers, organisations are likely to lack or lose their competitive edge.

But clearly, in order to tackle this issue, organisations must first understand what competencies are needed. To this end, numerous frameworks have emerged, proferring corporate, national and international frameworks which identify the competences required of ICT professionals to perform in a job, and typically support identification of levels of performance.

The desktop research undertaken as part of this project examines a number of relevant competency models in Europe and elsewhere which tackle the issue of defining competences for a given job role. In this section, we have divided the review of these initiatives based on them being either nationally-focused (fostering efforts within a single country) or regionally focused (fostering efforts across a specific region).

Our research also identified that the individuals constructing competency models can often lack relevant task information (Lievens et al, 2004) and there is a tendency to "focus on what managers currently do rather than what is needed to perform effectively in the future" (Vakola et al, 2007). For this reason, Vakola advocated competency modelling using a proactive approach (e.g. conducting interviews with high-performance individuals in a given domain in order to support identification of the relevant competencies). We would recommend that these concerns be considered when determining any proposed professionalism framework.

4.2.1.1 *Iceberg Model of Competences*

Our research has identified that many of the popular e-Competence models are based on the Iceberg Model of Competences.

Ho and Frampton (2010)[17] contrast traditional job-analysis frameworks which focus on "what" is accomplished (and which emphasise the IT knowledge and skills required to achieve work objectives), with competence frameworks which believe that traits and motivations are just as important, and are more worker-focused, examining "how" the objectives are met.

One of the best known competence models is the Iceberg Model of Competencies[18], comprising five types of competency characteristics: motives, traits, self-concept, knowledge and skills. The model title stems from the fact that knowledge and skills tend to be more visible than traits and motives (which are more hidden and difficult to develop).

[17] A competency model for the information technology workforce: implications for training and selection, Communication of the Association for Information Systems, Volume 27, Article 5, pp 63-80, July 2010

[18] Spencer and Spencer, 1993

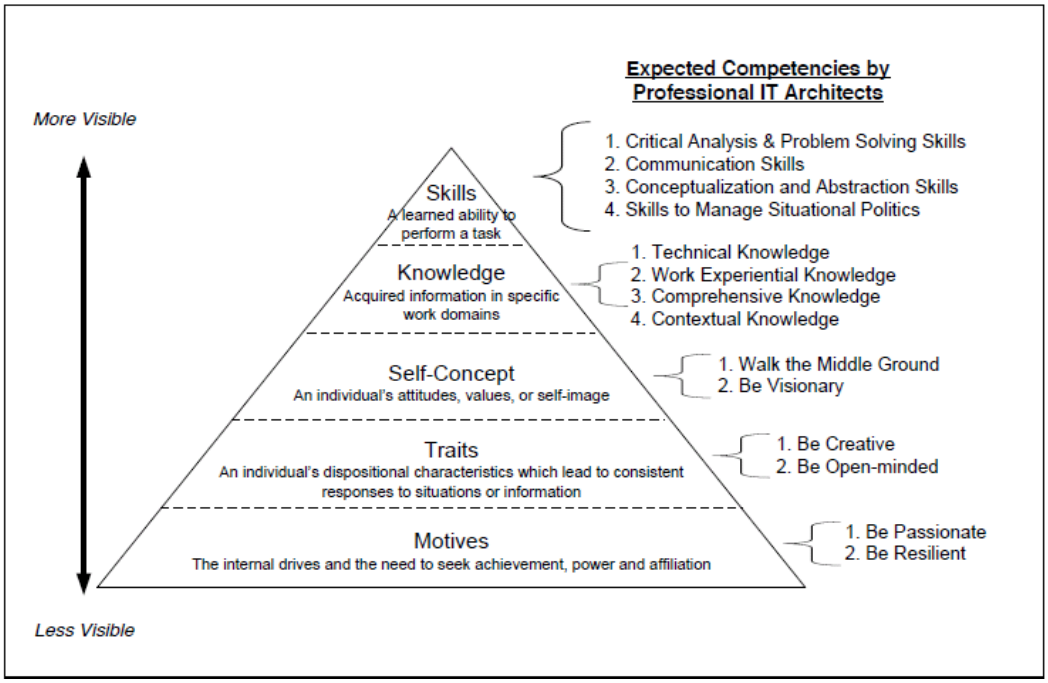


Figure 6 Competencies for IT Architect mapped to Iceberg Model (Extracted from Ho and Frampton 2010)

The above diagram shows expected competences for a single job role – in this instance, IT Architects. As we can see, the skills and knowledge are the characteristics of the role which are most visible, and which are most easily identified and developed in an individual.

This structure is reflected in many of the frameworks, where traits and motives are typically embedded within definitions, or which are assumed to mature in alignment with the level of proficiency of other skills/knowledge.

4.2.2 Competence Frameworks in Europe

4.2.2.1 *AITTS*

The Advanced IT Training System (AITTS) was established in 1998 as a joint project between the IT employers' and workers' organisations in Germany, with the aim of plugging the gap between vocational educational training and academic training. AITTS recognised that in many cases, highly skilled IT work required advanced competences, but ones which were not necessarily contained within an academic degree.

One of the key outputs of the original project in 2002 was to develop transparent occupational titles. Over time, this has evolved to define systematic career development paths with defined training and certification requirements. More specifically, successful completion of "an exam or certification within the AITTS *automatically* shows the ability to act competently in a defined context of business activities… Certification in AITTS is based on *having done* it."

AITTS career profiles are competence-based job role profiles. They create transparency about the work activities involved and the required competences: creating the basis for the definition of standards and qualifications.

Interestingly, there is a separation between the two professional levels and the specialist level based on the following delineating criteria:

- Problem-solving competence
- Communication
- Work Planning
- Shaping work processes and the decision-making framework
- Customer Relations
- Learning and transfer of knowledge
- Influence on the competitive situation of the business

Specialist job profiles are clustered into six functional groups. In contrast, the Professional roles within AITTS relate to managerial roles with larger areas of responsibility – or responsibility for organisational units, generally including personal and budgetary responsibilities. However, AITTS further stipulates that professionals are understood to be experts (not just managers!) "Their proficiency is based on comprehensive training and substantiated by experience grounded in the practice of their profession."

AITTS has also contributed to the development of the e-CF via its members of the CEN Workshop on ICT Skills.

4.2.2.2 *Career Space*

Career Space is an early example of a pan-European multi-stakeholder initiative focused on defining and fostering e-skills. Its importance was formally recognised in 2007, when the European Commission credited Career Space as the foundation for its e-skills agenda.

Formed in 1999, Career Space involved eleven major ICT companies working in partnership with leading European universities and the European Commission to encourage more people to join and benefit from the opportunities presented by e-Europe as well as to reduce the skills gap which threatened Europe's prosperity.

The first phase of work was to establish a set of "Core Generic Skills Profiles", defining the wide range of skills and capabilities required for the main job areas for which the ICT industry was experiencing skills shortages. These core profiles described the jobs, setting out the vision, role and lifestyle associated with them. "The specific technology areas and tasks associated with each job are also outlined, as well as the level of behavioural and technical skills required to carry out the profiled jobs"[19]

The next phase was to work closely with the education sector to devise e-competence curricula guidelines, intended to assist universities in designing courses to match the skills profiles and needs of the ICT industry.

[19] Curriculum Development Guidelines – New ICT curricula for the 21st century: designing tomorrow's education

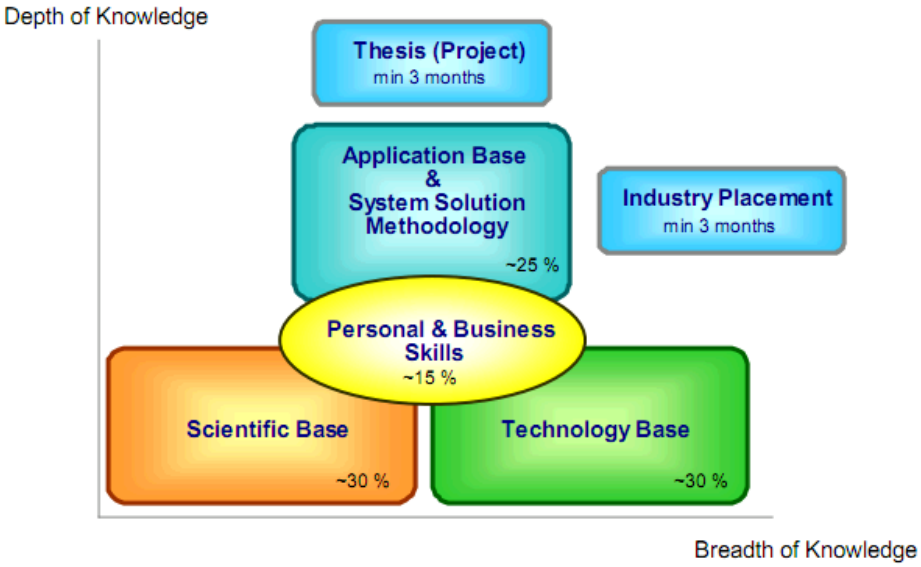


Figure 7 Scope of competence, showing model ICT curriculum content

Following analysis of a typical ICT graduate's role, the research identified the various tasks and characteristics of a particular job. Although the analysis showed that the activities varied according to the role, and placed different demand on the individual's knowledge and ability, the basic structure of the knowledge required remained the same. This knowledge requirement is shown in the diagram above.

Unlike the more recent ¨European e-Competence Curricula Development Guidelines" initiative (2010) which focused on curricula for developing an integrated set of technical and business skills (i.e. e-Competences), Career Space was more focused on technical e-skills, reflecting its objectives of meeting the skills shortage being experienced within the ICT industry specifically.

Stakeholder enthusiasm and subsequently, the relative importance of Career Space diminished following the dot-com crash.

4.2.2.3 *CIGREF*

CIGREF is a not-for-profit association of approximately 130 French companies and organisations, founded in 1970, covering a broad range of industry sectors. CIGREF cites its mission as follows: "To promote uses of information systems as a factor of value creation and source of innovation for the enterprise". Reflecting its composition and goals, CIGREF is managed by a Board of CIOs elected by other CIOs.

The three aims of CIGREF are:

- To bring together major companies using information systems
- To support CIOs and help them develop in the exercise of their profession
- To develop a long-term vision of the impact of information systems and technologies on the enterprise, the economy and society.

CIGREF has long since recognised the importance of identifying relevant skills demanded by their members in order to enhance business value from ICT investments. Critically, they developed a Job Profile Framework early on as a tool for IT Human Resource management (early 1990s). This evolved over time based on inputs from CIGREF members to support

identification of relevant competences for IT workers facilitating improved HR management, and subsequently to accommodate the relevance of describing appropriate career and qualification pathways.

CIGREF played an important role in the original development of the European e-Competence Framework (e-CF – see section 4.2.2.4), acting as a European expert during the formative phases of its development (2007). It was also one of the founding members of 'EuroCIO'. These actions reflect the growing importance that CIGREF attributes to the development of a European-wide ICT profession and the role that it can play in establishing this profession.

4.2.2.4 *European e-Competence Framework (e-CF)*

The European e-Competence Framework was initiated by the European Commission with a broad group of related stakeholders, with the objective of providing a "common, shared, European tool to support organisations and training institutions in recruitment, assessment, competence needs analysis, learning programmes, career path design and development"[20] as well as supporting policy makers in the definition of policies related to e-Skills development.

Prior to starting work on the e-CF, there was no common agreement on how to express ICT competences/skills requirements and gaps on a European level. As a consequence, many leading European firms were expending enormous costs and effort in establishing and maintaining internally developed ICT competence catalogues for HR planning, training and development, or were confronted with the prospect of adopting a distinct national level framework for each of the countries in which they operated. For this reason, the notion of a collectively produced framework represented a potentially major cost-saving opportunity. Moreover, at a European level, the framework represented an opportunity to improve the efficiency of an ICT-enabled European economy.

The development of the European e-CF was undertaken by the CEN Workshop on ICT Skills, a European workgroup consisting of both national and international representatives from the ICT industry, vocational training organisations, social partners and other institutions (approximately 100 entities in all). Also included within the e-CF project were members from AITTS, CIGREF and SFIA.

Version 1 of the e-Competence Framework was published in 2008, involving a broad group of stakeholders since its inception. The framework distilled the competence requirements of ICT professionals across all industry sectors to a mere 36 e-competences. Version 2 was issued in 2010.

In addition to translating the e-CF into other languages, there are also three related CEN projects running at European level, building on the e-CF:

- Development of ICT Professional Profiles project based on e-CF
- ICT Certification in Europe (linking certification offerings to e-CF)

[20] Building the e-CF – methodology documentation, e-CF 2.0 CWA Part III, 09/2010 www.ecompetences.eu

- e-CF application in SMEs
- Euromed: Digital job profiles for the Mediterranean Union in coherence with e-CF

The e-CF is structured along four dimensions:

- Dimension 1 comprises five e-Competence Areas, derived from the ICT business processes PLAN-BUILD-RUN-ENABLE-MANAGE
- Dimension 2 defines competences
- Dimension 3 provides proficiency level assignments that are relevant to each competence
- Dimension 4 provides short sample specifications of knowledge and skills (but is not intended in any way to be exhaustive)

The slide demonstrates a possible use-case for the four dimensions of the e-CF within an organisation.

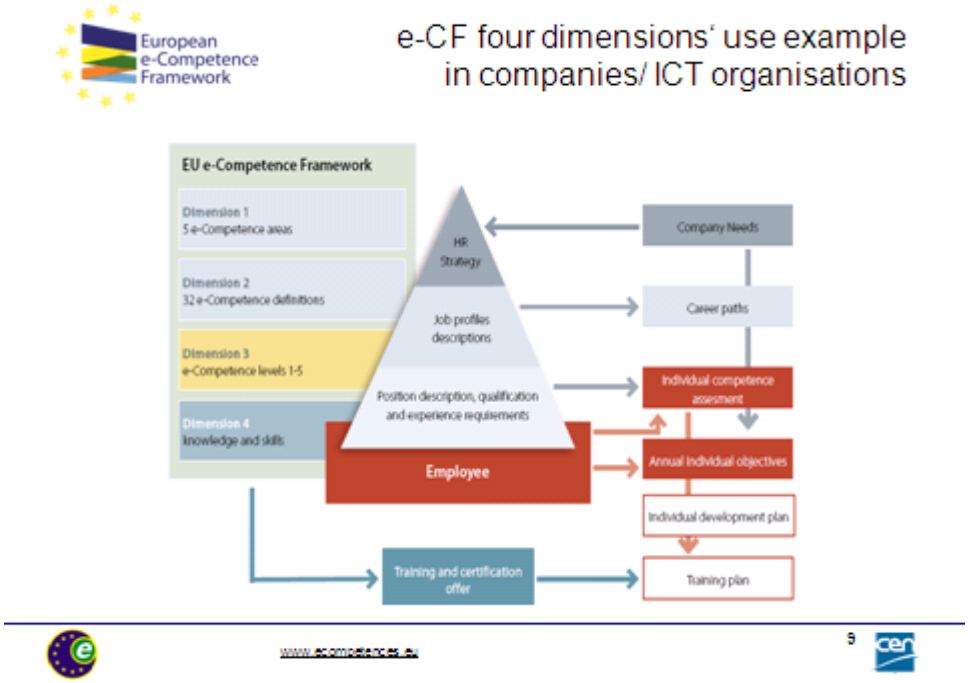


Figure 8 e-CF dimensions

It is also important to note that the 5 e-competence levels relate to levels 3-8 of the European Qualifications Framework (EQF). This is an important relationship, as it is likely to encourage education and training providers to map their offerings to the e-CF. The reason for this is that mapping certifications to the e-CF is currently a relatively straightforward peer review process, as opposed to the much more rigorous and time-consuming process required to achieve EQF parity.

To date, e-CF has been applied by companies, trade unions, qualification & certification providers in France, Germany, Italy, Estonia, Hungary, Bulgaria, Netherland, Canada, Malta and at EU level, with interest expressed from several countries outside of Europe. Importantly, the e-CF does not look to replace any existing national models – instead, the approach taken is based on national bodies wanting to adopt the e-CF, in parallel with existing national competence models, where desired.

4.2.2.5 *European Certification of Informatics Professionals (EUCIP)*

The EUCIP model provides for the definition and measurement of ICT skills and is currently used as the basis for the provision of certification and services in seven countries across Europe. The EUCIP programme, which was developed by CEPIS, The Council of European Professional Informatics Societies, is a professional certification and competency development scheme, aimed at informatics professionals and practitioners.

The EUCIP model includes:

- EUCIP Core that provides a solid foundation for all types of IT related work.
- EUCIP Professional – a professional certification scheme based around 21 professional profiles.
- EUCIP IT Administrator that focuses on the knowledge and skills for IT Administration.
- A range of business services have been developed to manage competence analysis and development

EUCIP has been used in seven European countries:

- To provide human resource and line managers with a common ICT job taxonomy based on competences and task descriptions
- As a base for professional development and staff retention
- As a benchmark tool for recruiting and skills procurement
- As a reference to compare learning programs in universities and to design lifelong training for practitioners
- To certify individual competences and control training effectiveness

EUCIP and the European e-Competence Framework (e-CF) have common features and some potential synergies. CEPIS has recently updated the EUCIP Professional profiles to version 3.0 which contain cross-references to e-CF[21]. The e-CF, as a common, accepted reference point for IT practitioner competences, has the potential to be an important input into the future evolution of EUCIP and its associated certification and service offering.

EUCIP's high level of granularity is useful for training departments to design and develop curricula and learning initiatives. It can provide detailed guidelines to identify knowledge and skill topics.

4.2.2.6 *ICT Professional Profiles project*

The primary objective of this project is to continue the convergence of the European ICT skills landscape by developing and providing a set of ICT role profile descriptions based on the e-CF. The project produced its final deliverable at the end of 2011, which was a set of approximately 20 European ICT professional profiles (see diagram below). These will

[21] "EUCIP Professional Profiles - Version 3.0" See http://cepis.org/index.jsp?p=1120&n=1122

provide the foundation for building individual position descriptions (as one position may correspond to all or be part of one or many jobs, depending on the size of the organisation) and for establishing career paths (in essence, a list of jobs to be pursued sequentially for self-development).

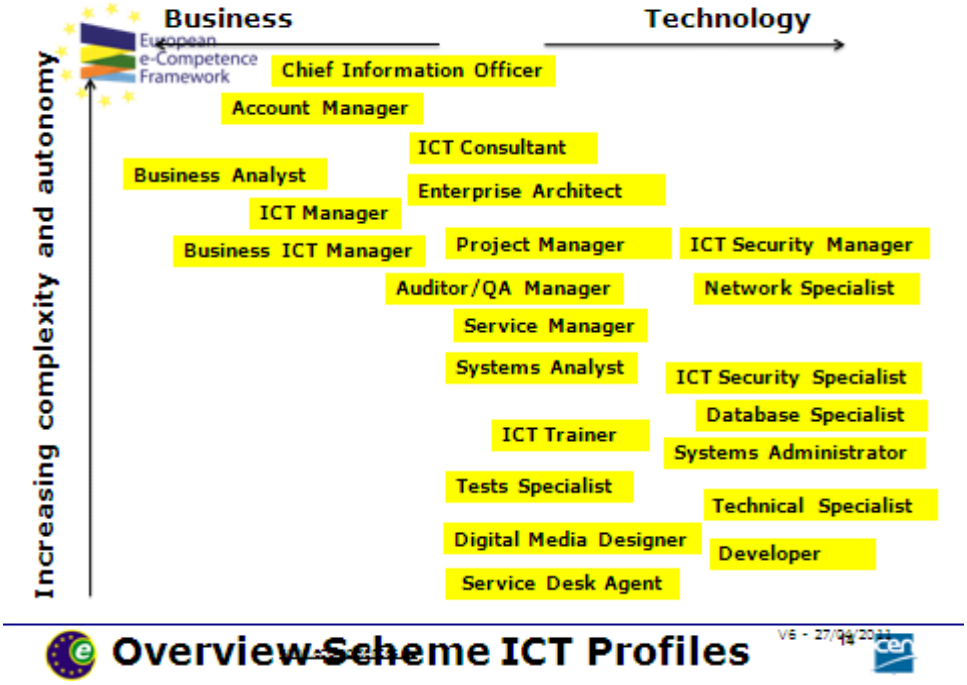


Figure 9 Overview Scheme ICT Profiles

4.2.2.7 *IT Professional Standards (e-Skills UK, 2011)*

The UK-based IT Professional Standards initiative describes the skills and knowledge required across the disciplines of the IT profession. Developed by e-Skills UK along with employers, professional bodies and other relevant partners, the standards "establish common terminology for describing IT disciplines including competence, knowledge and understanding statements that can be used and applied as appropriate."[22]
This initiative replaces the earlier e-Skills IT Professional Competency Model, Procom (to be confirmed). The disciplines currently covered by the new IT Professional Standards are as follows:

- business change
- information management and security
- IT service management and delivery
- programme and project management
- sales and marketing
- solution development and implementation
- solutions architecture
- transferable skills

[22] https://www.itskillsacademy.ac.uk/standards/about-the-it-professional-standards/

Draft standards have also been produced for

- Requirements engineering
- Modelling business and data
- Enterprise analysis
- Sales and marketing (in development)
- Information assurance (in development)

The diagram below shows an extract of the definitions for Level 3 of Systems Architecture (part of the solutions architecture discipline).

Figure 10 Extract of definitions for Level 3 of Systems Architecture

Importantly, the IT Professional Standards have been organised and aligned to the relevant Skills Framework for the Information Age (SFIA) skills and levels (more specifically, SFIA levels 2 to 6). These standards are designed to complement SFIA by adding detailed specifications for performance criteria, knowledge and understanding across all levels. e-Skills UK already has plans in place to continually review and develop the content to ensure that it reflects the changing needs of employers, educators, trainers and other stakeholders across the IT profession.

4.2.2.8 *Skills Framework for the Information Age (SFIA)*

The purpose of SFIA is to provide a standardised view of the wide range of professional skills needed by people working in Information Technology. As such, SFIA contains definitions of recognisable IT skills so that they can be, for example, incorporated in the job descriptions or role profiles used by an organisation. The SFIA claims to be the "world's most popular definition of IT skills".

Although originating in the UK, SFIA has since acquired partners in Australia (including Australian Computing Society), Belgium, Chile, Italy, Japan, New Zealand and Ireland. Notably, "the International Professional Practice Partnership (IP3), a global initiative sponsored by the International Federation for Information Processing (IFIP), has adopted SFIA as the skills and competence reference for the international professional standard - the IP3P"[23].

The SFIA Foundation in the UK is a not-for-profit collaborative initiative between e-skills UK, British Computer Society, Institution of Engineering and Technology (IET), IT Service Management Forum (itSMF), and Institute for the Management of Information Systems (IMIS). The Foundation works to further develop SFIA (work on version 5 is already underway) and encourage and support its use within organisations using information systems. The SFIA Council provides input to help shape strategic direction.

SFIA is constructed as a simple two-dimensional matrix. One axis shows the skills in categories and subcategories; the other shows a more specific definition at each of the levels (theoretically up to seven) at which the skill is recognised. The definitions (or "descriptors") used are intentionally only defined in terms of the capability required (e.g. database design) rather than being tied to specific technological domains (such as knowledge of a particular database type).

The seven levels of responsibility, as defined by SFIA are:

7 SET STRATEGY, INSPIRE, MOBILISE
6 INITIATE, INFLUENCE
5 ENSURE, ADVISE
4 ENABLE
3 APPLY
2 ASSIST
1 FOLLOW

Organisations can use SFIA to produce job profiles/descriptions by combining the SFIA skills with information about behavioural competences and relevant technologies/products. As with other competence framework, these can subsequently be used to support the management and deployment of IT capability as a whole.

[23] http://www.sfia.org.uk/cgi-bin/wms.pl/928

4.2.3 Competence Frameworks outside Europe

4.2.3.1 *The Information Technology Promotion Agency (Japan) – Skills Standards for IT Professionals (ITSS)*

The Japanese Information Technology Promotion Agency (IPA) was originally established in 1970, and its stated goal is "contributing to the growth and advancement of the Japanese economy by providing the strategic technological and human resource infrastructures"[24]. One of the four principle fields in which it operates is IT Human Resource Development[25], which incorporates projects for IT skills level improvement.

The Common Career/Skill Framework (CCSF) serves as the reference model for the three skills standards (Skills Standards for IT Professionals, User Information Systems Skills Standards and Embedded Technology Skills Standards) each of which provides guidelines for the effective development and deployment of human resources[26], and are centred on career level assessment methods and terminology.

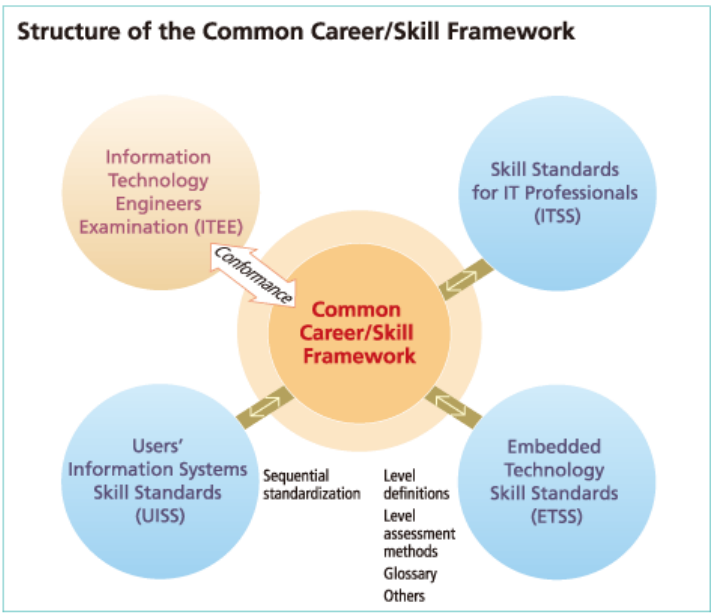


Figure 11 Structure of the Common Career/Skill Framework[27]

Of particular relevance to this research project**, The Skills Standards for IT Professionals (ITSS)** was developed as an industry skills standard in 2002, to enable the development of essential IT practitioners, in response to companies' cost-saving offshoring initiatives. ITSS is used as a tool within organisations to define and develop ICT workforce capabilities, by identifying the skills needed by people working in the IT services industry.

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[24] IPA Presentation: ITSS Latest Activity highlights and ITSS Implementation to Asian Country (Jan 2011)
[25] The other three fields being: Software Engineering, IT Security and Open Software
[26] Note: The CCSF framework also acts as a reference model for the IT Engineers Examination.
[27] Diagram source (Common Career/Skill Framework): http://www.ipa.go.jp/english/about/outline/human/02.html

ITSS breaks down into 11 job categories and 35 specialty fields (each with seven levels of proficiency, based on experience and results). This approach allows engineers to develop roadmaps for career progression.

ITSS Career Framework

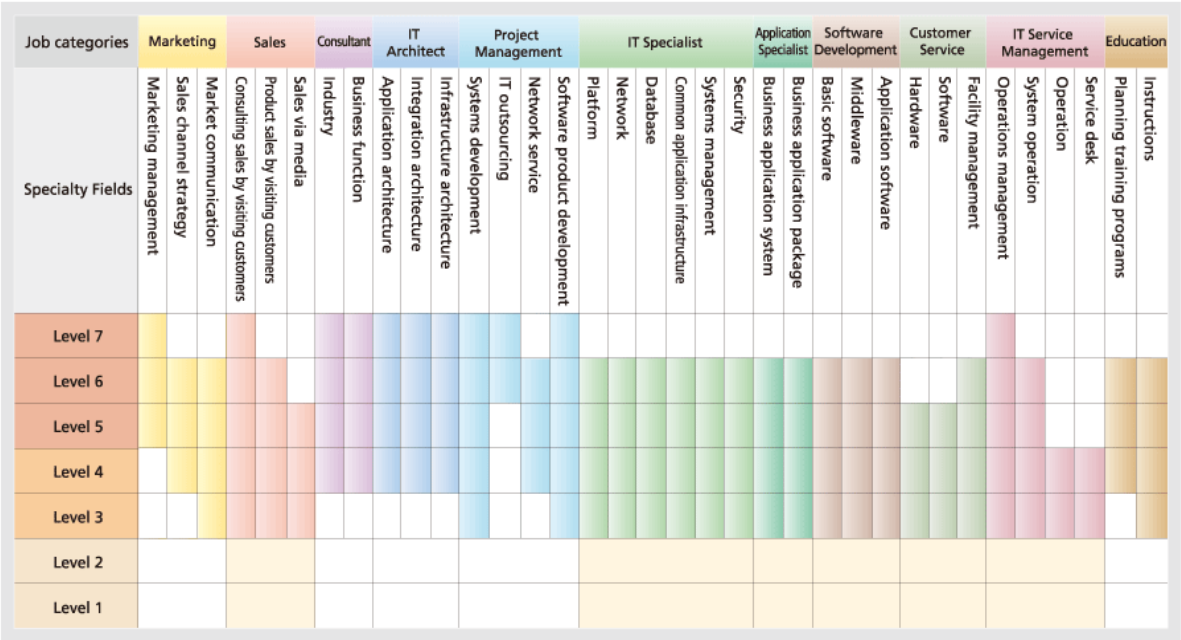


Figure 12 ITSS Career Framework

At each level for a given specialty, the following details are defined:

- Roles and Responsibilities
- KPI to assess experience and results
- Expected skills (Skill area definitions for job category and specialty fields)
- Expected proficiency of skills (Knowledge items for each skill in dictionary)
- Training Roadmap / Model curriculum

The seven levels equate to different levels of proficiency as shown in the table below and, importantly, align with different components of the IT Engineers Exam[28] as follows:

[28] 15.4 million people have taken the ITEE exam, with 1.78 million having passed.

	Level Concept	Related ITEE	
		Skills	Exp
7	Lead World IT	-	-
6	Lead Domestic IT	-	-
5	Lead Company	-	-
4	Lead Team	Adv	-
3	Do by oneself	AP	AP
2	Assist	FE	FE
1	Follow	IP	IP

[29]

Table 5: Mapping of ITSS Skills Levels to IT Engineers Exam

Approximately 90% of large enterprises and over 60% of SMEs within Japan have introduced or are considering introducing ITSS. IPA has also established an agreement with the Vietnam Software Association for implementation of the ITSS in Vietnam (Murayama, 2011; IPA, 2011).

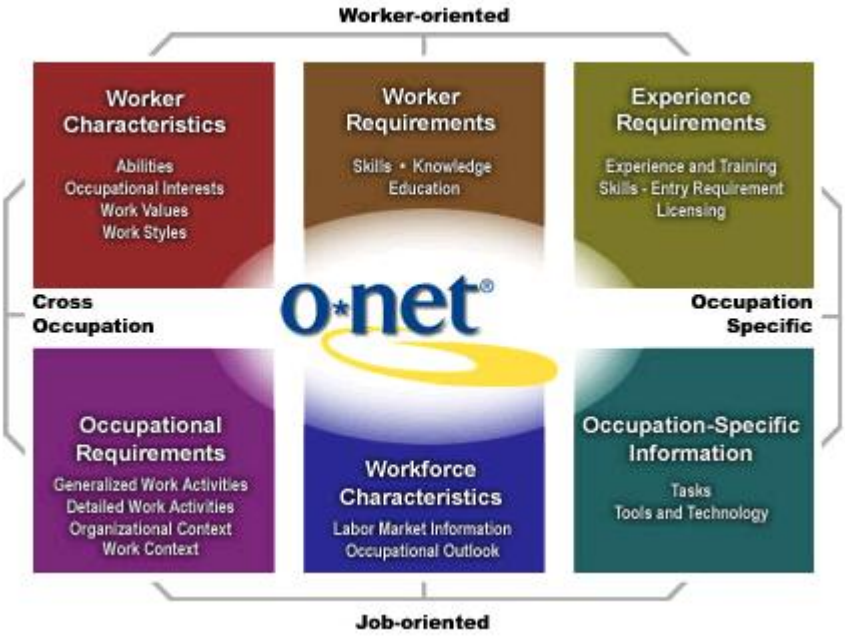
4.2.3.2 *O*Net (United States)*

O*NET is designed to serve as an occupational/labour market information resource for public and private sector use and development. Developed under the sponsorship of the US Department of Labor/Employment and Training Administration (USDOL/ETA), the Occupational Information Network program[30] (O*Net) is the main source of occupational information in the US, with the O*Net database containing information on hundreds of standardised and occupation-specific descriptors, for approximately 1000 occupations. The database, which is updated by surveying a range of workers from each occupation, serves as the key source for O*Net Online (an interactive application for exploring and searching occupations) and Career Exploration Tools (a set of assessment instruments for workers looking to change career). In doing so, it provides a common language for defining and describing occupations, and supports public and private sector efforts to identify and develop the skills of the American workforce. That is to say, organisations typically use the resource to develop job descriptions, and individuals use it to identify jobs suiting their skills and interests.

The O*Net Content Model (below) is the conceptual foundation of O*Net, identifying the key types of information about work, and integrating them into a consistent model.

29 Adv: Advanced Professional Exams; AP: Applied IT Engineer Exam; FE Fundamental IT Engineer Exam; IP Information Technology Passport Exam

30 http://www.onetcenter.org/



(extracted from **http://www.onetcenter.org/content.html**)

Figure 13 The O*Net Content Model

Recognising the complexity and scale of the task, the O*Net database acts as a publicly funded hub for an extensive network of developers, agencies and organisations, all working to enhance the employment potential of Americans. While the government accepts its role to ensure objectivity and fairness in data collection, it is recognised that a public/private partnerships are required to leverage the data for usage across the nation. Thus, under the direction of USDOL/ETA, and in its leadership role, the O*Net Development Center provides core staff to manage projects and contracts and provides technical support and customer service to O*NET users.

4.2.3.3 *Nasscom pyramid model*

NASSCOM, established in 1988 as a not-for-profit organisation, is cited as "the premier trade body and chamber of commerce of the IT-BPO industries in India"[31], representing more than 1200 member companies with a presence in India – operating broadly in the spheres of software development, software services, software products, consulting services, BPO services, e-commerce & web services, engineering services offshoring and animation and gaming. NASSCOMM's membership base constitutes over 95% of industry revenues in India and employs over 2.24 million professionals.

NASSCOM aims to drive the overall growth of the global offshoring market and maintain India's leadership position, by taking up the role of a strategic advisor to the industry. As one of the key aspects of its strategy, this includes supporting efforts to improve talent supply both in terms of

[31] http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=5365

quantity as well as quality. India currently has around 347 institutes of higher education and 16,885 colleges[32] – contributing towards the production of approximately 495,000 technical graduates each year.

NASSCOM has adopted a pyramid model (see below) to better understand the industry's skills requirements – in turn, this has been used to create specific education and development initiatives. For example, NASSCOM has worked with the Ministry of Human Resource Development to set up Indian Institutes of Information Technology (aimed at increasing numbers of highly specialised professionals in emerging fields) and IT/Engineering Finishing Schools (aimed at enabling young technical graduates to become "industry ready") as well as extending the NASSCOM Assessment of Competence to the IT Services sector (NAC-Tech: aimed at creating an industry standard for evaluating students wishing to work in the industry).

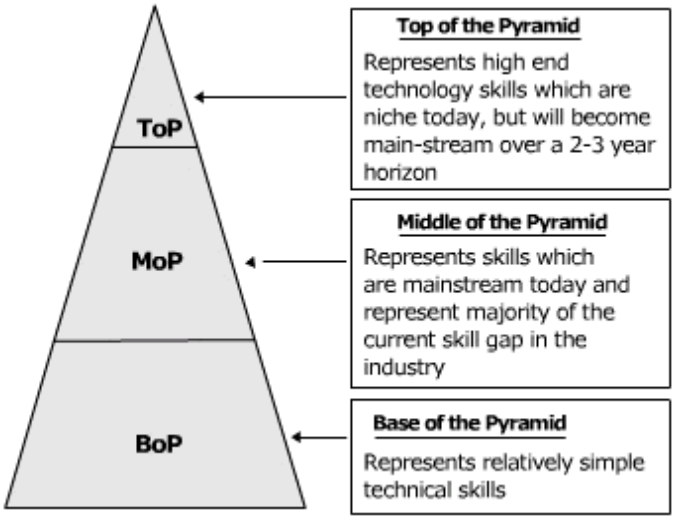


Figure 14 NASSCOM's Pyramid Model[33]

Another important initiative of NASSCOM is the IT Workforce Development initiative, which is focused on aligning industry and academia. For example, NASSCOM has organised workshops, conferences, faculty sabbaticals, training programmes and mentorship initiatives to synchronise IT education and industry requirements.

Interestingly, NASSCOM also supports The National Skills Register (NSR) which is a centralised database of employees of the IT services and BPO companies in India, containing third party verified personal, qualification and career information for each individual.

NASSCOM Assessment of Competence – Technology (NAC-Tech)[34]

[32] The numbers of institutions cited is not confined to those focusing on technical subjects only.

[33] http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=51761

[34] http://www.nac.nasscom.in/nactech/

NAC-Tech has been conceived as an industry standard assessment and certification program to support the development of an "employable" workforce (targeted at final year students), thereby creating a continuous supply of talent for the IT/Engineering industry.

The assessment aims to identify the level of talent across India, and provide feedback to them on areas for development in order to increase their employability.

The assessment covers a series of mandatory areas (Verbal Ability, Analytical Ability, Attention to Detail, Programming Fundamentals, Learning Ability, Written English) as well as an optional domain knowledge test (covering, for example, a wide range of key IT concepts).

4.3 Education and Training

4.3.1 Introduction to Certification

Information Communications and Technology (ICT) certifications (or e-certifications) are generally regarded as credentials received by an individual in a specific skill or set of skills as a result of attaining performance specifications outlined in a job profile. This credential is determined by an objective assessment process run by a third party. Certifications therefore validate the competencies of an individual; they represent a link with continuous professional development; and provide evidence that an individual remains up-to-date in a rapidly changing industry. Referring to the Beier and Dixon (CEN 2006) definition in CEN Workshop Agreement 15515:

"*Certification often means the awarding of a certificate, or other testimonial, that formally recognizes and records success in the assessment of knowledge, skills and/or competencies, as the final step in the completion of a qualification. However, it is also used, in particular in relation to ICT practitioner occupations, to mean the Qualification as a whole. It is important to be aware of these two ("narrow" and "broad") meanings of certification".*

E-certifications are provided by numerous bodies (CEN, 2009). The most common classifications include:

- ICT university and other academic institutions educational qualifications;
- Professional associations qualifications;
- Vendor specific qualifications, focused on the use of vendors own products, such as certifications provided by Microsoft, Cisco and IBM;
- Vendor neutral qualifications, which are similar in nature but present the technology in a manner that eliminates the "utopian view of the vendor towards its product" and are focused more on best practices and methodology in a specific area. Examples include A+ and Network+ provided by CompTIA;
- Vendor independent qualifications, which are delivered by organisations completely independent of vendors. Examples include the Information Systems Examinations Board (ISEB) qualifications provided by the British Computer Society (BCS), European Certification of Informatics Professionals (EUCIP) provided by the Council of European Professional Informatics Societies (CEPIS) and the Advanced IT Training System (AITTS) in Germany.

CEN (2009) identifies the value components of certifications from the perspectives of numerous stakeholders, including employees, employers, learners, customers and suppliers of ICT products/services, vendors, and society as a whole. The CEPIS (2005) study "ICT-Skills Certification in Europe" identified the top five drivers for ICT professionals to acquire

e-certification: 1) to increase credibility; 2) to assess knowledge; 3) to prepare for a new job; 4) to improve personal productivity; and 5) to meet job requirements. Similarly, the IT Certification Council (2011) highlights the following drivers for acquiring certifications:

- Improving technical competence and tangibly measuring and validating their knowledge in specific areas;
- Creating opportunities for career enhancement;
- Ensuring currency of skills;
- Enabling portability across organisations;
- Providing evidence to employers that individuals possess the requisite skills for specific jobs;
- Providing improved service and support to customers, thereby improving customer satisfaction.

Many individuals typically enter the ICT field via university/academic institutions educational qualifications. For those who do not pursue such qualifications, the certification process most often begins with acquiring vendor-neutral certifications. Such e-certifications build foundational knowledge and skills which are needed to later master vendor-specific product knowledge and skills (CompTIA, 2004). Multiple points of entry to the certification process are facilitated by a pyramid certification model. This is built on the concept of a certification ladder, which delineates various degrees of knowledge and skills associated with certification programmes. It promotes the advancement of an individual's skill set and knowledge to higher levels. In general, credentials fall into three categories:

- Basic or entry level certifications which promote the development of basic understanding, proficiency and knowledge in core skills for those with little experience in an IT area e.g. Microsoft Office Specialist or ECDL / ICDL Certification.
- Intermediate level certifications for individuals with some proven knowledge and technical skills working in their chosen field e.g. Microsoft Certified IT Professional. Re-certification may or may not be required.
- Advanced level certifications for highly skilled ICT professionals; these often require a combination of education, experience and basic and intermediate certifications as prerequisites e.g. Microsoft Certified Master Certifications. Many require periodic re-certification and/or annual fees to maintain the credential (Tittle and Kyle, 2010).

The certification process is reliant on several supporting mechanisms including defined skill standards, methods for accrediting learning material and curricula, validation of assessment tools, objectivity in administration, reliable protocols for data security, and mechanisms for tracking compliance and recertification. (CEPIS, 2005).

As outlined in the following sections, the ICT certification market has grown considerably during the past decade with numerous certification providers and certification products. Transparency of these certification product's quality assurance mechanisms is difficult to ensure because numerous providers deliver them on a national basis. Quality criteria for different parts of the certification system, e.g. testing, learning materials, applying quality standards etc in some cases may differ within and between countries. Similarly, differences are evident in accreditation measures and legal regulations in each country (Weiβ, 2009). Such complexities have resulted in past reports of a "certification jungle" that makes it difficult to select the certification best suited to an individual's career development goals. According to Van der Voort (2005), there are simply too many certifications on the market for stakeholders to be able to understand their inherent value. However, numerous initiatives, identified in the following sections, have attempted to address these problems and promote greater transparency of the ICT certification landscape.

4.3.2 Certification Initiatives in Europe

4.3.2.1 *E-Skills Industry Certification Report (2004)*

This report on the situation and role of e-skills industry certifications was prepared by CompTIA for the 2004 European e-Skills Conference, on behalf of the e-Skills Certification Consortium (eSCC[35]). The report discusses the role of Industry Based Certifications (IBCs) in lifelong learning in terms of addressing the needs of performance components required for ICT roles. Of the eight performance components identified by Campbell (1990) – (i.e. role specific task proficiency, non-role specific task proficiency, written and oral communication, demonstrating effort, maintaining personal discipline, facilitating peer and team performance, supervision, management and administration), neither the formal nor the informal education and training systems could deliver all eight. ICT certifications scope and reach are oriented towards role specific task proficiency. However, role specific task proficiency together with demonstrating effort and maintaining personal discipline are three performance components required of every role. This implies that IBCs will continually be relevant to firms.

However, because IBCs only measure one of the performance domains relevant to ICT roles, the report argues for a need to identify and establish ways to fill these gaps. This involves identifying the academic knowledge and skills, employability knowledge and skills, and specific occupational and technical knowledge and skills that pertain to key ICT roles. In order to bridge the gaps, the report presents the need for a partnership approach between government, industry, and educational institutions with a view to providing a "*learner-centred credentialing system*". For such a system to be viable there is a need for *"an overarching common architecture and common language"* to exchange information between formal and non-formal systems, and *"a need for a slew of middleware that leverages the effective and efficient use of performance standards and certifications*." Addressing these needs would promote the leveraging of IBCs; identification of ICT certification landscape gaps, use of a user centred quality assurance process, and improved knowledge flow between industry, education and training.

4.3.2.2 *ICT–Skills Certification in Europe (2005)*

This study carried out by CEPIS was launched in 2004 by the European Centre for the Development of Vocational Training (CEDEFOP) to promote discussion, at a European level, on ways towards a more harmonised ICT certification landscape. The CEPIS survey reported in 2005 on several dimensions of ICT certification in Europe; in total 106 different certification systems were identified by the survey respondents. Dimensions examined included:

[35] e-skills Certification Consortium – A multi-stakeholder consortium that joined together industry, governments and training institution representatives to promote industry-based and vendor independent certifications within EU national education frameworks. It sought to develop public private partnership agreements within Member States to incorporate certifications within national education systems, to influence EU level policy development, and give policy guidance on developing professional ICT skills and competencies. e-Skills Certification Consortium has evolved into the current European e-Skills Association with broader aims.

- Market recognition,
- Level of recognition,
- Level of skills (qualification),
- Geographic coverage,
- Certification body,
- Degree of standardization,
- Outcome of certification,
- Target group,
- Success factors.

Survey respondents largely indicated that Europe needs fewer and more relevant e-skills certification schemes. Respondents largely supported the general perception that greater transparency, comparability and portability of e-skills certifications were needed. This would require enhanced cooperation and joint activities between relevant stakeholders through public-private partnerships. Further, a pan-European meta or reference skills and qualification framework that incorporates learning outcomes was suggested as an important tool in any European approach to e-certification.

4.3.2.3 *The Harmonise Project (2007)*

This EU Leonardo funded project carried out by CEPIS reviewed certification schemes for ICT professional qualifications with a view towards achieving greater harmonisation across Europe. The project sought to identify the need for a more harmonised certification market, and to identify future steps and measures in achieving this. A stated vision was "*to develop a new harmonised certification scheme, cross-domain and cross-brand, responding to market demand for increased professionalism in ICT, harnessing support from the major ICT vendors and offering a "win-win"-situation to industry, practitioners, ICT vendors as well as ICT professional institutions*". The study examined:

- ICT professional labour market
- ICT skills certification system
- ICT certification market
- Quality standards for ICT professional certification.

HARMONISE suggested that the market was a "certification jungle" with 62 providers, 617 types of qualifications, and 5 million certifications issued over the previous six years.

4 Pillars to Harmonisation

The report suggested that any proposed harmonisation solution would have to cope with national market characteristics e.g. culture, attitudes, maturity, regulations, structure etc. and would need to develop partnerships to work towards a non-competitive market space. In fact CEPIS suggested that a harmonized European approach to certification needed to be built on four pillars:

- Explaining the roles/needs of ICT professionalism and standards, with a view towards driving an international ICT profession and establishing an agreed ICT body of knowledge that encapsulates principles for certification.
- A multi-stakeholder partnership approach between professional and industry associations, ICT vendors, government bodies and social partners. Further, an ability to respond to local and global market characteristics, and an "umbrella" approach that allows different certification schemes to co-exist and be cross referenced was

required. This was with a view towards creating a non-competitive environment ("blue ocean" and/or "mutual zones of trust").
- Agreed quality standards, principles and measures that are transparent and flexible, and explained through a quality framework. The survey found that such standards were highly demanded components of any European framework for ICT certification.
- Network of relationships between ICT certifications, supported by collaboration between providers, acceptance and integration of other certifications, methods to combine content of different providers etc. Flexibility in terms of combining modules and training content would lead to enhanced learning opportunities and ability to react to skill gaps.

Roadmap towards Harmonisation

CEPIS (2007) also proposed a roadmap towards Harmonisation which includes a number of objectives, steps and measures as outlined in Figure 15. Critical objectives in working towards harmonisation include for example achieving a common understanding and agreement on the requirements of harmonisation, and achieving greater transparency and more widespread recognition of e-certifications. Critical measures include for example establishing a round table as a forum for information exchange and a facilitator of a partnership approach. The report outlines that the "*starting point of the harmonisation process is the red ocean, which is characterised through market competition, clear business interests and the attitude of looking for clear benefits that justify the investment in any harmonisation endeavour*". CEPIS argues for a market-driven approach that receives the support of ICT professional associations and vendors, in establishing clear measures and actions.

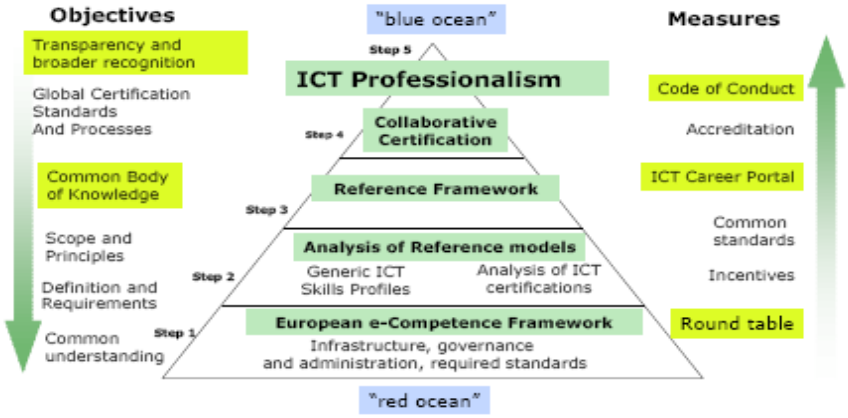


Figure 15 Roadmap towards Harmonisation

Challenges of Harmonisation

Working towards a harmonised certification market is faced with several challenges:

- The main goal of the major ICT vendors, leading the ICT certification market, is higher revenues. For a harmonisation solution to be effective, it needs to overcome market boundaries by establishing common goals. Hence, a considerable difficulty is achieving the willingness to buy into harmonisation and the concept of a non-competitive environment, while simultaneously ensuring the ability to create sufficient revenues for the ICT vendors.
- Ability to collaborate, and integrate the content of different certification systems, evaluate this content and promote its acceptance, e.g. the European Credit Transfer

System's (ECTS) awarding of credits to areas of qualification or learning achievements.

Key Success Factors to Harmonisation

Factors critical to success of the project included:

- A harmonised approach to certification needs to be separated from market influences and business interests. Any solution needs to be considered in terms of a non-competitive environment where all stakeholders participate and contribute.
- Establishing a framework that integrates and recognises content from different providers. Such a framework should be aligned with the European Qualifications Framework (EQF) and ECTS. Agreed standards are critical for positioning products on such a framework and in ensuring the content of certifications do not coincide.
- A learner-centred focus.
- A multi stakeholder and partnership/round table approach involving all key stakeholders, e.g. professional associations, industry ICT associations, ICT vendors and so on.

4.3.2.4 *ICT Certification in Europe (2009)*

The CEN e-Certification in Europe project operated between March 2008 and July 2009. It updated and extended the data of the CEPIS HARMONISE project. The CEN project describes:

- Updated statistics of the e-certification market in Europe
- The creation of "landscape maps" showing the main organisations involved in certification in some member states, and for the EU
- A methodology for positioning e-certifications against the e-Competence Framework (e-CF)
- A proposed European model for e-certification schemes

In the two years between the Harmonise and the current report, some changes in the market were evident. For example, such views as the "certification jungle", "vital eco-system" and "parallel universes" between market certifications and the university education system were now regarded as out-dated. The emerging view was towards a "coalescence of universes", where education, training, and certification all support a cycle of lifelong learning. Examples of collaboration between industry ICT certifications and public education is evident in many countries e.g. the SAP university alliance in Germany, the Microsoft IT academy program in Germany, and use of the EUCIP syllabus in companies, universities, and institutions in Italy. However, both political and academic resistance towards this coalescence remains in some Member States. "*This CEN project is aiming to assist that convergence by presenting and describing a market structure with supporting tools in which the respective contributions of education, certification and professionalism are recognised and respected for their value to lifelong learning*". Vendor specific, vendor neutral and vendor independent certifications (as defined in section 4.3.1), are the focus of this report.

Project Action Item 1: Market Dynamics

The project updated the market statistics collected in the HARMONISE project, and sought to establish a process for so doing annually. In excess of 100 providers, offering more than 1300 certification products, were identified. Leading providers by market share included:

- Microsoft
- CompTIA
- IBM
- Cisco
- Sun
- Oracle
- EXIN
- ISEB
- SAP
- HP
- ISACA
- CISSP

The market was growing by approximately 25% annually (total of 10 to 11 million), having demonstrated almost 4-fold growth between 2000 and 2007**.** The report highlights that the actual volume of learning may be 10 times the volume of certifications issued, suggesting there may be over 100 million learners globally. However, difficulty exists in breaking down these figures to a national or European level. Suppliers often regard this data as commercially sensitive and in many cases such data is not readily available.

Project Action Item 2: e-Certification Landscape

Action 2 of the project created a set of landscape maps of the organisations involved in e-certification in Europe. An overview is provided in the following table:

Map of European Organisations	
Standards Bodies (National or European)	ETSI; ECMA; CEN
Public or Government Bodies, Ministries, Departments or Parliament Groups	DG Education & Culture; DG Employment and Social Affairs; DG Information Society & Media; DG Enterprise & Industry (European Commission Departments)
National or European Agency	Cedefop; ETF
Research Agency	Empirica; EITO
Education	Informatics Europe; European Schoolnet
User Body	EuroCIO
Trade Association	European e-Skills Association (EeSA); Digital Europe; PIN-SME; CompTIA
Trade Union	EMF/UNI Europa; ETUC
Professional Body	CEPIS; FEANI
Certification System, scheme	ECDL Foundation; EUCIP

Table 6: Summary of Certification Organisations in Europe

In addition, maps for 5 member states (UK, Germany, Italy, Ireland and Belgium) were prepared, identifying education bodies, training institutions, accreditation bodies, certification bodies, corporate bodies, public/government bodies, standards bodies, research agencies, national or European agencies, professional bodies, certification

schemes, educational vendors, trade unions, trade associations and so on. Investigation also revealed that there was a poor culture of certification in France and hence no landscape map was created. The maps provide understanding of the state of play with respect to certification in each country. Differences exist across Member States due to political, legal, regulatory, education and cultural issues. For summary findings on the 5 member states, the reader is referred to CEN (2009: p13-14).

Some non-national features of the e-certification scene were identified:

- Fragmentation of education and training responsibilities to sub-country level e.g. Italy
- Cultural divergence between the "Anglo-Saxon" approach dominated by professional bodies and qualifications based on education, experience and responsibility levels; and the "continental" approach dominated by academic and state bodies that control formal, theoretical education
- The viewpoints between employers, employees, and learners who regard e-certifications as value credentials, and the ICT vendors who regard e-certifications as the revenue source that supports and protects their business.

The landscape maps help highlight why "*localization*" is important not only because of language and cultural issues, but also because institutions have a role to play in the accreditation process.

Project Action Item 3: Deploying the e-Competence Framework (e-CF)/Positioning Certifications against the e-CF

Action 3 was focused on relating certifications against other certification products and qualifications. The report proposed a self-assessment methodology, based on peer review to position certifications against the e-CF and thereby also relate them to the EQF. The process involves selecting the relevant e-competence area for the certification; selecting the reference e-competence(s) that best matches the certification content; selecting the most appropriate proficiency level; consulting with and responding to external peers; and recording who was responsible for the process. This approach is similar, albeit more formal, to the steps taken by CompTIA in creating their certification roadmap (Figure 16). The CompTIA certification roadmap, similar to a European metro map, links approximately 50 certifications of the leading ICT certification providers and has support of several vendors.

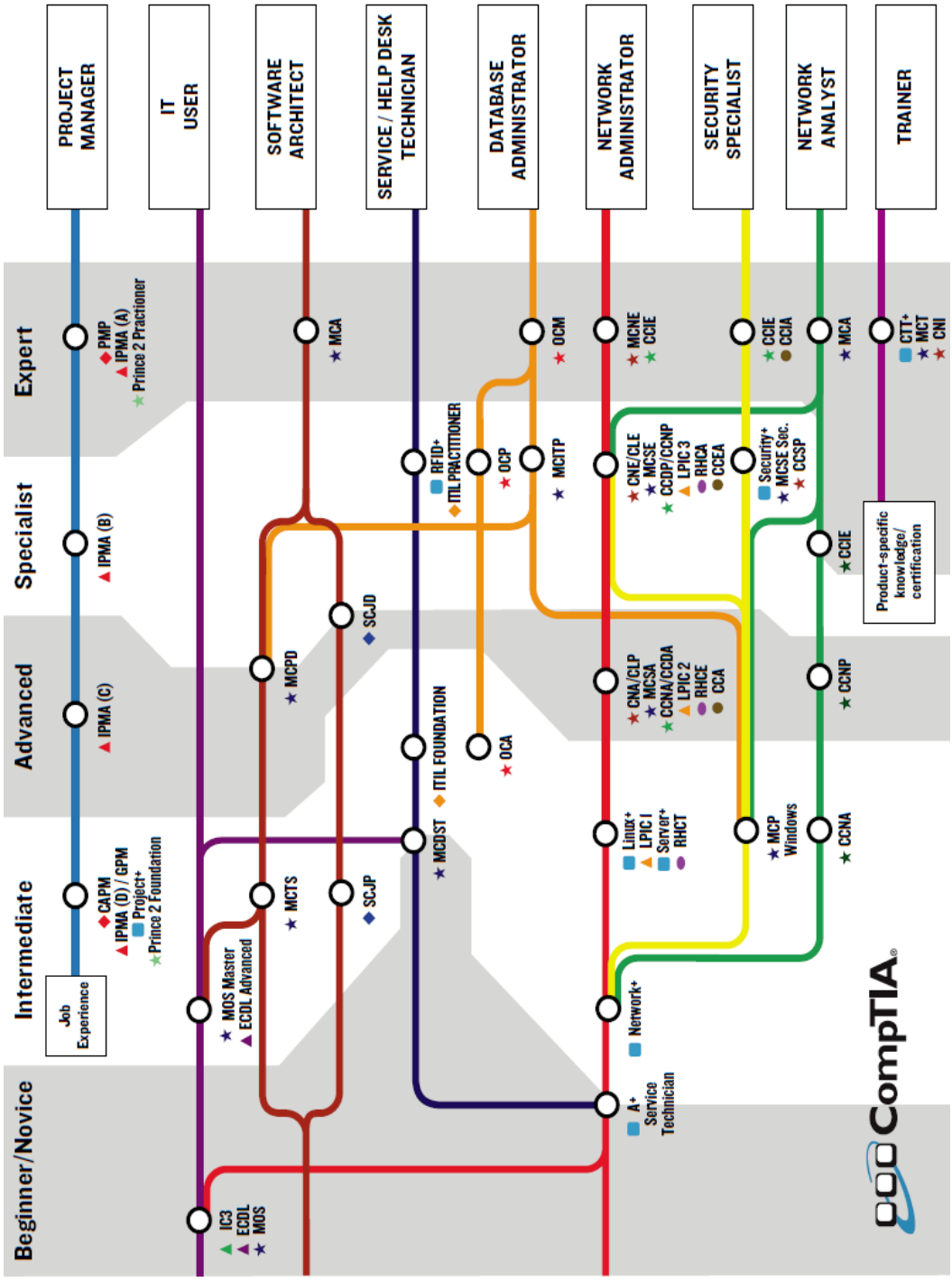


Figure 16 CompTIA's Certification Roadmap

Project Action Item 4: European Model for e-Certification Schemes

Action 4 of the project was concerned with proposing a European model for e-certification schemes. The view was to improve the market structure and its inter-operability by adopting best practice principles, including:

- Schemes will position certifications against the e-CF
- Schemes will provide information on certification content to their users

- Schemes will adhere to an established quality assurance mechanism e.g. EN ISO/IEC 17024
- Schemes will avoid lock-in mechanisms to a specific certification brand
- Schemes will comply with the gathering of annual metrics.

Recommendations of the Report

The project resulted in several recommendations to advance ICT certification initiatives in Europe. These included the annual collection of certification market statistics; the maintenance and extension of the country landscape maps; the positioning of certifications against the e-CF by certification vendors; the re-development of CompTIA's certification roadmap to the e-CF's proficiency levels and competence areas; the validation of the proposed European model by a number of leading certification providers; and the creation of round tables for discussion at a country level. These recommendations were the basis for the current "ICT Certification in Action" project (see 4.3.2.5 below).

4.3.2.5 *ICT Certification in Action (2011)*

This is the follow-on project from the "ICT Certification in Europe" CEN Workshop Agreement, running from May 2010 to July 2011. The project aims to:

- Maintain and extend the country landscape maps of key certification stakeholders
- Update metrics on the main certifications in the major markets annually
- Trial the CEN (2009) methodology for positioning ICT certifications against the content, levels and structure of the e-CF and EQF. This aims to examine how the e-CF may serve as a foundation for comparing certifications and navigating the market.
- Redevelop CompTIA's navigation roadmap for positioning the major certifications and relate it to the e-CF.
- Pilot test the CEN (2009) European model for ICT certification schemes
- Co-operate with relevant ISO and CEN initiatives

The project presented its interim findings in January of this year (O'Sullivan, 2011) and published its interim report in February (O'Sullivan, Weiss and Sharkov, 2011). Progress is outlined under the following headings.

Landscape Maps

The interim report suggested that the certification landscape maps have served as an important tool supporting collaboration between industry, education and government and in identifying differences between local markets. It sees them as being of particular relevance to vendors and national computer societies. These landscape maps are maintained by country expert groups. Four landscape maps have been updated, and new maps created for Romania, Bulgaria and the Netherlands (Draft format).

Market Dynamics

The certification and training markets have been impacted by the global economic crisis. Despite an increase in the certification market in 2009, the market flattened in 2010 and as of January 2011 was in decline. As a result the major vendors have ceased publishing statistics on their certification volumes and hence difficulties were experienced in updating market data. The European IT Observatory (EITO) has been approached to gather certification market statistics on an annual basis.

Growth among the number of certification providers in recent years has given rise to a price war, resulting in the closure of some offices e.g. CompTIA's Brussels office. Similar closures are experienced across ICT training companies. The economic crises have resulted in a disconnect between training and certification markets; particularly in poor countries, while individuals may undertake training, certifications costs may be unaffordable. One noticeable trend however is the expected doubling of the number of information security professionals from 2.3 million in 2010 to 4.3 million in 2015. This will result in significant growth in the number of related certifications, as certifications are ranked as important by 90% hiring in this field.

Re-development of CompTIA's Certification Roadmap

Some progress has been made on redeveloping CompTIA's certification roadmap to incorporate e-CF competence areas and proficiency levels. Discussions with CompTIA have taken place in London and Bonn. To date, an English version mapped to SFIA and a German version mapped to e-CF levels have been drafted. Neither is linked to specific competence areas. Further discussions on this activity are on-going.

Positioning Certifications against the e-CF

Both individual and collective discussions with certification vendors on positioning certifications against the e-CF have taken place. "*The Bonn meetings have shown that better transparency and recognition is of high interest to cert vendors*". Weiss and Sullivan's (2010) paper presented at the e-Challenges conference[36], building on Weiss (2009), put forward a competence meta-model for qualifications and skills as a foundation for this positioning exercise between certifications and the e-CF. Successes include:

- EXIN's (certification organisation in the Netherlands) mapping of 3 out of 5 streams of its domestic product TRACKS accreditation to the e-CF version 1. These include its business information manager, tester, and IT project manager roles. Each track consists of a number of core tasks related to the specific role, and for each of these tasks, the relevant e-CF competence and e-CF level have been selected.
- Microsoft's mapping of 5 leading certifications to the EQF and achievement of accreditation in Ireland by its Higher Education and Training Awards Council (HETAC). ECTS credits for each certification are also established. Accreditation is now being sought in 5 other member states. It has begun mapping of certifications against the e-CF, covering both competence areas and levels, as a further way to achieving formal EU certification recognition.
- The SEI is interested in mapping certifications related to the CMMI to the e-CF, and plans have been established to undertake this mapping process within the next 6 months. The aim is to map to e-CF levels, and ultimately to specific competencies that relate to specific roles in the business.
- Discussions with CompTIA have resulted in a draft German version of CompTIA's certification metro roadmap linked to the e-CF and a draft English version linked to SFIA. Neither are linked to specific competence areas and are subject to validation.

[36] http://www.echallenges.org/e2010/default.asp

- Workshops held by Cert-IT (accreditation agency in Germany) involving Microsoft, Cisco, and CompTIA, is working on the positioning of the 74 certifications from CompTIA's roadmap to the e-CF and EQF. These workshops have partially positioned 7 certifications from four different vendors against CompTIA's roadmap, the e-CF, EQF and SFIA levels. Plans exist to also map to specific e-competence areas in future months. The possibility of developing a certification portal, with certifications linked to e-CF levels is also being considered.

4.3.3 Certification Initiatives in the US

4.3.3.1 *CompTIA's TechCareer Compass*

CompTIA's TechCareer Compass is an online searchable database assisting individuals to choose the right certification to meet their career development goals. The initiative was started by the US Dept of Labor in an effort to develop a skilled US workforce; CompTIA was chosen to develop and maintain the site. It offers a repository of over 250 certification programs, searchable by vendor, government compliance, skill category and job title. For each certification it presents the associated job skills and titles. Hence, for individuals it represents a tool assisting in skills enhancement and career progression.

4.3.3.2 *US Department of Education - States Career Cluster Initiative (SCCI)*

The US States Career Cluster Initiative (SCCI) was established under the US National Career Technical Education Foundation (NCTEF) in 2001. Its goal was to develop career clusters as a means to facilitate the change from education to career. It involves partnerships between state, educators, schools, employers, and industry to develop pathways from secondary school to college to the workplace. This involves developing curriculum guidelines, standards, assessments and professional development material for core, pathway and specialisation skills for 16 career clusters that have been identified. One such career cluster is Information Technology. The scope of this career cluster is "*building linkages in IT occupations framework: For entry level, Technical, and Professional Careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services*". The initiative presents career cluster knowledge and skill statements that apply to all careers in the IT cluster. IT careers are divided into 4 pathways: network systems, information support and services, programming and software development, and web and digital communications. Jobs and credentials associated with each pathway are identified.

4.3.3.3 *United States Agency for International Development (USAID) - Centre of Excellence in ICT Training and Certification (2009)*

This report was prepared for USAID to outline the key steps in developing a centre of excellence in ICT training and certification in South East Europe and the Caucasus. The goal is the creation of a sustainable system of ICT quality competence centres, the backbone of which will be supported by several training and certification centres of excellence. Cooperation between these centres is expected to improve access to knowledge, training and certifications adapted to the requirements of the region, greater cooperation between the ICT industry and universities for research, and greater ICT competitiveness, among other benefits.

4.3.4 Certification Initiatives in India

4.3.4.1 *Computer Society of India's Education Directorate*

The Computer Society of India (CSI) was established in 1965. One of its key priorities is the promotion of ICT as a profession. In so doing, it organises regular information exchange and dissemination events and facilitates career development through training provision and updating of skills. The CSI Education Directorate undertakes several activities pertaining to training and certification. Services provided include for example:

- Provision of professional certifications and training programmes to CSI members and the public, including the underprivileged and individuals with disabilities
- Carrying out certification examinations with a view to increasing their uptake by industry
- Leveraging the benefits of affiliations with international professional societies, for example by providing British Computer Society certification examinations
- Evaluating and accrediting professional programmes
- Collaborating with certification providers/agencies to expand the reach of global certifications and skill developments to members of CSI.

The CSI Education Directorate is also developing training and certification programmes in more emerging technological areas, for example, wireless technologies; bio-informatics; green IT; nano-technology; virtualization; grid computing; cloud computing, among others.

4.3.4.2 *Computer Society of India's Memorandums of Understanding (MOUs).*

The Computer Society of India has established a number of Memorandums of Understanding (MOUs) with national and international bodies. Examples include MOUs with Microsoft, the IEEE, the Project Management Institute (PMI), the British Computer Society (BCS) and the Centre for Development of Advanced Computing (C-DAC) in India. These MOUs generally specify actions in establishing a closer working relationship between the CSI and the various bodies. Some of these MOUs emphasise relationships between industry and educational institutions. For example, MIEL's postgraduate programme in Information Security Management called PRISM is offered through various educational partners, with successful participants in the programme receiving joint certification from CSI, MIEL e-Securities Ltd and the educational institution. Similarly, the MOU with Microsoft involves provision of Microsoft faculty development programs for various CSI Chapters and Colleges, as well as Microsoft webcasts on emerging technological trends for CSI professionals and academics.

The MOU with the British Computer Society aims to share publications, services and qualifications for their respective members, and is evidenced by the provision of BCS certifications by the CSI's Education Directorate. The MOU with the Project Management Institute is focused on realising the benefits of project management certification throughout India through implementing best practices and standards of project management, while the MOU with C-DAC aims to strengthen the reach and capabilities of both groups through joint programmes on training, skill development and certification.

4.3.4.3 *IEEE Initiatives*

The Siemens Group in India has endorsed the IEEE Computer Society's Certified Software Development Associate (CSDA) and Certified Software Development Professional (CSDP) certifications. The two credentials are regarded as the benchmark for software certification and are used to raise software development standards within the company. As part of the

IEEE's India Initiative, the IEEE Computer Society is engaging with Indian technical institutions, particularly computer science, software engineering, IT and software applications faculty/students. VIT University, Vellore became the first Indian university to sign an agreement to offer the CSDA certification to its students and entry-level software engineers.

4.3.5 Certification Initiatives in Japan

4.3.5.1 *The Information Technology Promotion Agency*

The Information Technology Promotion Agency (IPA) of Japan focuses on assuring security and reliability of IT in the social infrastructure, promoting international competitiveness, and developing skilled IT human resources. Its principal fields of work are IT security, software engineering, open software and IT HR development. IPA initiatives for developing skilled human resources include:

- Preparing the IT Engineers examinations,
- Developing Skills standards - Skill Standards for IT Professionals (ITSS); Embedded Technology Skills Standards (ETSS); and User Information Systems Skill Standards (UISS).

Similar to the view reported in "ICT Certification in Europe" re the "coalescence of universes" the IPA also promotes industry-academic government collaboration. IPA holds the role of executive office for the Industry-Academic partnership for Human Resource Development. This partnership was established by the Ministry of Economy, Trade and Industry (METI) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT). IPA also formed collaborative agreements with the National Institute of Informatics (NII) of the Research Organisation of Information and Systems (ROIS), which is an inter-university research institute. It established an Industry-Academia IT HR development implementation working group. IPA also has plans pertaining to the design of curricula that reflect company needs and developing frameworks for using instructors from companies. Further, its iPedia website provides information on upgrading and expanding practical IT education.

4.3.5.2 *Japan Information Technology Services Industry Association*

Japan's Information Technology Services Industry Association (JISA) was founded in 1984. It is focused on enhancing the Japanese economy and more specifically on maintaining growth in its Information Services industry. In terms of initiatives pertaining to certification, JISA aims to promote partnerships between industry and academia, and offers training courses based on the ITSS to further develop ICT professionals' skills.

4.3.5.3 *Information Processing Society of Japan*

The Information Processing Society of Japan (IPSJ) was established in 1960. It is involved in numerous areas of activity in information processing and computer science, including for example establishment of special interest groups, standards development, research, and educational activities. Similar to the Computer Society of India, it has established a number of partnerships with other organisations in the form of Memorandums of Understanding. Examples include agreements with the IEEE, the Association for Computing Machinery (ACM), the Association Française des Sciences et Technologies de l'Information (ASTI), the Computer Society of India and the Korean Information Science Society. These MOUs promote greater understanding and cooperation between the societies in several matters,

some of which pertain to training and certification. For example, the agreement between the IPSJ and the ASTI discusses the possibility of engaging in joint projects on educational materials and standards. The IPSJ-IEEE MOU has a similar remit but is extended to include mutual participation in standards development and information exchange on standards initiatives between the respective groups.

4.3.6 Certification Bodies Examples

Certification bodies are typically overarching organisations or alliances of organisations that work to promote the take up of certification across various areas of ICT. Activities carried out by these bodies vary, but may include for example development of knowledge, provision of a wide range of certification programmes, promotion of certification quality assurance, development of new or adherence to existing standards, and in some countries provision of accreditation for vendor certification programmes etc. This section provides an overview of a selected sample of certification bodies. Note it is not intended as an exhaustive list.

4.3.6.1 *IT Certification Council (ITCC)*

The IT Certification Council (ITCC) is comprised of industry leaders who are focused on growing professional ICT certifications and promoting the benefits of acquiring certification, so as to ensure professionals have the requisite skills to effectively operate in the ICT industry. The ITCC's work involves for example establishing best practices, ensuring examination testing security, and promoting certification value to industry, employers and professionals. Members of the Council include Microsoft, IBM, Novell, HP, Cisco, EXIN, Certiport, among others.

4.3.6.2 *The International Certification Council (IC-Council)*

The IC-Council is a non-profit alliance of organisations focused on ensuring competency and high degrees of professionalism by setting global standards for licensing, accrediting, certification and credentialing programmes. While educational accreditation is carried out by government organisations in most countries, in the United States quality assurance for professional certification and academic degrees is performed by private associations, not the government. The IC-Council promotes quality assurance and improvement through accreditation via peer evaluation. In addition to providing recommendations to educational institutions, the IC-Council provide accreditation for vendor specific certification programmes, programmes administered in training centres and so on.

4.3.6.3 *Institute for Certification of Computing Professionals (ICCP)*

The Institute for Certification of Computing Professionals (ICCP) is based in Illinois USA. It promotes professional credentials for the following professions: Systems Analysts, Computer Scientists, Computer Programmers, Database Administrators, Business Analysts, Network Administrators, Computer Software Engineers, Information Technology Managers, Chief Information/Technology Officers, Computer Security Analysts, Telecommunications Analysts, Business Intelligence Professionals, Data Management Professionals, and IS/IT Consultants. Certifications include the Associate Computing Professional (ACP), Certified Business Intelligence Professional (CBIP), Certified Computing Professional (CCP), Certified Data Management Professional (CDMP), Information Systems Analyst (ISA) and Information Systems Professional (ISP). Through these certifications, the ICCP aims to "*assess stringent industry fundamentals*" through its professional examinations. Its CCP certification is recognized worldwide as an indicator of a high degree of professional competence.

4.3.6.4 *International Information Systems Security Certification Consortium (ISC)²*

The International Information Systems Security Certification Consortium positions itself as the world leader in certifying information security professionals. Based in the US, it has offices in London, Hong Kong and Tokyo, and provides vendor neutral certifications in more than 135 countries. It was the first information security certifying body to conform to the ISO/IEC 17024 certification standard. Certification programmes include Systems Security Certified Practitioner (SSCP); Certified Authorization Professional (CAP); Certified Secure Software Lifecycle Professional (CSSLP); Certified Information Systems Security Professional (CISSP); Information Systems Security Architecture Professional (ISSAP); Information Systems Security Engineering Professional (ISSEP); and Information Systems Security Management Professional (ISSMP). The CISSP certification is its gold standard flagship product offered globally. The (ISC)² also develops and maintains an information security critical body of knowledge.

4.3.6.5 *Information Systems Audit and Control Association (ISACA)*

The Information Systems Audit and Control Association (ISACA) is an independent, global organisation established since 1969, and is involved in developing, adopting and using leading information systems knowledge and practices. Certification programmes include the Certified Information Systems Auditor (CISA); Certified Information Security Manager (CISM); Certified in the Governance of Enterprise IT (CGEIT); and Certified in Risk and Information Systems Control (CRISC). ISACA certifications are recognised and accepted worldwide, and according to the organisations website, they have been consistently rated in independent studies as among the most "impactful certifications an IT professional can earn".

4.3.6.6 *Institute of Electrical and Electronic Engineers (IEEE)*

The IEEE computer society is the world's leading computing professionals' organisation. The computer society is focused on advancing theory and application of computer and information-processing technology, and is known globally for its computing standards activities. IEEE offers the following certifications: Certified Biometrics Professional (CBP), Certified Software Development Associate (CSDA), Certified Software Development Professional (CSDP), and Wireless Communication Engineering Technologies (WCET). The CSDA credential is aimed towards entry-level software professionals or software engineering graduates as a bridge between formal academic knowledge and the requirements of industry. The CSDP credential is aimed towards mid-career professionals looking to further develop or confirm their proficiency levels and advance their careers.

4.3.6.7 *Software Engineering Institute (SEI)*

The Software Engineering Institute (SEI), based at Carnegie Mellon University, offers certifications in computer security, process improvement, measurement and analysis, software architecture, service-oriented architecture, among others. Its certification programs comply with all Carnegie Mellon University and SEI policies.

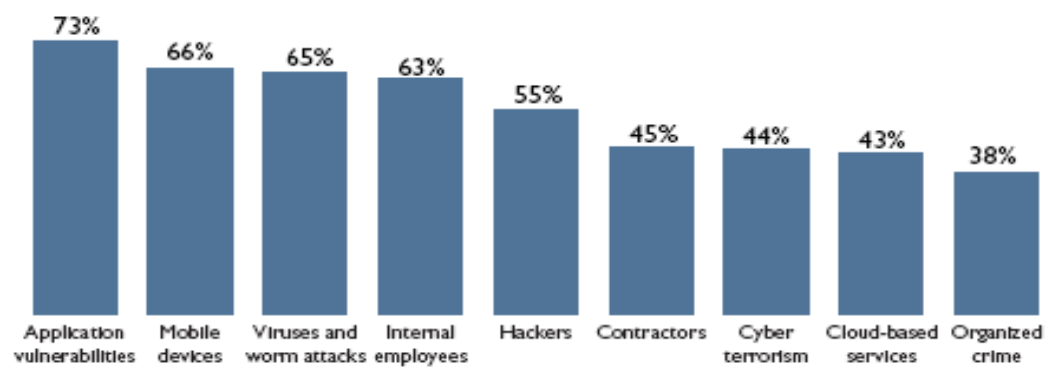
4.3.7 Certification Vignette

Information Security Professional Certification – Challenges of Cloud Computing

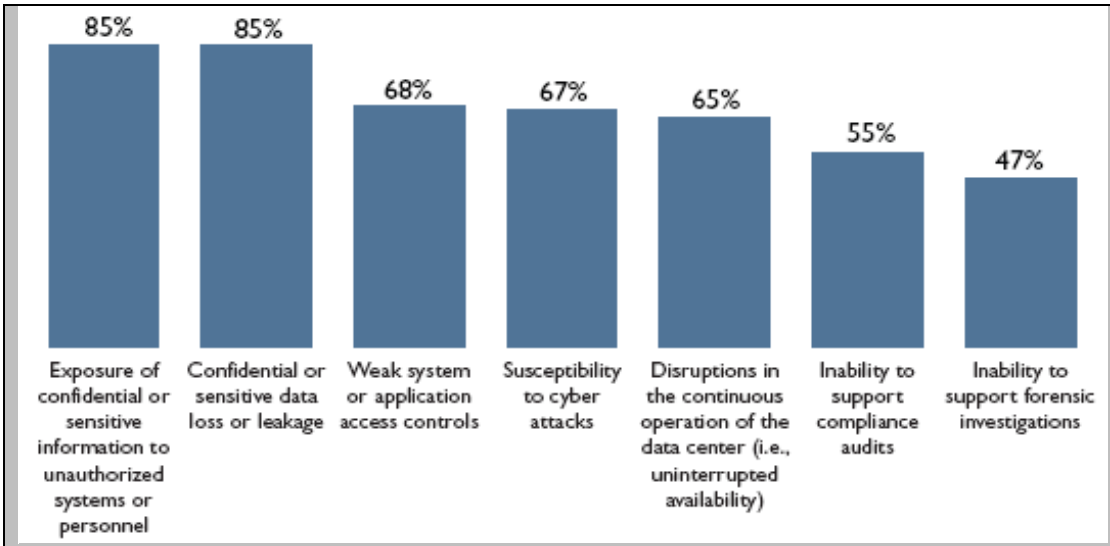
The 2005 ICT Skills Certification in Europe report discussed a lack of common agreement on

what constitutes a security professional's role. As cited in this report "*depending on the responsibilities and functions of a security position and the infrastructure of the organisation, someone in this role at one company can have a drastically different skill set than someone in a similar role at another company*". In this report, the ICT security professional was described as "*one of the hottest occupations in the ICT industry*" due to the lack of suitably qualified individuals.

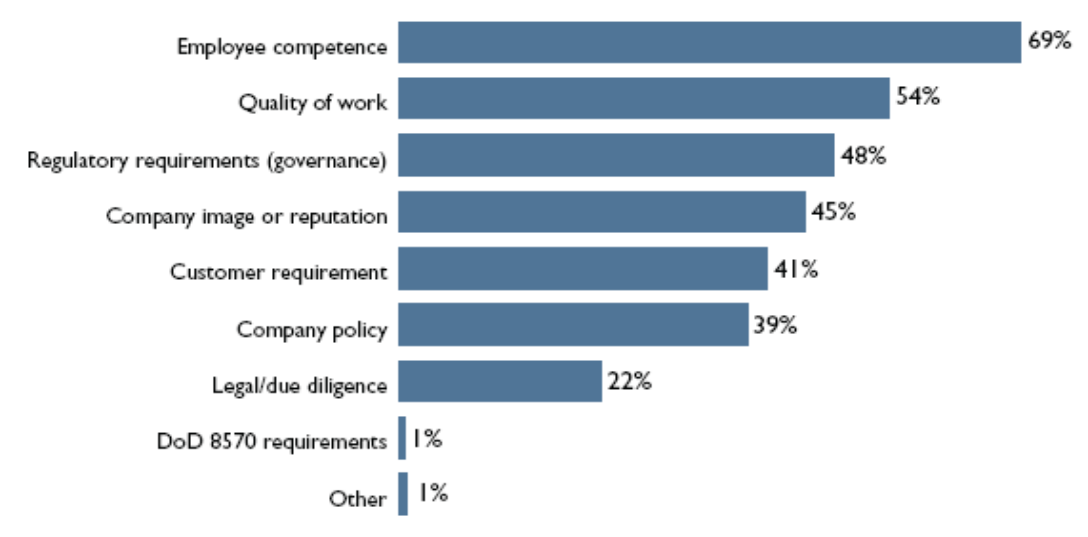
Six years on, there remains a skills gap to effectively protect organisations resultant from the increasing pace of technological trends and new developments. Nonetheless, the popularity of Information Security roles and certifications has intensified. The 2011 $(ISC)^2$ Global Information Security Workforce Study conducted by Frost and Sullivan gathered insight from 10,413 information security professionals around the globe. It found that the number of professionals in this area was expected to double to 4.2 million by 2015. Thus, in contrast to other professions, despite the economic recession, approximately 60% of $(ISC)^2$ members reported an increase in salary during 2010. The growing interest in this area is driven by the increasing number of security threats facing organisations. Top security threats are outlined in the below figure.



Of particular concerns are emerging challenges related to cloud computing, mobile applications, social media, and associated new skill requirements. Honing in on the challenges of cloud computing, the greatest concerns exist around the potential exposure of sensitive information and its loss or leakage. The below figure highlights security challenges related to cloud computing. Further cloud risks are identified by ENISA (2009) including loss of governance, lock in, isolation failure, compliance risk, management interface compromise, data protection, insecure or incomplete data deletion and the malicious insider. 74% of respondents indicated a need for new skills to effectively address the challenges of securing cloud based technologies in the coming years.



Certifications are an important requirement for recruitment in the field of information security and the market in this area continues to grow strongly. The below figures indicates reasons as to why managers prefer hiring certified information security professionals.



Approximately 60% of the professionals surveyed planned to acquire new certification during 2010-2011. The impetus to acquire new certification perhaps can be tied to the diminishing relevance of some ICT certifications over time. This is particularly so in relation to information security where new technological trends give rise to new security risks and challenges. In order to overcome this diminished relevance, a membership requirement of many certification bodies stipulates the need to re-certify periodically in order to remain current in the field. Examples of certifications serving the information security professional include CompTIA's Security+ certification, Microsoft Certified Systems Engineer (Security Specialisation), Cisco Certified Security Professional, Cisco Certified Network Associate, Check Points Certified Security Expert, (ISC)² Certified Information Systems Security Professional and ISACA's Certified Information Security Manager.

4.3.8 Standards

4.3.8.1 *Introduction*

As outlined earlier, the certification process is dependent on several supporting mechanisms, one of which is defined quality standards. A standard is defined by the International Electro-technical Commission as a "*document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context*". The following sections discuss the roles of standardisation bodies, and issues with and examples of standards pertaining to ICT certification.

4.3.8.2 *Standardisation Bodies*

International Standardisation Bodies

International standards bodies include for example the International Organisation for Standardisation (ISO), the International Electro-technical Commission (IEC), and the International Telecommunications Union (ITU).

The ISO is the leading global developer of international standards, and is comprised of national standards institutes from 159 countries. It works to build consensus on solutions/standards that meet both business and societal requirements. ISO technical committees in response to international needs develop standards; they are reviewed 3 years after first publication and every 5 years thereafter. In addition to ISO standards, the ISO produces:

- ISO/PAS Publicly Available Specifications
- ISO/TS Technical Specifications
- ISO/TR Technical Reports
- IWA International Workshop Agreements
- ISO Guides.

The IEC's Technical Committees are responsible for developing international standards related to electro-technology i.e. electrical, electronic and related technologies, as well as normative and informative publications. Deliverables are based on international consensus built from the IEC national committee members.

The ITU is focused on sustaining growth and development of telecommunications and information networks and providing universal access. It has put forward over 3000 recommendations or standards related to key components of ICT.

European Standardisation Bodies

There are three recognised standardisation bodies in the EU. They include the European Committee for Standardisation (CEN), the European Committee for Electro-technical Standardisation (CENELEC), and the European Telecommunications Standards Institute (ETSI).

CEN focuses on developing new standards, harmonising national standards, promoting implementation of international standards, and supporting the work of the ISO, among other activities. It produces:

- European Standards (ENs)
- Technical Specifications which are prospective standards for provisional application in certain technical fields
- Technical Reports for communication and the transfer of information
- 'CEN Workshop Agreements' which are consensus-based documents created in a Workshop environment.

CENELEC is focused on setting standards in the electro-technical sector and promoting those standards internationally. CENELEC produces:

- European Standards
- Harmonization Documents
- Technical Specifications
- Technical Reports
- Guides
- CWA – CENELEC Workshop Agreements.

ETSI produces standards for the telecommunications sector in association with CEN and CENELEC. It develops:

- European Standards (telecommunications series)
- EN Harmonized Standards
- ETSI Technical Specifications
- ETSI Standards
- ETSI Guides
- ETSI Technical Reports.

The above three bodies are the only recognised European organisations for planning and adopting European standards according to Directive 98/34/EC. CEN and CENELEC work on building consensus and standards implementation based on national representation. ETSIs work relies on direct participation of individuals; its deliverables may or may not be implemented in the catalogues of national standards (EC, 2007).

US Standardisation Bodies

In the United States, industry leads the development of performance standards. In many cases, "*firms voluntarily agree on the desirability of a given credential but have for the most part stopped short of mandatory requirements*" (CompTIA, 2004). Several organisations have voluntarily developed and maintained rigorous certification programmes. For over 90 years, the American National Standards Institute[37] (ANSI) has coordinated the work of the private sector voluntary standardization system in the US. The US has hundreds of standards developing organisations (SDOs) that develop voluntary national consensus standards, with 90% of standards being produced by the 20 largest SDOs. Further, hundreds of non-traditional SDOs, such as consortia exist. ANSI accredits procedures of SDOs, thereby facilitating development of American National Standards (ANS). ANSI accreditations requires adherence to the "ANSI Essential Requirements: Due Process requirements for

[37] American National Standards Institute (ANSI) - http://www.ansi.org

American National Standards". These apply globally accepted standardization principles implemented by international standards bodies such as the ISO, IEC and ITU. ANSI also promotes adoption of US standards internationally (many are taken forward to the ISO and IEC), and promotes usage of international standards where they meet user requirements.

India's Standardisation Bodies

The Bureau of Indian Standards (BIS) is the national standards body of India. It works towards development of harmonised standards and ensuring quality certification across 14 sectors, including electronics and information technology and electro-technical. Separate division councils oversee the work in these sectors. BIS also cooperates in international standardisation activities of the ISO and IEC, participating in over 51 technical committees, and has established MOUs pertaining to standardisation and certification with a number of countries.

Japan's Standardisation Bodies

In Japan, numerous industry associations are involved in developing ICT standards. Examples include Japans Electrical Manufacturers Association (JEMA), Japans Electronics and Information Technology Industries Association (JEITA) and the Communications and Information Network Association of Japan (CIAJ). Japanese Industrial Standards are generally aligned with international standards, such as the ISO and IEC. The Japanese Standards Association, linked to the Ministry of Economy, Trade and Investment (METI) aims to "*educate the public regarding the standardization and unification of industrial standards, and thereby to contribute to the improvement of technology and the enhancement of production efficiency*". It produces draft standards in numerous fields including ICT, publishes Japanese Industrial Standards, and actively participates in some ISO and IEC deliberations to support production of international standards.

4.3.8.3 *ICT Certification Standards*

Findings from the HARMONISE study found that quality standards and accreditation were among the most important issues to be considered in any European approach to certification. Accreditation, which is the remit of inspection bodies, assists the international acceptance of certifications by determining if a certification scheme conforms to specific standards. Quality management procedures pertaining to 1) examination and testing; 2) training provision; and 3) definition of requirements are addressed, and conformity of modules, certification and testing is determined.

The value placed on certifications is dependent on the transparency of their quality assurance mechanisms. Applied quality standards help promote acceptance and recognition of certification bodies and schemes internationally. However the HARMONISE project also identified that there is "*no coherent, universal definition of the terms "quality" and "quality standards*"". Existing quality standards are numerous and differ in terms of their areas of activity or coverage, followed paradigm, subject areas covered such as process, method, content and so on. Initiatives to date have shown that the focus placed on various aspects of certifications quality assurance differs. Quality assurance needs to be considered at the organisational, awarding body and training levels (CEPIS, 2007).

For organisations offering certification of persons, a sample of globally-recognised quality standards is outlined in Table 7. Note the below list is not exhaustive: numerous other national and international standards exist, including for example those by ASTM International, the Institute of Credentialing Excellence, and national standard bodies.

Certification Quality Standards	
ISO/IEC 17024: 2003	*ISO "Conformity assessment – General requirements for bodies operating certification of persons".* This international standard aims to be the globally accepted benchmark for bodies operating certification of individuals. It specifies requirements for certification bodies, personnel and certification schemes (including their development and maintenance). The standard addresses the following issues –defining competencies; knowledge, skills and personal attributes; examination independence and valid test of competence; and independence of certifying organisation from examination organisation.
ISO/IEC TR 19759:2005	*Software Engineering Guide to the Software Engineering Body of Knowledge (SWEBOK)* This standard describes the body of knowledge generally accepted within the software engineering profession. Among other things, it describes its content and a history of standards work in this field.
ISO/IEC 24773:2008	*Certification of Software Engineering Professionals – Comparison Framework.* This standard supplements and refines ISO/IEC 17024. It aims to establish a framework for comparing software engineering certification schemes and facilitate certifications portability. The standard is based on SWEBOK; organisations must map to the ISO/IEC 19759 above to facilitate comparison. The standard identifies 10 certification scheme requirements – title, tasks, level of accountability etc, competencies, minimum qualifications or experience; evaluation of competencies; delegations; code of ethics; maintenance of certification; as well as 13 items that may be included in the professional code. It is adopted by for example the British Standards Institute.
ISO/IEC 17799: 2005	*Information Technology Security techniques -- Code of practice for information security management* This provides guidelines for information security management. It outlines best practices and controls across 11 areas of information security management; and serves as a common basis for developing security standards and practices.
European Cooperation for Accreditation	This body offers guidelines in relation to certification of products, management systems and personnel. For example: Certification Bodies (Management Systems) - EA Guidelines for the Accreditation of bodies operating certification/registration of Information Security Management Systems Certification (Personnel) - EA Guidelines on the Application of EN 45013 – General Criteria for certification bodies operating certification of personnel. (Note EN 45013 was superseded by ISO/IEC 17024 above).

Certification Quality Standards	
IP3P Standard	*IP3 – International Professional Practice Partnership* IP3 is a project of the International Federation for Information Processing (IFIP). It accredits schemes for certifying professional status of member societies; societies accredited by IP3 accept certifications from other accredited societies. As of September 2010, both the ACS and CIPS had been accredited. Thus, IP3 accreditation promotes international ICT certification acceptance and portability of professional membership. The first IP3 certification is the International IT Professional (IITP) designation and will be offered to more than 30 million people. The IP3P standard is the accreditation standard used to assess an organisation's professional standard. It outlines ICT certification programme requirements and defines the minimum standards for certifying professionals. The Skills Framework for the Information Age (SFIA) is used in determining minimum standards of professional competence. The standard is dependent on maintaining competence via continuing professional development and is supported by a disciplinary code.

Table 7: Certification Quality Standards

4.3.9 Qualification Framework Initiatives

The ability to map academic or industry based qualifications to a specific qualifications framework would promote qualification mobility, coherence and transparency from an organisational and ICT practitioner perspective, and would define a way to relate different education and training sub-systems. Initiatives regarding such frameworks are described in the following sections.

4.3.9.1 *A Framework for Qualifications of the European Higher Education Area*

The Berlin conference of the higher education ministers (2003) proposed the development of an "*overarching framework of qualifications for the European Higher Education Area (EHEA)".* In response to this, this report was commissioned by the 'Bologna Follow Up Group' (BFUG) on Qualification Frameworks in 2005 with a view to:

- Identifying reference points for National Qualification Frameworks (NQFs) to help Member States develop their frameworks. Reference points included workload, learning outcomes, levels, competences and profiles;
- Developing an overarching framework/meta framework of qualifications for the EHEA;
- Developing, at both national and EU level, principles for the frameworks of qualifications and criteria for ensuring compatibility with the framework for the EHEA.

The proposed framework for the EHEA consists of three principal divisions/stages:

- First cycle (higher education) qualifications
- Second cycle (higher education) qualifications
- Third cycle (higher education) qualifications.

Provision for a short cycle linked to the first cycle is also included. The framework uses the Dublin descriptors as reference points to describe its cycles and help in the alignment of qualifications. The Dublin Descriptors provide generic statements of expectations in terms of abilities and achievements linked to qualifications associated with the various cycles (in terms of knowledge and understanding; applying knowledge and understanding; making judgements; communication skills; learning skills). The framework proposes the following guidelines for ECTS associated with each cycle completion.

- Short cycle - approximately 120 ECTS credits;
- First cycle qualifications - 180-240 ECTS credits;
- Second cycle qualifications - 90-120 ECTS credits;
- Third cycle qualifications may not have associated credits.

The challenge in creating the Framework for Qualifications of the EHEA was to ensure a structure that enabled a linkage between NQFs and which could cope with NQF variations. This was necessary to more precisely define the relationships between different European higher education qualifications. Such a framework would promote transparency across higher education systems, support mobility through recognition of various Member State qualifications, provide a basis for quality assurance, and would serve as a boundary and outline for developing NQFs. 2010 was the recommended date for completion of self-certification by signatories.

4.3.9.2 *The European Qualifications Framework for Lifelong Learning (EQF)*

The European Qualifications Framework (EQF) is a European reference framework, in force since 2008, linking countries' national qualifications systems together and acting as a translation mechanism to make qualifications more understandable across national boundaries in Europe. It promotes lifelong learning and individuals' mobility between countries. The framework is voluntary; however, 2010 was the recommended date for countries to relate their national qualifications systems to the EQF, and 2012 for countries to ensure that all new qualification certificates, diplomas and Europass documents are referenced to the relevant EQF level. The EQF will therefore complement Europass, Erasmus, and ECTS mobility instruments.

The EQF has 8 reference levels described in terms of learning outcomes, and covers 3 categories – knowledge, skill and competence. The EQF covers all qualifications from basic (school level) to advanced (doctoral level) attained in general, vocational, academic and continuing education and training. Through a focus on learning outcomes, the EQF will support validation of formal and non-formal learning. The EQF should also facilitate international organisations in relating their qualifications systems to a common European reference point and thereby highlight the relationships between such systems.

The EQF is compatible with the framework for Qualifications of the EHEA developed under the Bologna process. Both the EQF and Bologna process overlap in terms of timing and objectives despite being based on separate political initiatives. Descriptors for its short, first, second and third cycles correspond to the learning outcomes of EQF levels 5, 6, 7, and 8 respectively. Similarly criteria for referencing NQFs to the EQF and for self-certification with the EF-EHEA are also compatible.

4.3.9.3 *The Development of National Qualifications Frameworks in Europe*

This report by Cedefop reflects the situation regarding development of NQFs as at August 2010 in 27 countries of the European Union, in 2 EU candidate countries (Croatia and Turkey) and in Norway and Iceland. It highlights for each country:

- Rationale and main policy objectives
- Involvement of stakeholders
- Levels and level descriptors
- Use of learning outcomes
- Referencing to the EQF
- Lessons learned and the way forward
- Main sources of information.

NQFs are regarded as important instruments to influence national polices and bring about reforms in education, training, qualification systems and employment. All 31 states are working to develop NQFs that can be related to the EQF, albeit many are in earlier stages of development. Many countries are now moving from stages of framework conceptualisation and design to the stakeholder consultation and testing phases for their frameworks. Formal adoption of frameworks has been achieved in Belgium Flanders, Lithuania, Malta, Estonia and Portugal. Countries with established frameworks, such as Ireland, UK and France are carrying out/have carried out framework reviews.

NQF framework developments are political processes subject to conflicting viewpoints but they can also facilitate discussion on how barriers to education, training and learning can be overcome and how practices can be improved. NQF success depends very much on the ability to involve and stimulate interest of key stakeholders and openly address issues of conflict on for example the relationship between vocational education and training and higher education. Such stakeholder involvement is critical in ensuring that the NQFs developed tie closely with existing systems and practices, otherwise their level of "buy in" will be limited.

Note that countries are not required by the EQF recommendations to develop NQFs. They can relate their qualifications to the EQF without a formal national framework, as long as they are learning outcome based. However, countries concerned by the EQF have already committed to developing NQFs compatible with the QF-EHEA and therefore will have NQFs at least for the Higher Education part of their systems.

4.3.9.4 *ICT Lane*

The ICT Lane initiative was a Leonardo da Vinci co-funded project, and was responsible for developing and testing sector specific implementations of the EQF, using pilot software, the ICT Lane Tool. Kozma et al (2008) describe the project objectives as follows: "*to decide the specialties of the ICT area, to develop a transparent model of the ICT trainings that is comparable on an international level, to implement descriptors in the experimental software, and finally to test and validate the descriptors with it".* The project is linked to other initiatives such as the EQF and e-CF.

Commonly defined standard descriptors would enable ICT qualifications to be more transparent and understandable EU wide. The standard descriptors identified for the European ICT Qualifications Framework include for example title, name of qualification supplier, kind of qualification supplier, name and kind of accreditation body, reached title/certificate, country, city, duration intensity and schedule, entry requirements, learning outcomes, ICT area, reached competencies, reached level, teaching language, price details, learning approach, accreditation prior to learning, number of students per group etc. Such descriptors aim to increase transparency in ICT offerings and proposed to add value from a variety of perspectives: for employees it would facilitate vocational self-evaluation and identification of training required for specific jobs; for companies it would enable recruitment of trained employees for specific roles; and for vocational institutes it would offer training aligned with European training trends.

4.3.10 Non Formal Learning and Informal Learning

Knowledge, skills and competences are developed not just through continued commitment to acquiring formal academic qualifications and certifications, but also through learning in non-formal and informal settings. As such, non-formal learning complements formal education. The following distinctions are made between formal, non-formal and informal learning on a European level:

- Formal learning is typically provided by education or training institutions, with structured learning objectives, learning time, and learning support. It is intentional on the part of the learner and leads to certification.
- Non-formal learning is not provided by an education or training institution and typically does not lead to certification. However, it is intentional on the part of the learner and has structured objectives, times and support.
- Informal learning results from daily activities related to work, family life or leisure. It is not structured and usually does not lead to certification. In most cases, it is unintentional on the part of the learner. (European Commission, 2011).

The recognition of this non formal and informal learning through identification of validation approaches has been recognised as a priority activity within the EU. For example, the Europe 2020 strategy calls for *'the promotion of the recognition of non-formal and informal learning*' while the May 2010 Council Conclusions on competences for lifelong learning and the 'new skills for new jobs' initiative, call for the *'further development and promotion, in collaboration with all the relevant stakeholders, of the recognition of non-formal and informal learning'. "Giving value to this learning – by identifying, documenting and/or certifying it - is important for individual motivation for lifelong learning, for transfer and mobility in education and training as well as in the labour market and in society at large*" (European Commission, 2010).

In 2004, the European Council adopted a set of common European principles for identifying and validating non‑formal and informal learning. At a high level, these principles addressed such issues as individual entitlements, stakeholder obligations, confidence and trust, and credibility and legitimacy. These principles have since acted as a reference point for national validation initiatives across Europe.

Further, in a RoadMap document entitled "*Recommendation on the promotion and validation of non-formal and informal learning*", a series of policy options to support recognition and validation were put forward in 2010. The proposal of concrete measures based on the Council's recommendations for the further development of some existing European instruments and existing soft law (e.g. EQF), was regarded as the most feasible option. It was suggested that given the on-going implementation of NQFs across 31 states, as well as other on-going initiatives such as EQF, ECVET and Europass, the proposal of concrete measures was timely to lay the foundations for effective systems for the validations of non-formal and informal learning. Further, the proposal to further develop existing soft law would strengthen political cooperation on a national and EU level. To date, a number of initiatives focusing on validation of non-formal and informal learning have taken place; however there is significant variance in the degree of support and adoption of practices across the EU – a number of countries have established systems, while others are in the early stages of formal recognition of non-formal/informal learning.

4.3.10.1 *Cedefop's Guidelines on the Validation of non-formal and informal learning*

In 2009, Cedefop, which is the EU's reference centre for vocational education and training, published a report which serves as support for developing practices for validation of non-formal and informal learning. The report presented an integrated view of non-formal and informal learning validation (Table 8), which provides context for understanding its challenges at all levels – EU, national, education and training sector, business sector, voluntary sector and the individual level.

	Who is involved?	What are the results?	Why are they doing it?	How is this done?
European level	EU Commission and Council EU agencies, Cedefop and European Training Foundation (ETF) Social partner organisations Ministers of education and training Employment ministers	European qualifications framework (EQF) Europass Common European principles for validation Draft European guidelines for validation European credit system for vocational education and training (ECVET) and European credit transfer system (ECTS)	Comparability and transparency Increased mobility Competitiveness Lifelong learning	Open method of coordination (OMC) Technical cooperation (peer learning) Experimental and research programmes (Lifelong learning programme, Framework research programmes)
National level (including regional stakeholders such as local government)	Ministries Qualification authorities Social partners NGOs	National curricula Qualifications	Knowledge society Mobility Innovation Skills supply	Systems Projects Networks Financing Legal framework
Education and training sector	Local government institutions Private institutions Assessment centres Vocational schools Universities Specialist recognition centres	Education programmes (standards) Certificates recognising participation Diplomas	Education for all Tailored training Shortened study period Increased admission	Defining assessment and validation methods
Business sector	Business managers Human resource managers Trade union representatives	Occupational standards Competence profile Work descriptions	Modernisation Competitive advantage Resourcing Career planning Training	Mapping Counselling Assessment Validation
Voluntary sector	Communities NGOs Projects	Skills profile	Social and personal reasons Employability	Mapping Youthpass Europass CV
Individual	Candidate Employee	Motivation to learn Self esteem Proof of knowledge and skills Personal reasons	Personal reasons Employability Mobility Career advancement Entrance to education	Supplementary learning Documentation Taking part in assessment

Table 8: View of non-formal and informal learning validation

One of the key recommendations of this report was that validation needs to become an integral part of the national qualifications system in order to ensure its credibility; the on-going development of NQFs is seen as a means to systematically integrate validation of non-formal/informal learning into the qualifications system.

4.3.10.2 *European Inventory of Validation of non-formal and informal learning*

The purpose of establishing a European inventory was to provide "*a catalogue of good practices in the area of validation for policy-makers and others to seek inspiration in*". The

recognition that validating non-formal learning is challenging, with limited information on practices within most countries, was a key motivator for its development. This project is on-going. A series of reports published in 2004, 2005, and 2007 have provided in-depth insight into validation practices and developments across Europe to date, with further reports planned on a periodic basis. The latest report published for the European Commission in 2007 by ECOTEC Research and Consulting highlights validation initiatives in 32 countries, developed by for example private, public and third sector organisations as well as case studies on good validation practices in Europe. This European Inventory is also seen as a means by which to monitor the degree of implementation of the European Common Principles (2004) for validation in future years.

4.3.10.2.1 European Inventory 2007 Update

Non formal and informal validation initiatives across Europe vary in their size, their degree of adoption and acceptance. This report outlined the key motivators for validating non formal and informal learning:

- "Economic factors (e.g. using validation to facilitate staff development, ensure the most effective use of resources, comply with regulations regarding professional qualifications, meet skills needs or aiding in re-structuring processes)
- Social factors (e.g. providing opportunities for disadvantaged people to reintegrate into the labour market and society as a whole, as validation helps to establish equality in the education and training systems and in the world of work)
- Education system factors (e.g. improving access to and efficiency in the formal education system, using validation to create individual pathways and avoid repetition of learning which has already been achieved)
- Demographic factors (e.g. increasing ageing of the population and migration levels can help combat unemployment particularly amongst these groups, which often have a wide range of skills that are not recognised)
- Technological factors (e.g. the development of new technologies accentuates the appreciation of technical skills gained through informal and non-formal means, in relation to which the formal education system is not well suited to keep up with developments)
- EU policy developments (e.g. contributing to the achievement of the Lisbon Strategy and other key EU policy goals)
- Increased awareness/acceptance of validation amongst stakeholders (e.g. greater awareness has led to greater use and involvement of stakeholders)
- Increased use of qualification frameworks (e.g. contributing to making a reality their focus on learning outcomes, regardless of where skills have been created)"

The report categorises countries in terms of whether they have high, medium or low degrees of development with respect to validating non-formal and informal learning[38].

- Countries with a high degree of development typically have validation practices and schemes that are applicable in all aspects of the education system. They often have supporting legal structures and strong policy frameworks. Examples of such countries include France, Denmark, Finland, Netherlands, Sweden and Ireland.
- Countries with a medium level of development are typically in the process of implementing a recent policy or legal validation framework or are developing a national validation approach based on results from piloting different methodologies. Such countries include Italy, Luxembourg, Slovenia, Romania and the Czech Republic.
- Countries with a low degree of development have little acceptance of non-formal/informal validation approaches. Typically, there are limited policies or practices to facilitate its validation. Examples include Malta, Croatia, Slovakia, and Latvia.

Validation of non-formal/informal learning initiatives in the various countries are often stimulated by either a top down or bottom up approach. A top down approach, as indicated by the introduction of national laws or policies, was evident in France, which was the first country to introduce legislation pertaining to validation. On the other hand, a bottom up approach was evident within the UK. A response to a need of UK formal education providers resulted in education providers themselves establishing a system in the 1990s for accrediting prior learning (APL).

While this report outlines several developments with respect to validation, it should be noted that for several years, there was a certain degree of resistance among the higher education sector to the validation of non-formal/informal learning. However the 2007 update suggests that this is changing particularly in response to the requirements of the Bologna agreement with respect to recognising prior learning. However, in some countries, e.g. the Netherlands where some validation practices are evident, these practices are mostly found in higher vocational institutions as opposed to the university sector. It is suggested that this may be because vocational type institutions are more focused on the acquisition of skills and competences as opposed to knowledge acquisition and transfer, which is at the core of the university system. Hence, there may be a perceived risk to university quality status by non-formal/informal learning validation among some within this community.

Our proposed framework emphasises the importance of non-formal learning through promoting its validation by ALL higher education institutions. As such, there are several good practices we can draw on as evidenced throughout Europe to-date. For example, in Germany the Externen-Prufung, which is an examination for external candidates not involved in a formal vocational training programme, permits admission to a final apprenticeship trade exam without undergoing formal training provided the individuals have '*been employed in the occupation for which they wish to take the examination for a*

[38] For details on individual countries, please refer to http://www.uk.ecorys.com/europeaninventory/publications/inventory/EuropeanInventory.pdf

period at least one and a half times as long as is prescribed for the period of initial training'. Further, the following vignette provides an in-depth example of validation practices in France, which is one of the countries at the forefront with respect to validation of non-formal and informal learning.

4.3.10.2.2 Vignette: Validation of Non-formal/Informal Learning in France

France has developed a comprehensive policy on the validation of non-formal and informal learning, and was the first EU member country to introduce legislation in this area (related to both education and employment). These developments are evident over a longitudinal timeframe, with the first legislation changes appearing in 1934 enabling the awarding of an engineering diploma based on experience. The below table highlights further legislative changes over the years.

France, the introduction of legislation relating to VINFL, a timeline	
1934	Legislation introduced to enable individuals to obtain an engineering diploma on the basis of professional experience.
1985	Decree adopted to allow professional experience to be taken into consideration in determining access to higher education (HE). The process, termed 'VAP 85' enables any person aged at least 20, who ceased their initial studies a minimum of two years ago, to apply for a place on a HE course
1986	Ministry of Employment created a network of over 100 publicly-run skills assessment centres (*Centres Interinstitutionnels de Bilans de Compétences*, CIBC). These centres were designed to enable individuals to analyse their skills and the opportunities open to them and, on this basis, to define a personal training or occupational plan.
1991	A law passed on the 31st December 1991 gave all workers with at least five years professional experience[1] a legal right to obtain a *bilan de compétences* (personal skills audit). The same law introduced the right to 24 working hours paid leave to undertake the process at an accredited centre (including, but not exclusively, the CIBC). The system is financed by a combination of compulsory employer contributions and direct subsidies from central government. The *bilan de compétences* is also available to those out of work.
1992	Further legislation[1] enabled the concept of *Validation des Acquis Professionnels* ('VAP 92') to be used for exemptions for qualifications awarded by the Ministries of Education and Agriculture (secondary and higher education). People with five years' work experience could apply for exemptions by submitting a portfolio detailing the activities undertaken and skills (competences) gained through their experience, which was then examined by an assessment panel (*jury*), who on this basis, could award credits for elements of a course of study or to allow access to a course where other formal qualifications would otherwise be required.
1999	The above law was this extended to include qualifications delivered by the Ministry of Youth and Sport.
2002	The Social Modernisation Act: validation was extended to include all the main types of qualification (*certification*) used in France and allow complete qualifications to be awarded on the basis of knowledge gained through experience. This broadened concept of VAP is referred to as *Validation des Acquis de l'Expérience (VAE)* or Validation of Prior Experience. The 2002 law made access to validation of knowledge gained through experience a right for everyone with at least three years of paid or voluntary experience (compared to five previously).

Table 9: Legislation pertaining to validation of non-formal and informal learning

One of the key changes in France over the past two decades was the 2002 legislative change on the *Validation des Acquis de l'Expérience* (VAE). This was a forward step from the

previous concept of *Validation des Acquis Professionnels* (VAP). The latter enabled prior experience to be considered with other means of assessment when awarding formal qualifications. However, VAE permits the awarding of full qualifications by higher education institutions, not just units, and is the main informal/non-formal learning validation system in France. The validation process is facilitated by a jury specific to each degree, who conducts a VAE assessment based on evidence provided by the candidate and an interview. As outlined through the above legislation developments, non-formal and informal learning in France may serve as the basis for awarding all types of national qualifications, recorded in a national vocational certifications directory (RNCP), which was established in 2002. All qualifications listed can be acquired through formal, non-formal or informal learning. This directory is overseen by a national agency - *Commission Nationale de la Certification Professionnelle* (National Vocational Certification Commission).

Over the years there has been a considerable increase in the popularity of and demand for the VAE system. Between 2002 and 2005, in excess of 50,000 qualifications were awarded. However, it should be noted that to date validation has been focused in certain sectors and vocational subjects e.g. health and social care. Over a quarter of the 2004/2005 qualifications related to professions in health and social care. Approximately, 4,000 of the 30,000 qualifications obtained through VAE are university degrees.

4.4 Ethics/Codes of Conduct

4.4.1 Introduction

Documents specifying principles of individuals' behaviour generally fall into two categories: Codes of Ethics and Codes of Conduct/Professional Practice. Berleur et al (2004) differentiate between these terms as follows:

- Codes of Ethics provide high level statements or guidelines on issues such as honesty and integrity which govern an individual's ethical conduct. These documents tend to be relatively static in nature.
- Codes of Practice provide specific and detailed statements pertaining to "*good practice*" or how an individual executes his/her technical work in the operational environment. Such codes relate to specific domains such as security, software engineering etc. and due to rapidly evolving technological environments are subject to more frequent change than Codes of Ethics/Conduct.

While the terms "Code of Ethics" and "Code of Conduct" are often used interchangeably in existing computer society codes, IFIP and CEPIS differentiate between them in the following ways. Codes of Ethics are general statements which outline the computer society's vision and objectives in terms of its public mission, and guidelines that are informative for the profession as a whole. Conversely, Codes of Conduct are focused on the profession or professional practice and may contain enforcement rules and sanctioning processes. These Codes of Conduct usually originate at the national level and effectively control professional practice within a national context, limiting their transferability and adaptability.

The Institute of Engineering and Technology (IET) states that a defining aspect of any profession involves recognising and adhering to a shared Code of Ethics/Conduct. Such codes serve a variety of purposes including for example:

- Self-regulation
- Definition of professional value and standard setting

- Increased public awareness of professional behaviour
- Indication of responsibility and accountability for work performed
- Support for the legal process
- Evaluation mechanism for the public and a basis of comparison with other professions
- Enhanced reputation of the ICT profession (Berleur et al, 2004; Udas et al, 1996).

However, approaches to ethics vary across countries. National tradition and degree of professionalization determine the ethical environments that exist globally. Cultural differences are an important dimension. As stated by Grodzinsky (2000), "*asking a group of multi-cultural professionals to abide by a set of standards that might contradict their cultural ethics creates a dichotomy in the personal and professional self*". For example, Whitcomb et al (1998) identified differences between American and Chinese values and their rationales behind ethical decisions. In Japan, Codes of Conduct are not well known among ICT professionals; many Japanese individuals maintain that ICT does not impact on ethical issues, and is just a technological concern (Nagao and Murata, 2007). Ethical behaviour in Japan is considered in terms of the relationship between the person and his/her community and the extent to which he/she acts in ways acceptable to this community (Nishigaki, 2006). More recently however, Davison et al's (2009) study reported a willingness among Japanese and Chinese ICT professionals to follow established rules and laws, suggesting that approaches in East Asia may be changing. In general, the content of the codes, their enforcement and sanctions, and their legal application vary. Hence, any analysis for this report needs to be general enough to encompass the various ethics codes, guidelines and laws in force.

The development of Codes of Ethics/Conduct and their maturity define the scope of their applicability and enforcement. They also establish the boundaries of interaction between the professional and other stakeholders. Ethics determine the relationship between the professional and customers, colleagues and society at large. Legislation had to be devised and implemented from a public policy point of view, with clear examples being the protection of personal data and information as well as security. Industry and large companies have established self-regulatory ethical frameworks, or already apply Codes of Ethics/Conduct. National Informatics or Information Processing Societies have a Code of Ethics/Conduct, effectively regulating the ICT Profession in its activities, in its relationship to external and internal stakeholders, with established, or less so, reviewing processes.

Despite the development of Codes of Ethics/Conduct by the major professional societies, there has been some criticism for failing to establish sanctions, enforce them, or test their applicability in the real world (Martin and Martin). In professions such as medicine and law, breaches to Codes of Ethics/Conduct result in inability to practice ones profession. This does not apply in ICT, where there is no legal qualification of professionals. While professional ICT society members can be held accountable through the bodies disciplinary procedures, they can still practice their profession outside of the member society. Further, many individuals working in the ICT domain do not belong to a specific organisation, and questions also exist regarding how individuals who belong to more than one organisation should behave in certain situations (Oz, 1993). Previous surveys by Prior et al (2002) indicated a high level of ethical awareness among ICT professionals, however research carried out by IFIP (2004) and academic studies by Grodzinsky (2000) found that in some cases Codes of Ethics/Conduct only paid "*lip service*" to self-regulation. As stated by Lee and Berleur (1994) "*codes, like laws, tend to keep the honest persons honest and have little impact on those who chose to ignore their precepts or who have never been exposed to their tenets.*"

The ambiguities as outlined in the above paragraph call for clearer ethical guidelines from an ICT practitioner's perspective. Because adhering to appropriate ethical standards is a

defining aspect of any profession, our research needs to consider accountability and ethical conduct within the ICT profession. This is apparent when one examines for example the "hacker ethics" principles as applied by the Chaos Computer Club (CCC). The CCC is a community of individuals, who advocate freedom of information and communication and strictly oppose censorship. It is the largest hacker group in Europe, involved in technical research, developing publications, and providing policy advice on anonymizing services etc. The group is largely based in Germany, but also extends its reach to Austria, Switzerland and the Netherlands. The group's "Hacker Ethics" promotes among others the following principles: unlimited access to computers; freedom of all information; decentralization and a mistrust of authority; making public information available while protecting private data of the individual; and using a computer to create "art and beauty", thereby changing one's life for the better. The potential for individuals involved in hacking activities to exploit sensitive data is just one example of why accountability to an ethical code is a fundamental requirement of an ICT profession.

This section provides an overview of previous research initiatives pertaining to Codes of Ethics/Conduct. It details the importance of an ethics component within the framework for ICT professionalism and provides an overview of its content.

4.4.2 Ethics Initiatives in Europe

4.4.2.1 *CEPIS Taskforce on Professionalism*

Since 2007, the Council of European Professional Informatics Societies (CEPIS) has been working towards building the foundations for a coherent approach to the topic of ICT professionalism. CEPIS's Taskforce on Professionalism has proposed a common definition of professionalism as it relates to ICT. According to CEPIS, an ICT professional's work embodies several characteristics of professionalism including Knowledge, Quality, Ethics, Accountability, Experience, and Earns Living (CEPIS, 2009). As outlined previously, this project will look to build upon the existing work of CEPIS in this domain and produce a revision of this, drawing upon the expertise and wide validation of the existing definition.

According to the Taskforce on Professionalism, Ethics outline the boundaries of relationships with customers, colleagues and society. Hence, ethical guidelines and principles are applicable at different levels. There is an internal dimension focused on ethical conduct within the organisation and amongst colleagues or other professionals involved in ICT. There is also an external dimension concerned with the impact of the organisation's work on society at large and within the organisation's sector or industry.

The ICT professionals' commitment to Ethics can be demonstrated by assessing their professional practice against an agreed Code of Ethics/Conduct. Related to the notion of integrity, an ICT professional would strive to provide high-quality results through optimal use of available resources. Although Quality can be described in many ways, the pursuit of high quality in product delivery is commonly accepted as a characteristic of professionalism. Producing quality products depends on the knowledge and competencies of the professional and on his or her continuous professional development (CPD). Declaration to attain high quality in product deliverables and professional relationships is common to the majority of Codes of Ethics. The Professionalism Taskforce defines Accountability as "*the professional taking 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.*" It is worth arguing for the incorporation of accountability within the Ethics characteristic, since many components of accountability are found in Codes of Ethics.

Finally, CEPIS activities noted that Ethics are measured in their contravention, i.e. failure to comply leading to some form of censure. It is important to note at this stage that infringement, complaint, and redress procedures exist but differ largely between national contexts.

4.4.3 Ethics Initiatives Worldwide

4.4.3.1 *The Toronto Resolution*

The Toronto Resolution (1991) developed a methodology for evaluating ethical codes in science and scholarship. It presented a common preamble and a list of 12 key elements that should be contained in all such codes. A consortium of 23 international scientists signed the resolution. The initiative was regarded as a step towards agreeing "*a common moral framework*" for work activities. While various disciplines develop their own ethical codes, the effectiveness of these and existing codes should be considered in light of the Toronto Resolution's guidelines/elements. Although this initiative was not specifically targeted to the ICT profession, it is a useful basis for comparing and evaluating ICT professional society codes.

4.4.3.2 *Ten Commandments of Computer Ethics*

The Computer Ethics Institute (CEI) founded in 1985 is focused on identifying, assessing, responding to and raising awareness of ethical issues related to the development and use of ICT. CEI is a research, education and public policy organisation located in Washington DC, and is made up of professionals from multi-disciplined, multi-cultural, cross-generational and international backgrounds. Among other publications, this organisation developed Ten Commandments of computer ethics to encourage appropriate computer use. These commandments, representing general moral principles by which individuals should abide, have been translated into 17 languages.

4.4.3.3 *International Federation for Information Processing (IFIP)*

An IFIP General Assembly task group was established in 1992 to assess the feasibility of developing an IFIP worldwide ethical code. Interest in developing a universal "*Hippocratic Oath for the computer professional*" is also evident in academic studies of the early 1990's (see for example Oz (1992) and Oz (1993)). Conclusions from the IFIP work suggested that a universal Code of Ethics for ICT practitioners/professionals was not possible to mandate given the diversity of IFIPs members with respect to:

- Cultural, traditional, legal, social, and political differences across countries,
- Differences in ethics status across member societies, and
- Misunderstandings of the meaning of ethics and professional conduct.

A further deterrent was the difficulty in establishing procedures for enforcement. For example, comments from panellists at the IFIP World Computer Congress in 1992 on the proposal of a worldwide code included *"we are doubtful about any pronouncement on ethics which lacks any obvious policy mechanism other than international opinion"*

In 1994, the IFIP task group was transformed into a Special Interest Group (SIG9.2.2), which was focused on "*Ethics of Computing*". This group produced a number of publications with a view towards stimulating discussion and reflection on approaches to ethics.

4.4.3.4 *IFIP's Analysis of Member Societies' Codes of Ethics*

IFIP's "*Ethics of Computing*" book, published in 1996, produced an analysis of approximately 30 Codes of Ethics/Conduct of IFIP member societies across 12 countries. In this and a related document drafted in 1995, IFIP's Ethics Task Group put specific recommendations on the content of such Codes forward. Three of the recommendations are to include the content of existing Codes of Ethics/Conduct of member societies, computer specific ethical issues that were lacking in the majority of codes, and suggestions made by the Council of Europe. These are summarised in Table 10:

Areas for Inclusion	Scope
Content of IFIP societies existing codes	5 main topics addressed in almost all 30 codes examined include: • Respect for people/things e.g. for individuals' and public interests/rights, the profession, public welfare and quality of life, the computer society, the environment, and public differences • Personal/institutional qualities e.g. conscientiousness, honesty, positive attitude, competence & professional development, efficiency, integrity, acceptance of responsibility, respect for contracts • Promotion of information privacy and data integrity e.g. confidentiality, respect for property rights • Production and flow of information e.g. flow to involved parties, to the public, comprehensive information, production of tests, evaluations, specifications • Attitude towards regulations e.g. respect for the code, respect for the law, respect for professional standards, sanctions against breach (addressed in less than half of the codes)
Computer specific ethical issues	• Repositories and processors of information e.g. their unauthorised use raises questions of fairness and appropriateness • Producers of new forms and types of assets e.g. computer programmes may not follow the same concepts of ownership as other assets • Instruments of acts e.g. the degree to which computer services and users are responsible for computer output integrity and appropriateness • Symbols of intimidations and deception e.g. in terms of regarding computers as thinking machines, absolute truth producers and substitutes for humans • Other issues e.g. computer crime and security, computer theft, intellectual property rights, hacking, viruses, IS reliability, data storage and privacy
Suggestions made by the Council of Europe	• Social responsibility with respect to the employer and society itself • Personal competence and behaviour, training, and legislative information for practitioners

Areas for Inclusion	Scope
	• Specific problems related to copyright, programme ownership, etc. • Confidentiality and secrecy, protection of privacy etc. • Security regarding protection against fraud, abuse, and data security

Table 10: Recommendations on the content of Codes of Ethics/Conduct

4.4.3.5 *IFIP's Ethics and the Governance of the Internet (1999)*

IFIPs "*Ethics and the Governance of the Internet*" monograph sought to promote discussion on ethical issues surrounding Internet Governance. Berleur et al (1999) outlined areas for discussion including:

- Protection of the individual e.g. questions regarding risk, security, reliability, vulnerability, liability, privacy, identification, authentication, confidentiality, encryption, intellectual property rights, copyrights, computer crime / misuse, etc.
- Collective organisation of society e.g. infrastructure ownership, technological awareness and education, impact on work and organisations, role of governments, political aspects, public policies, telecommunication policies, self-regulation etc.
- More ethically oriented issues e.g. equity in the right of access, respect for individual's dignity, rights and interests, justice and social exclusion, quality of life, right to information, personal qualities, respect for cultural differences, etc.

4.4.3.6 *IFIP's Criteria and procedures for developing Code of Ethics/Conduct (2004)*

In 2004, IFIP's Special Interest Group (SIG9.2.2) put forward criteria and procedures for developing Codes of Ethics/Conduct. These reflect from IFIP's viewpoint the minimum requirements in terms of content, process and evaluation for developing Codes. The work provides a framework of principles for organisations who wish to develop Codes of Ethics/Conduct and acts as a checklist for existing codes. Such an approach offers the flexibility to take into consideration organisational and cultural issues. Areas for consideration in developing ethical codes include:

- Existing Codes content (Table 10)
- Issues of a more ethical nature (Section 4.4.3.5)
- Issues related to the Internet as identified by Internet Service Providers (ISPs)
- Issues identified for the World IT Forum 2003.

Although this list of ethical issues is suggested as a "snapshot" at a particular point in time, it nonetheless provides guidance for organisations in terms of consensus topics gathered from analysing existing codes and other forums of discussion. Development of Codes of Ethics/Conduct should be done within the member societies through a democratic process involving consultation, feedback and "*spaces for discussion*". This is necessary to encourage acceptance and adherence by members. In other words, it is necessary for individuals to commit to the values of any Code developed (Grodzinsky, 2000; Nagao and Murata, 2007).

4.4.3.7 *IFIP's Ethics of Computing Committees: Suggestions for Functions, Form and Structure (2008)*

This study prepared by IFIP's Special Interest Group (SIG9.2.2) discussed the setting up and running of national and/or professional ethics computing committees, in other words ethics committees sponsored by national or government associations or professional organisations within a country. The study provided experiences from committees including the Association of Computing Machinery's (ACM) Committee on Professional Ethics (COPE), the Australian Computer Society's (ACS) national Committee on Computer Ethics (CCE), the ethics committee of the British Computer Society (BCS), and the Finnish Information Processing Association (FIPA) ethics work group. However, the research identified that such ethics committees had not been established in the majority of IFIP professional societies or their equivalent. The report argues that such committees within the various computing associations would facilitate the development, update and evaluation of Codes, and would provide forums for raising and discussing issues, and raising ethical awareness.

4.4.4 Sample Professional Bodies Codes of Ethics Examined

4.4.4.1 *Association of Computing Machinery*

ACM's Code of Ethics and Professional Conduct, adopted in 1992, discusses responsibilities in 4 areas:

- General moral imperatives including for example contribution to society/human wellbeing through protecting human rights and respecting cultural diversity; avoiding harm caused by intentional destruction of computer files; avoiding discrimination; being honest and trustworthy; honouring property rights; respecting privacy in terms of data privacy and accuracy, unauthorized access, accidental disclosure; and honouring confidentiality.
- More specific professional responsibilities in terms of achieving the highest quality professional work; acquiring and maintaining competence; respecting laws; accepting and providing reviews/evaluations of own work/work of others; honouring contracts and accepting accountability.
- Organisational leadership responsibilities including articulating social responsibilities of members; managing personnel and resources; supporting authorized use of the organisation's computing resources; ensuring user needs are articulated and met; supporting policies that protect individual dignity; and creating learning opportunities for organisational members.
- Compliance with the code in terms of upholding its principles and treating violations as inconsistent with ACM membership.

The above four high level responsibilities are intended to remain constant; their associated lower level clauses are subject to update as technologies/practices advance. A Committee on Professional Ethics (COPE) was formed to review and revise this code as required, promote ethical conduct, and educate members on making ethical decisions. Termination of ACM membership may occur in instances of gross misconduct/violations of the code.

4.4.4.2 *IEEE*

The IEEE's Code of Ethics provides high-level principles in terms of:

- Accepting responsibility for making decisions that are consistent with public safety, health, and welfare

- Avoiding conflict of interests and disclosing any to affected parties
- Being honest
- Improving technical competence and understanding of technology, its application, and consequences
- Accepting and offering honest criticism of technical work
- Treating all persons fairly
- Avoiding harm to individual's property, reputation, employment
- Assisting others in their professional development.

4.4.4.3 *ACM/IEEE-CS Joint task force on Software Engineering Ethics and Professional Practices*

This Code was approved by both the ACM and IEEE-CS in 1999 as the standard for teaching and practicing software engineering. It is adopted by professional societies in Argentina, Australia, Canada, China, Croatia, England, Italy, Israel, Japan, Mexico, Spain, and the US. It is based on eight principles:

- Acting consistent with public interest
- Acting in the best interest of the client and employer, consistent with public interest
- Producing products that meet the highest professional standards
- Maintaining integrity and independence in professional judgment
- Adopting an ethical approach to the management of software development and maintenance
- Enhancing integrity and reputation of the profession consistent with public interest
- Being fair and supportive to colleagues
- Participating in lifelong learning and promoting an ethical approach to practice of the profession.

This code is regarded as serving as an ethical foundation for individuals, which remains adaptable and relevant as situations change. In areas where standards are in tension with one another, the software engineer is expected to use his/her ethical judgment to behave consistent with the "spirit" of the Code of Ethics.

4.4.4.4 *Institute of Engineering and Technology*

The IET offers rules of conduct that pertain to:

- Updating knowledge through planned professional development
- Working only in areas of competence
- Accepting responsibility for work performed
- Respecting the institution and profession
- Avoiding harm to individuals or their reputation
- Acting professionally in all relationships
- Expressing professional opinions objectively and only when qualified to do so
- Disclosing conflicts of interest
- Respecting confidential information
- Promoting public awareness of engineering/technology achievements, among others.

Violations of these rules of conduct are examined under IET's investigation and disciplinary procedures.

4.4.4.5 *Project Management Institute (PMI)*

PMI's Code of Ethics and Professional Conduct is applicable to PMI members and individuals holding/applying for a PMI credential. In terms of 4 keys areas the Code specifies both aspirational and mandatory standards.

- In terms of an individual's responsibility, the code specifies the need to work in the best interest of society, public safety, and the environment; accept assignments consistent with experience and qualifications; take accountability for errors/omissions; protect confidential information; adhere to policies, regulations and laws; and report unethical conduct/violations of the Code to the appropriate body.
- In terms of acting in a respectful manner, individuals are required to avoid behaviours disrespectful to the customs of others; listen to others points of view; behave professionally; do not influence decisions to benefit personally; avoid abusive behaviour and respect property of others.
- Individuals are expected to act impartially and objectively in the interest of fairness, demonstrating decision making transparency, disclosing real or potential conflicts of interest and refraining from decision making until such disclosure is made; avoiding decisions based on personal considerations such as favouritism or prejudice; and avoiding discrimination against others.
- Finally, individuals are required to demonstrate honesty through avoiding deception or dishonest behaviour for personal gain; and acting truthfully in communications.

Practitioners who do not conduct themselves in accordance with these standards are subject to disciplinary procedures before PMI's Ethics Review Committee.

4.4.4.6 *Institute for Certification of Computing Professionals (ICCP)*

The ICCP Code of Ethics specifies responsibilities in terms of promoting understanding of information processing methods and procedures; upholding the levels of knowledge as evidenced by the certificate held; serving the interests of employers and clients; avoiding conduct that would discredit the reputation/integrity of the profession; and avoiding implications that the certificates held are the sole claim to professional competence. The ICCP also specifies a Code of Conduct for Certified Computing Professionals outlining requirements in terms of disclosure of confidential information; social responsibility; providing conclusions and opinions; acting with integrity; conflicts of interests; accountability; and protection of privacy and confidentiality of all entrusted information. A certification council, on behalf of ICCP can revoke a certificate for violation of the Code of Ethics or engagement in conduct discrediting the computing profession.

4.4.4.7 *International Information Systems Security Certification Consortium (ISC)²*

The ISC² Code of Ethics specifies four mandatory canons in terms of:

- Protecting society, the commonwealth and infrastructure
- Acting honourably, honestly, justly, responsibly and legally
- Providing diligent and competent service to principals
- Advancing and protecting the profession.

Adherence to this Code is a condition of an individual's certification. Violations are examined by a peer review panel and may result in certificate revocation.

4.4.4.8 *National Professional Societies Codes of Ethics/Conduct*

Professional ICT societies typically define codes of ethics, standards of conduct and codes of professional practice for their members, often in a single document. Details on these codes are outlined in the Country Profile Template for each of the EU member states.

4.5 CIO/ICT Manager Training

In order to begin defining a CIO training framework it is important to consider its place in the context of the overall development of an ICT profession. For other professional career paths (e.g medicine, accountancy, engineering, quantity surveying, architecture etc.,) the start point is defined by an academic education programme. This programme will be ratified and approved (accreditied) by the respective professional body. Therefore, through professional body cooperation and affiliation at a regional level, it is easy to understand and relate to the basic educational level for practitioners in their respective profession.

The first issue with the ICT profession and particularily with the role of ICT manager, or CIO is that, to date, there is no commonly accepted basic academic training requirement. This has been both an aid and hinderence in the development and formalisation of the ICT profession as a whole. An aid in that it has allowed for the inclusion and mobility of a rich mix of professional types in becoming ICT practitioners. This can be seen in the number of Arts, Philosophy, Geology, Engineering, Medical, Accountancy etc., professionals who have successfully transitioned into the area of ICT practice and management. This has also been a hinderence in that the lack of any formal course ratification process has meant little or no structure in helping to ensure basic professional standards are set and maintained.

That said it should also be recognised that most, if not all professional bodies recognise that once the basic level of education has been obtained, the individuals career path may take any number of different turns. Some professional bodies (Institute of Engineering and Technology's SATOR programme) have increased the basic academic training qualification for some of their levels of professional recognition. However, many other bodies recognise the breath of roles a practitioner can now have within a profession which in turn can make it difficult to define on-going academic training in terms of postgraduate qualifications. To that end, whilst still acknowledging the attainment of further acdemic qualifications, professional bodies ensure their members continue to develop and learn through the attainment of Continual Professional Development (CPD) programmes. Figure 17 shows the typical interaction between a professional body and an individuals career progression.

Figure 17 Typical interaction between a professional body and an individual's career progression

In Figure 17 the professional body acts to ratify and accredit the basic educational qualification that acts as the entry point for the individual into the respective profession. The professional body also acts to approve on CPD training courses and assess work experience for professional recognition.

With CPD the focus is on time spent in achiveing personal development, that is particular to the individual's career development plan. The emphasis being placed on the number of hours engaged in CPD over a defined period of time, as opposed to specific training courses being identified for completion. This has lead to a demand-generated portfolio of training programmes. Professional bodies ensure that these training programmes are relevant by approving the programmes for CPD. In many cases the training is provided by academic institutions and independent commercial training organisations. However, this has made for a fragmented landscape in terms of who, how, and what training is available for CIO / ICT managers across the EU.

There is also a disconnect in that the role of CIO / ICT manager is not identified by any ICT related professional bodies in terms of education and training requirements.

4.5.1 Understanding the ICT Training Landscape

Both professional and academic training is available in multiple formats that in turn offer many levels of engagement. In terms of certification alone, according to the HARMONISE Report (CEPIS 2007) there are currently over 600 overlapping qualifications being provided by over 60 providers, in effect creating a 'certification jungle'. This doesn't even consider the myriad of academic courses being offered by third level (Higher and Further Education) Business Schools and Computing Science Departments.

This situation developed for many reasons however, the increasing complexity of certain applications has created a need for professional development courses to support ICT product market penetration. Also, there is a reticence amongst many higher education establishments (HE) to provide non-academic, professional training as part of their core education programmes. That said many further education establishments (FE) are now offering vendor-specific professional skills courses, but mainly around improving practitioner understanding (Oracle professional, Microsoft professional, Cisco network professional, Macromedia flash etc.), and not core ICT management skills.

The rate of change of technology coupled with the need to compete within a global market place has seen a significant increase in the number of professional courses being offered by both hardware and software vendors. Further complication is added as many ICT providers are moving from the 'provision of goods' to a 'provision of services' business model (Paton & McLaughlin, 2008)[39] that in turn is being influenced by the growing realisation that to remain competitive their offerings need to be less supply-driven and more demand-driven. Therefore, the training and certification on ICT systems is no longer simply the domain of ICT professionals; certification is now being offered to traditionally what would be perceived as non-ICT professionals such as banking professionals, engineers, lawyers, health care professionals, graphic and multi-media artists etc.,

So, how do we now start to tackle the question of ICT Management training when those professionals now working within ICT are multi-disciplined, and in many cases employed in business functions other that the traditional ICT function? Certainly, there is a requirement to ensure those responsible for the ICT capabilities within any organisation or enterprise, are trained and competent for the task at hand. In the US the Federal Government has now regulated the role of CIO. Therefore, in order to operate as a CIO an individual must demonstrate certain competencies as outlined in the Clinger & Cohen Act 1996.

The benefits of this 'top-down' approach to driving a level of conformity across the ICT management strata are obvious. However, the European Union is a different entity altogether. There is more devolved responsibility around education and professional standards to name but two areas of difference. Therefore, a top-down approach in regulating CIO competencies would be a costly and potentially futile exercise due to the current landscape as outlined in the HARMONISE Report (CEPIS 2007). However, working with industry, academia, local government, professional institutes and ICT practitioners from a 'bottom-up' perspective can help build a more consolidated understanding and view of the profession. This in turn can then be used to encourage the adoption of EU-supported competencies, training programmes, and professional standards. That said, there are learning points that can be taken from the US, and other emerging economic regions such as the competencies as identified by Clinger & Cohen (1996). These competencies relate to managing ICT in a complex environment, and as such make a sound basis on which to start developing a relevant training programme.

It must also be realised that significant work has already been undertaken by industry, academia and many ICT related professional bodies in the development and provision of ICT

[39] Paton R.A. and McLaughlin, S.A (2008) "Service innovation and the Supply Chain: managing the complexity", *European Management Journal*, Vol 26, No 2, pp77-83

management training. However, as stated this work has largely been conducted at a local, or national level with little consideration given to linking these initiatives at a EU level.

4.5.2 Certification, Qualification and Education.

A new understanding of the market structure sees education, training, certification, and experience as mutually supporting components of lifelong learning and professionalism.

Vendor specific and professional non-academic qualifications will continue to exist and will enhance and reinforce the professional standing of practitioners. The value and attractiveness of professional and academic courses will have different value paradigms for employees, employers and customers. The motivations and possible funding models associated with the acquisition of certifications and qualifications needs to be understood.

At the CIO level, the provision of the various capabilities or competencies needed is planned according to the resources available and competitive pressures. In smaller business entities staff members may be expected to operate across many of these capabilities while in larger organisations staff may operate in more specialised roles. This highlights the contingent nature of the CIO / ICT managers working environment. Defining the role and nature of every variation of a CIO / ICT managers' job would be an endless task, especially considering the dynamic and changing nature of the role. Therefore, in order to understand the scope of CIO / ICT manager's role the e-Competence Framework 2.0 has been used to define the profile (Figure 18).

Profile title	**(5) Chief Information Officer (CIO)**		
Summary statement (5 – 15 words)	Aligns Information Systems with the Business needs.		
Mission	Defines the IS strategy and governance. Determines necessary resources for IS strategy implementation. Anticipates IS market evolutions and company business needs. Contributes to the development of the strategic plan.		
Deliverables	**Accountable**	**Responsible**	**Contributor**
	• IS Strategy	• Project portfolio • Service level agreement	• Risk management policy • Information security Strategy

Figure 18 e-CF CIO Profile

4.5.3 Shaping the Current Approach to Professional Training

In order to identify potential options for the development and delivery of suitable training programme(s) for CIO/ ICT managers, this research project has reviewed and considered the following core sources of information:

- **European Qualification Framework (EQF)** – This is fundamental to ensuring any proposed training can be related to existing training qualifications across the EU.
- **Clinger and Cohen Act 1996** – This provides a list of competencies for CIO's operating in the US. These competencies will provide an indication of the core areas of expertise required by senior ICT managers.

- **e-Competence Framework** – This provides a list of competencies of individuals working in ICT related roles. This will also provide an indication of the core areas of expertise required by senior ICT managers.
- **IT-Capability Maturity Framework (IT-CMF)** - This is a framework currently being used to assess levels of maturity of ICT operation across organisations / enterprises. The basis of this framework is currently being used to develop a Master's level degree in ICT Management.
- **European Certification of Informatics Professionals (EUCIP)** - is a pan-European qualification scheme for people entering the IT Profession and also for people currently involved in the ICT Profession and wishing to further their professional development.
- **Service Science, Management and Engineering (SSME)** – This is a collaborative initiative being lead by IBM between industry, academia and Governments. This initiative has identified skills that the SSME collaborative group believe senior managers (in particular those coming from a technology background) now need if they are to operate within a service-orientated industry.
- **Harmonise Report (CEPIS 2007)** - The Harmonise project examined vocational ICT qualifications in Europe, with a view to establishing a common basis for assessing and comparing the ICT professional qualifications offered in each country.
- **ICT Certification in Europe Report (CEN 2009)** – A follow-on report to the HARMONISE project as conducted by CEPIS. This report has created landscape maps of the current certification bodies and offerings available across the EU. The report also includes a European model for certification schemes, consistent with ISO standards in this area.
- **European e-Competence Curricula Development Guidelines** – This report highlights the challenges facing academia, public, private and the third sector in designing, improving and implementing the curricula required to develop e-competencies across the EU. The report defines e-competencies as the integrated set of technical and managerial capabilities organizations need to achieve their objectives.

As well as reviewing the existing EU position on training, initiatives currently being developed and deployed within the US, Canada, Japan and India have also been assessed. These include:

- **Clinger and Cohen Act 1996** – This provides a list of competencies for CIO's operating in the US. These competencies will provide an indication of the core areas of expertise required by senior ICT managers.
- **Service Science, Management and Engineering (SSME)** – This is a collaborative initiative being led by IBM between industry, academia and Governments. This initiative has identified skills that the SSME collaborative group believe senior managers (in particular those coming from a technology background) now need if they are to operate within a service-orientated industry.
- **E-Japan Strategy (JICA 2003) -** Japan aims to construct a network infrastructure, promote e-commerce, and establish digital content distribution mechanisms for further cooperation under the global partnership. Examples of such initiatives in the Asian region are "Asia Broadband Program" for enhancing network infrastructure and "Asia IT Initiative" for ICT capacity building.
- **Promoting ICT for Development (JICA 2005)** - The international community is working together on the implementation and utilisation of ICT in developing countries with the view that prevalent use of ICT will potentially provide "digital opportunity"
- **Current Trends and Prospect on ICT Training in Japanese Context (UNESCO-PROAP, 2001) –** This looks at the need and provision of ICT training at second level education.

- **India's ERNET Project** (On-going) – This examines the upgrading of the education and research networks connecting universities and engineering colleges across the Indian sub-continent.
- **India's National Task Force on HR Development in IT** (On-going) – This covers recommendations concerning the role of IT companies in IT education, academic policies for advancing IT adoption and capability, developing IT entrepreneurship, national infrastructures for IT, and financial schemes for SME's to improve technology usage / adoption rates.

Although, each of these sources does not specifically address the issue of developing a framework for the training of ICT managers, they do provide an excellent, and informative resource on which to build a proposal for delivering training for ICT managers. It should also be noted that many of the issues identified for further research concerning ICT professionalism have a significant impact on the shape and format of ICT training.

4.5.4 Application of the e-Competence Framework[40]

It must also be stated that the provision of training is not simply to ensure the individual is aware of the latest technology and its capability, but to ensure the individual can operate and contribute to developing sustainable competitive advantage for their respective organization or enterprise. In order to do so, the individual must fully understand how ICT can contribute to business success, not just business operations. This will therefore, also require the training to consider innovation and managing change as key components to the curriculum.

Education and training providers can use the standards frameworks like the e-Competence Framework to align courses and certification assessment levels. The European Qualifications Framework can also be used to align and compare qualifications across and within national boundaries. See Figure 19.

[40] User Guidelines for the application of the e-Competency Framework 2.0

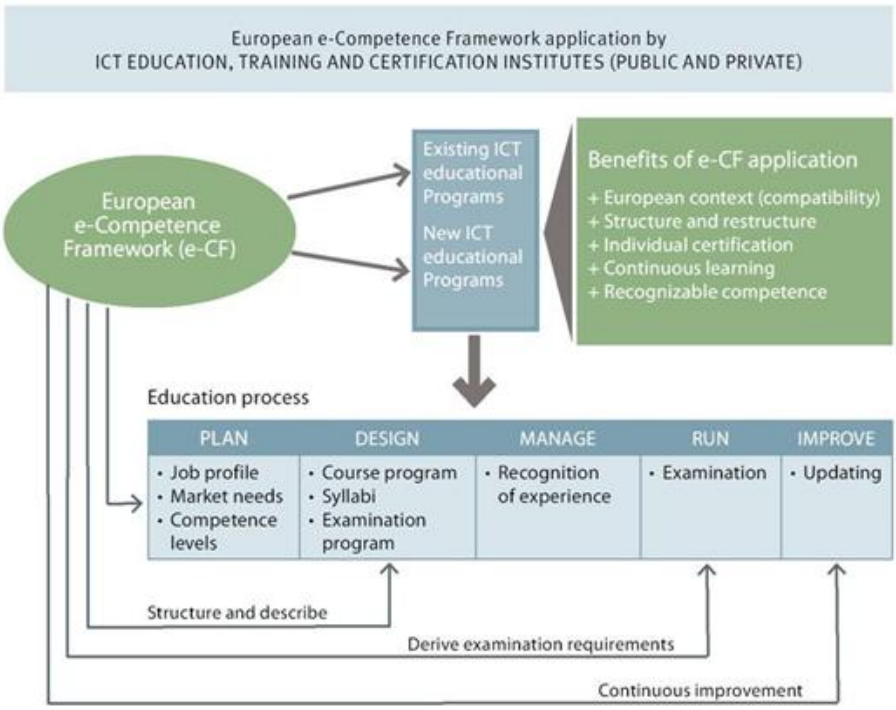


Figure 19 e-Competence Framework

However, in order to identify the key aspects of the proposed training programme the research will focus on identifying the linkages between existing collaborative initiatives between industry, academia, professional institutes, and local Governments. In essence a framework will look to address the following:

- **Compliance with the existing frameworks** – How well the proposed framework links in with existing frameworks such as the EQF, SFIA, IT-CMF, e-Skills framework, and e-Competence Framework?
- **Identification of best practice** – What is the scope of ICT Management training currently being offered by both academic and professional bodies in terms of course content, and what is perceived as best practice from an industry, practitioner perspective?
- **Identifying core curriculum components** – What core components, such as innovation and change management, should be included in the curriculum for developing ICT Managers?
- **Target audience for training** – Whom is the training targeted at? Will it be for individuals already in ICT management, or also those practitioners working towards a role in ICT management?
- **Nature of training** - Will the training be delivered as a one-off course, professional or academic, or as part of an on-going staged development programme (Lifelong learning), or as a combination of both?
- **Expected capability on completion of training** – What type of role will the trainee be expected to be able to carry out on completion of the training, or on completion of various stages of the training?
- **Routes of access to training** – How can an individual access the training, and what entry requirements will they need before being accepted for training?
- **Methods of training delivery** – Can the training be delivered via a mix of professional and academic courses?

- **Process of training adoption** – What options are available to ensure EU-wide adoption of any proposed framework? How can we position the proposed training programme in a way that demonstrates business value to all stakeholders?
- **Cost options for developing the training framework** – What are the expected costs involved in developing a training framework? Are there different cost options to provide training?

This research also considers existing initiatives being developed and deployed within the US, Canada, Japan and India. What is also important is that consideration is given to existing training programmes for CIO level executives / managers concerning the use and management of technology. In particular, how current, and future technologies (web 2.0 and beyond) harness an organisations ability to innovate in a highly competitive environment.

4.5.5 Comparison of Postgraduate ICT Education

Before recommendations for a training framework can be defined it is important to first understand how training is currently being delivered to CIO / ICT managers. For the purposes of this report, it is accepted that a) the CIO / ICT manager role is not an 'entry-level' job for an ICT Practitioner, b) there is a need for strategic and business, as well as technology components to the job, and c) the expectations on the role will be contigent on the industry sector, size and capability of the organization, strategic direction of the organization, and competitive environment. Therefore, it is important that anyone assuming the role of CIO / ICT manager be adequately trained for the role.

In order to understand the breath of training being offered in terms of postgraduate courses 19 universities were reviewed. These universities are recognised as being within the top 100 univeristies world-wide. The nature of most academic courses is that they strive to be original in terms of the unique selling point, and as there is currently no ratifying body for CIO training (within the EU) to ensure levels of consistancy across the various courses, the content and focus can vary significantly. The 19 universities where selected against the following criteria:

1. They must be seen as world class.
2. They must provide postgraduate training around technology management.
3. Where possible the selected universities should be representative of countries across the EU and the rest of the world.

Against this criteria the following univeristies where selected:

- Cambridge (ENG)
- ETH Zurich (CH)
- Uppsala University (SWEDEN)
- Edinburgh University (SCO)
- Ecole Normale Superieure (FRA)
- University of Copenhagen (DEN)
- Ruprecht-Karls-Universitat (GER)
- Trinity (IRL)
- Univerity of Amsterdam (NL)
- Universitat of Bologna (ITA)
- Universitat Autonoma de Barcelona (SPN)

- Nyenrode Business Universiteit (NL)
- Carnegie Mellon Heinz College (US/AUS)
- Australian National University (AUS)
- University of Hong Kong (HK)
- Indian Institute of Technology (IITD) (INDIA)
- University of Toronto (CANADA)
- National University of Singapore (SINGAPORE)
- Tsinghua University (CHINA)

From the selected universities 28 postgraduate programmes where identified. Figure 20 shows how the course content was broken down over the programmes reviewed.

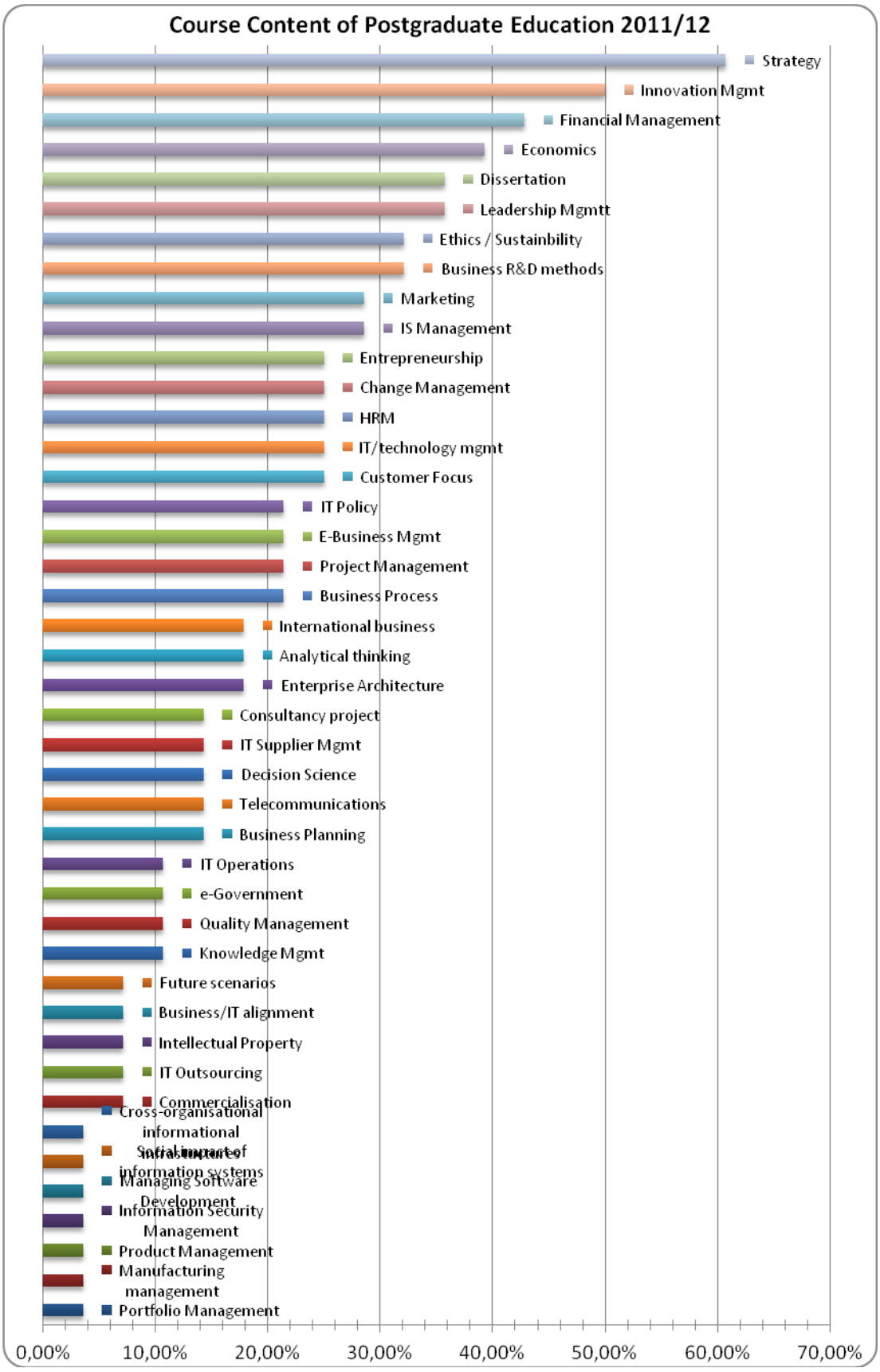


Figure 20 Course breakdown for Post-graduate Business and technology focused education.

It is interesting to see how the more traditional business and management course modules still dominate across the wide range of available MSc and MBA programmes. What was also

interesting to see was how few programmes were based around the development of specific themes and concepts. Of the 28 programmes identified only 3 had identified specific themes and concepts around which they had constructed their respective programmes. Of the 3 programmes, all 3 look at the role of the CIO. Figure 21 shows how themes and concepts around which programmes have been developed.

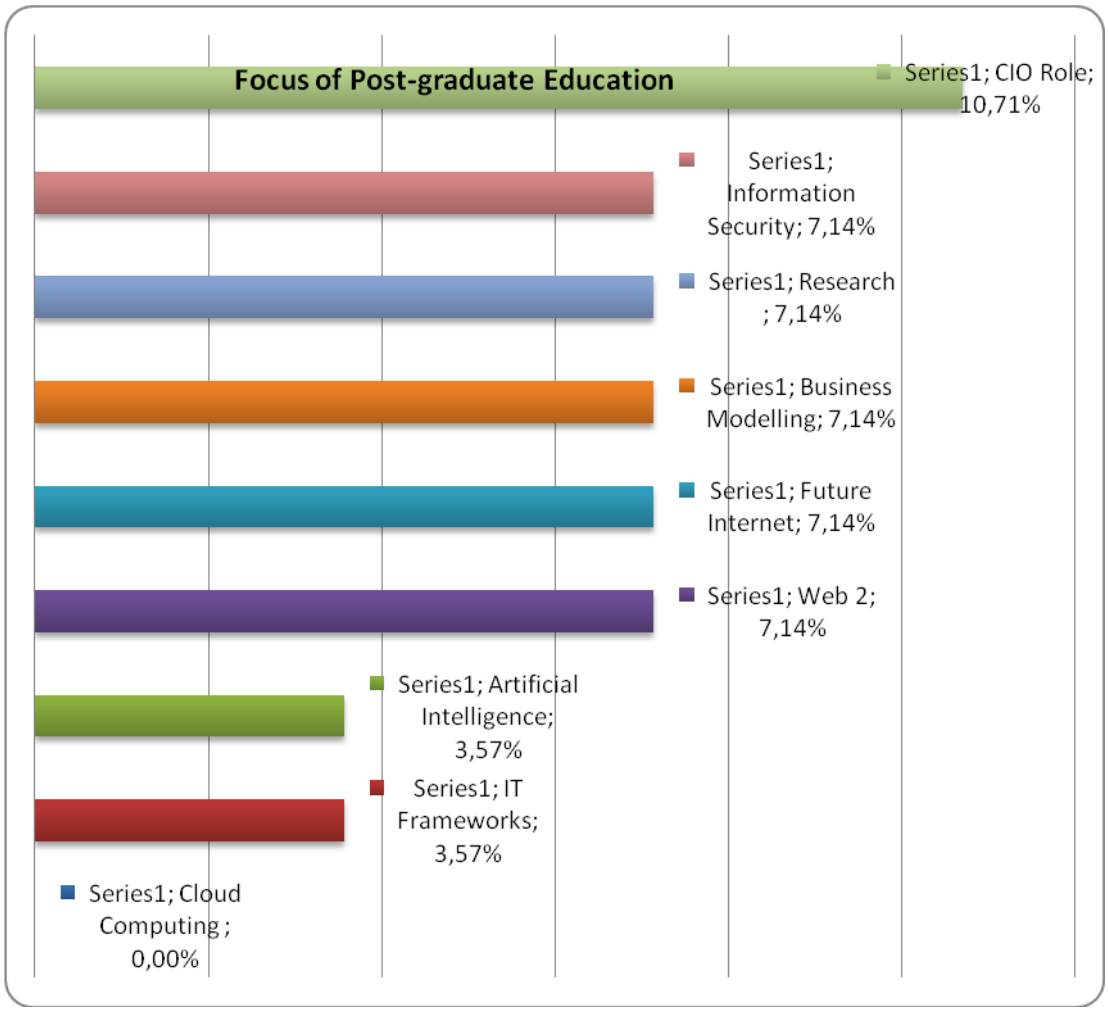


Figure 21 Key Themes and Concepts being addressed by sample post-graduate programmes.

Of the 19 universities three are worth singling out. Carnegie Mellon (US) is now offering a US Government recognised postgraduate qualification (Federal CIO Certification programme) specifically to support the Clinger Cohen Act. This is a one year part-time course that builds towards their MSIT (Master's in IT) postgraduate degree. The basic topics covered as part of the Clinger Cohen Act are as follows:

- Policy and Organisation
- Leadership/Managerial
- Process/Change Management
- Information Resources Strategy and Planning
- IT Performance Assessment: Models and Methods
- IT Project/Programme Management
- Capital Planning and Investment Control (CPIC)
- Acquisition
- E-Government

- Information Security/Information Assurance (IA)
- Enterprise Architecture
- Technology Management and Assessment

CMU also provide a number of postgraduate (MSc) courses that cover the Clinger Cohen Act requirements in more detail. Nyenrode Business Universiteit (NL) is also providing an MBA in IT specifically targeted at CIOs and senior IT managers. NUI Maynooth is also launching a MSc in IT Strategy and Management aimed at helping CIOs / ICT Managers realise business value through improved IT performance. What is interesting is that these three univeristies are the only ones of the 19 reviewed that explicitly target CIO level managers.

For these programmes the common denominator courses, in no particular order of importance, are as follows:

- Strategy
- Innovation Management
- Business Planning
- Business Process
- Leadership/Organisational Management
- IT/technology management
- Quality Management
- Project Management
- Financial Management
- HRM
- Change Management
- International Business
- Entrepreneurship
- IT Policy
- Ethics / Sustainability
- Managing the IT Supplier Environment
- Dissertation

Two points are worth noting at this stage. The first is the significant and dominant focus on Business and Management topics across both the Federal CIO Certification Programme and the Masters programmes being offered by CMU, Nyenrode, and NUI Maynooth. The second is how these courses appear and map to the 28 programmes as highlighted in Figure 20.

This certainly highlights the fact that CIO level training is important, there is a recognised need for it, and educational institutes are now developing courses to meet this need. However, the need is not clearly defined, and educational institutes are developing their respective offerings without formal direction or guidence from any EU source.

It should be noted that in the case of CMU, the structure of their courses is being shaped by the need to help CIO / ICT managers comply with the Clinger Cohen Act (1996). That said, the course content identified within their Federal CIO Certification programme is common amongst their established master's level programmes. In the case of Nyenrode Business Universiteit and NUI Maynooth, where there is no obligation to comply with government legislation in terms of offering CIO education, the development of the respective courses has been shaped by increasing demand from ICT management practitioners.

What is interesting is that all of the courses offered are ratified and accedited by various professional bodies (AMBA, EQUIS, BCS, IEI, IOD etc.,) with many courses being accreditied

by more than one professional body. However, the courses are reviewed and assessed in terms of professional development, and not in terms of specific roles, or job levels.

4.5.6 Delivering CIO / ICT Manager Education

Changing age and job profile demographics coupled with the realisation that lifelong learning is now a requirement for personal and professional development have significantly changed the way in which education is now delivered. Technology has also played a significant part in improving course delivery and the quality of the learning experience for the individual. Of all the programmes reviewed they all provided both part-time and full-time options for learning. This is very important especially if the target audience is the CIO level, or just below CIO level management. The nature of their jobs will be demanding, and for any programme to be valued and completed it must fit around the demanding schedule of the potential student.

Many programmes are now accessible via the Internet, which in turn has allowed the programmes to be delivered virtually to students who are not physically located near the programme provider.

In effect the problem is not access to suitable courses for CIO / ICT Training, but identifying why potential students should or need to engage in the training. There is not a requirement at a professional or job level to complete the training, and therefore, no incentive other than personal achievement and development; which it should be noted is no guarantee of career advancement.

4.5.7 Financing CIO / ICT Manager Education

Embarking on a postgraduate programme can be a costly and time consuming endeavour. Across the EU the cost of education is increasing. Tuition fees in the UK alone for many courses are set to increase from €4K to €11K over the next couple of years (2011/13), with many universities being pressured to increasingly self-fund their research activities through the delivery of their educational offerings. For non-research, or vocational postgraduate programmes such as MBA's and many MSc's, with a strong business and management element, the cost of undertaking such programmes can range from €6K to €60K+. MBA degrees proving to be the more expensive option with their fees ranging from €26K to €60K+. Within the United States this is even higher. The range in costs for these programmes is quite dramatic. However, education providers are constantly trying to ensure their programmes are percieived as being unique, and therefore, allowing them to set fees based on local competitive factors.

Considering 97% of EU business is SME based (OECD), the increasing cost of post-graduate training will be prohibitive for many organisations and businesses. Certainly the structure for financing and delivering CIO / ICT manager education is in place, and already delivering CIO specific content and training. However, without a more clearly defined incentive to take part in the education programmes, the uptake on these programmes will be largely limited to students being sponsored by large MNEs, or students directly enrolling from their undergraduate degree programmes. Therefore, there is a significant risk that the main body of practitioners who would greatly benefit from the education (SME based CIOs / ICT managers) will not be adequately represented on any of the programmes.

5 Desktop Analysis

This section of the report draws out a series of findings and conclusions from the desktop research in Phase I. The analysis is broken down into five sections (Bodies of Knowledge, Competence frameworks, Education and Training, Ethics, and CIO/ICT Manager Training), in alignment with the research segments.

5.1 Analysis of Bodies of Knowledge (BOKs)

An overview of some eleven bodies of knowledge is described in section 4.1 Bodies of Knowledge. The current status of these bodies of knowledge is shown in Appendix B.

There are a large number of bodies of knowledge in ICT related fields. These collectively cover much of the scope of ICT. There are gaps and overlaps between sometimes competing bodies of knowledge. In summary, we did not identify a body of knowledge that was all encompassing and addressed all aspects of ICT. Some are targeted at the practitioner level, others at the organisation and more address the management of ICT.

The IT-CMF is a new initiative from the Innovation Value Institute that appears to have the widest coverage of the ICT domain but does not cover the topics to the same level of depth as some of the other BoKs. This value focused assessment framework does provide a possible mechanism which could be used to index the bodies of knowledge.

In general, bodies of knowledge are focused on their chosen area of specialism.

This has advantages in that the scope is controlled and the expertise needed is focused. Typically, there is a shared interest of the BOK development, maintenance and promotion organisations.

The development of Bodies of Knowledge is located mostly in the USA and the British Isles.

The existing bodies of knowledge were generated for the most part by practitioners who felt a need to document the body of knowledge. The funding in many cases came from the practitioners but also from large companies or government agencies (CMMI/Prince2) that shared the views of the practitioners.

Today's bodies of knowledge appear to be well funded, perceived as delivering value by a sufficient number of practitioners to ensure their continued viability into the future. The fragmented landscape from an ICT Professional perspective means that practitioners, employers or educators must address several of these to provide a general training base for ICT practitioners.

Indeed there is limited evidence of bodies of knowledge being used as the basis for developing academic courses. These would appear to be drafted, and peer reviewed across colleges to ensure scope, depth, and standards are adequate.

5.1.1 Issue 1- large number of bodies of knowledge

The overlapping nature of bodies of knowledge offers competition and choices. This comes at a price in terms of effort and compatibility. Regions and sector groups have preferences as is illustrated by the adoption of Prince2 by the UK government. However, the supplier may be using PMBOK internally and with other multi-national customers. Suppliers in some

instances need to maintain knowledge and levels of certification on both bodies of knowledge and associated certifications.

Practitioners with limited funding also have a dilemma determining where to expend time and funding.

5.1.1.1 *Large number barriers*

Body of knowledge developers' perspective

Financial drivers for the organisations involved mean that convergence is not likely on the successful body of knowledge areas. The existing differing bodies of knowledge are working and delivering value. There is no impetus to change something that works.

Body of knowledge consumers' perspective

Language is still a fundamental barrier. Cost is also a major factor. To maintain a library of the complete set of bodies of knowledge associated with ICT alone would cost thousands of Euros on an annual basis.

5.1.1.2 *Lessons learnt*

Convergence can be achieved. It involves negotiations and a willingness on both sides to achieve this. For example, the Institute of Electrical and Electronic Engineers dropped its project management standard and adapted the Project Management Institute's PMBOK®. Both organisations achieved this through cooperation.

5.1.2 Issue 2 - bodies of knowledge are not mapped to roles or jobs

The bodies of knowledge do not map to roles or jobs. The bodies of knowledge are mapped to ICT sub domains like development, acquisition or project management. Professionals need to review these to determine what is appropriate to their roles and the task at hand. This can be a time consuming process that would exceed the capacity of individual practitioners.

Having said that, organisations do use the Bodies of Knowledge in gap analysis for their employee development.

5.1.2.1 *Body of knowledge role mapping barriers*

Roles and jobs are not universally defined. These differ from individual to individual. Some developers double as designers and others act as team leads and project managers. Yet more also act as data base designers or data modelling workers or business analysts or process managers.

The competences attributed to an individual cannot be easily mapped. The bodies of knowledge have not been mapped to any competence frameworks. Indeed the bodies of knowledge in most cases do not identify the associated competences.

5.1.2.2 *Lessons learnt*

Where companies or organisations have adopted a body of knowledge and put in place support training and certification criteria, most benefits are derived. Mapping at the

individual level becomes less of an issue now that it has been determined for the employee and the rewards are clear and defined by the employer.

5.1.3 Issue 3 - bodies of knowledge provide an incomplete view

All body of knowledge organisations acknowledge that they cannot be used in isolation and that other skills not described in the body of knowledge are needed. The bodies of knowledge on project management do not address space craft design. Thus, a project manager assigned to a space project needs knowledge beyond what is specified in the project management related bodies of knowledge.

Because the bodies of knowledge provide an incomplete view, it can be difficult for individuals and organisations to manage their learning and continuing professional development. Many references need to be consulted and one is never sure that the coverage is appropriate, adequate or timely.

PMBOK® documents project management specific "generally accepted good practices", that are pertinent to project management. However, the document is scant in other people and managerial skills. The PMBOK does make reference to some of these but they are not documented in the PMBOK. While the PMBOK does provide details on many "generally accepted good practices", it is described by the Project Management Institute more accurately as an index to the body of knowledge.

5.1.3.1 *Bodies of knowledge are incomplete barriers*

The focus of the organisations that develop bodies of knowledge is on the domain that they are addressing. It is appropriate that these organisations continue to give of their time, knowledge and expertise in the maintenance of these. There is no overall encompassing ICT body of knowledge. Even if one were available to address all ICT, it would not address all overlapping areas. Specifically, personnel management, financial control, treasury management, building maintenance and optimisation, logistics, marketing, research and development etc. could not be addressed and yet ICT staff has occasionally a need for some or all of the knowledge in these areas.

5.1.3.2 *Bodies of knowledge are incomplete lessons learnt*

ICT practitioners need skills sets wider than the skill spectrums addressed in the bodies of knowledge. They need the depth of the bodies of knowledge but the breadth of knowledge necessary to be successful in the environment. Communications and people savvy are essential to leveraging from the knowledge of others and as appropriate imparting knowledge to others.

Body of knowledge support organisations that have active research programmes can assist members in understanding the current changes in the domain of interest. The Open Group for example sees its role encompassing emerging ideas and facilitating convergence onto standards. Thus, once the material is standardised, it goes to the body of knowledge but is actively managed prior to that state. The Open Group by working and cooperating with standards bodies helps shape the domain for its constituent members of enterprises, vendors and practitioners.

5.1.4 Issue 4 - Language delays

All of the bodies of knowledge analysed for this report originate and are maintained in English.

Translations take time and thus, the availability of bodies of knowledge in other languages is delayed. These delays vary from months to years. In some cases, the other language versions are a full revision behind the English version.

5.1.4.1 *Body of knowledge language translation barriers*

The bodies of knowledge development teams have taken different approaches to documenting the knowledge.

The British Computer Society IT Diploma syllabus does not provide the detailed knowledge; rather it acts as an index to the body of knowledge. Some of the syllabi based bodies of knowledge come with bibliographies while others do not. Bibliographies associated with the bodies of knowledge were typically English language based.

As these BOKs are being pushed/pulled out/to the rest of the World, many organisations have found it necessary to modify the BOKs. The PMI has modified the manner in which its exam questions are set, validated, and approved. Multiple-choice questions are now typically set in one country by experienced practitioners. These, in turn, are reviewed by practitioners on another continent that will review the wording, choices offered and the designated correct answer. The team members in both the question development and review cycles are usually from multiple countries. There is a final approval cycle by yet another team.

As the professional bodies promoting the BOKs have been successful, they have taken on board feedback from their new markets and adapted to the needs of these new markets. This has been illustrated by the increasing numbers of languages in which BOKs are available.

5.1.4.2 *Language delays lessons learnt*

The linguistic translation effort is significantly impacted by the type and nature of the BOK. The simplest translation effort is encountered using simple syllabi that do not have associated bibliographies. The next by way of increasing effort is the translation of the comprehensive bodies of knowledge. Finally, the more time consuming are those based on bibliographic linked syllabi types. These necessitate identifying text books in the designated language.

Cultural biases do need to be actively managed out of the bodies of knowledge. This necessitates the active involvement of practitioners from culturally different backgrounds working together.

5.1.5 Issue 5 - body of knowledge maintenance

Some fields are slow moving while others are rapidly changing. Organisations that maintain bodies of knowledge need to be responsive and adapt quickly. However, they cannot respond to every new fad or idea that might or might not have merit. Many new ideas fail to gain acceptance and thus do not meet the criteria “generally accepted good practice”. At the same time, the body of knowledge must keep pace and be relevant to the practitioner and

the employing organisations. Organisations have on a few occasions not been responsive enough.

5.1.5.1 *Body of knowledge maintenance barriers*

Competitive advantage based on newly developed knowledge is often lost when this is shared. Thus, the guarding of intellectual property can delay the dissemination of knowledge and create a time lag before the appropriate body of knowledge can reflect the leading edge practices.

5.1.5.2 *Body of knowledge maintenance barriers lessons learnt*

The active open management by communities of practice or special interest groups can pro-actively influence standards, adaption policies and even legislators. This wider approach has proven to be more successful in the generation of new business of a sustainable nature.

The Open Group and the PMI both support the concept of Special Interest Groups (SIGs) as do other body of knowledge maintenance organisations. These groups help to transform emergent ideas into accepted good practice or body of knowledge materials.

5.1.6 Major trends and developments

There is a common trend towards internationalisation. This is more pronounced in the more successful bodies of knowledge. This in reality is simply reflecting the need to reach more customers via the customers' language.

There are also trends towards more specialised derivative products. This is particularly true in the certifications associated with the various bodies of knowledge. An example is the increasing variety of certifications now available from the PMI, ISACA, COBIT, ITIL and IT-CMF.

The reality is that ICT covers a massive area of knowledge and encompasses concepts like project management, security, risk and quality management, resource utilization and management. These in their own right have associated Bodies of Knowledge along with standards and certifications. The focus of interest by the body of knowledge owners responds to the needs of practitioners and ultimately to the consumers of the practitioner's services and/or his or her employers.

5.1.7 Body of knowledge creation

The development of bodies of knowledge tends to be a slow process. It requires identifying "generally accepted good practice". This in turn has to be verified and established by consulting with a large number of practitioners. Consensus and agreement all take time and effort.

Thus, the cost of developing a body of knowledge as a financial investment is very risky. Two crucial risks are related to time. One is that the pressing need or the issues to be resolved by developing the body of knowledge may not be as important or even be relevant when the body of knowledge is ready and approved. Two is related to possible income streams being very far out in terms of time. Many of the bodies of knowledge looked at in this report took 10-years or more to gain wide-spread acceptance and use.

Another issue around this type of research is that it tends to be open. It is not about developing intellectual property or defining knowledge assets that are unique. Thus, bodies of knowledge once developed can be easily and quickly imitated. Training and derivative products and services can be offered by competitors.

While there is little protection, we found no cases of replication. We did find a competitive environment where many education suppliers leveraged off the same bodies of knowledge and competed in that space.

The development of bodies of knowledge tends not to be financially motivated. However, successful BOKs do have viable supporting business models.

5.1.8 Legal financial and framework conditions

Few countries have legislated around the use or otherwise of any particular ICT body of knowledge. Many state agencies and employers do stipulate that knowledge of one or more bodies of knowledge is required. By way of example advertisements for project management roles will stipulate that certification in Prince2/PMI/APM or equivalent is required.

In the US, the Homeland Security initiatives have moved security certifications onto the mandatory level. In the UK, Prince2 is mandated for some UK Government appointments and contracts.

5.1.9 Further investigation

5.1.9.1 *BOK sources*

Industry established BOKs tend to be in one of these formats:

- Syllabi
- Body of knowledge in text and diagram
- Syllabi with bibliography
- Encapsulated in capability maturity models

Our desktop research has led us to the conclusion that another format also exists and is widely used in colleges and universities. Basically, it resides in the detailed syllabi and associated bibliographies for undergraduate course. A handful more are expressed as a series of learning outcomes. Many universities at undergraduate level teach what can be referred to as 'fundamental truths'.

Research should be undertaken to see if the colleges and universities would share and pool their syllabi (BOKs) so that a central European BOK could be established in the first instance. This could also avoid the need for translation as each country could merge locally with bibliographies.

This should also be possible in taught masters' programmes if there is a willingness to share and thus avoid all replicating this effort.

5.1.9.2 *ICT Subdivisions*

Computing – Core Disciplines	Computing-Computer intensive Disciplines	Computing – Infrastructure Disciplines
Artificial intelligence	Aerospace engineering	Computer technician
Cloud computing	Bioinformatics	Database administrator
Computer Science	Cognitive science	Help desk technician
Computer engineering	Computational science	Network technician
Computational science	Digital library science	Professional IT trainer
Database engineering	E-commerce	Security specialist
Computer graphics	Genetic engineering	System administration
Cyber security	Information science	Web identity designer
Human computer interaction	Information systems	**Web programmer**
Network engineering	Public policy and privacy	Web services designer
Operating systems	Instructional design	
Performance engineering	Knowledge engineering	
Robotics	Management information systems	
Scientific computing	**Network science**	
Software architecture	Multimedia design	
Software engineering	Telecommunications	

Table 11: Professional subdivision of the computing field (Peter J Denning, 2011)

Peter Denning and Dennis Frailey (2011) identified over 40 professional groups which were allocated to three categories shown in Table 11. Each of these disciplines has its own set of bodies of knowledge and research communities. These may offer a basis on which to build a wider index to the body of knowledge using academic syllabi. However, the above list is very technical and would need to be augmented with business, management, communications and other appropriate disciplines.

5.2 Analysis of Competence Initiatives

This section provides a brief analysis of some of the recent initiatives undertaken with respect to developing competency models at a national and international level. In doing so, it provides a brief description of the main issues related to the topic, as well as related barriers and key lessons.

5.2.1 Issue 1 - Balanced Skillset

Early initiatives on the development of competence models (e.g. Career Space) focused predominantly on technical skills, reflecting the composition of the project sponsors and the original project objectives. While more recent initiatives have looked to address this issue by expanding the scope to cover e-business skills, concerns were voiced during the interview stage that further work is still required in this area.

Many organisations now have shrinking central ICT departments, at a time when the usage and importance of ICT in organisations is growing, and when the number of people in ICT roles located within the business (rather than in, say, the traditional IT Operations environment) is growing. It could be argued therefore, that the relevance of a competence such as network management is diminishing within these organisations, at the same time that a competence such as Innovation Management (i.e. the competence of identifying, harnessing and managing ICT-enabled innovation in the enterprise), is growing. It is therefore essential that the competence framework accurately reflects the changing demands of the workforce and provides an adequate balance of technical and e-business skills.

5.2.1.1 *Balanced Skillset barriers*

Lievens et al (2004) identified that the individuals constructing competency models can often lack relevant task information. This suggests that competency models are often constructed by people with an inadequate understanding of the roles being defined. Obtaining the input from relevant skilled individuals on the scale required to construct a meaningful competency model requires a large investment of time from relevant stakeholders as well as a more extensive coordination effort, to enable the highest quality deliverable.

Vakola et al (2007) stated that there is a tendency to "focus on what managers currently do rather than what is needed to perform effectively in the future". This is an important concern and one which is difficult to address again as it implies a requirement to involve experienced individuals who can identify emerging trends within their work environment.

5.2.1.2 *Balanced Skillset lessons learned.*

Firstly, it is essential to identify a set of competencies that truly reflects the wide range of organisational types in different countries, in different sectors, and of different sizes. Further, in developing the details of the competences, experienced experts with deep knowledge of the area should be used, rather than relying on secondary HR experts, particularly when taking into consideration the importance of understanding how the competences are developing over time so that the models remain relevant to practitioners.

5.2.2 Issue 2 - Value Proposition / Demand-driven

It is not feasible to adopt the approach of "Build it and they shall come" – the value proposition of a competence framework for each stakeholder must be apparent. For example, Career Space achieved initial success and was recognised as making significant contributions in this area, but sadly, was unable to achieve the necessary critical mass and momentum to realise longer-term goals.

The table below outlines a high-level value proposition for different stakeholders adopting an ICT competence framework, based on a review of the benefits proposed by the developers of each framework. Validation of these findings would strengthen the case for any future solution.

Stakeholder	Value Proposition
Employer	• Establish common language and structure for identifying, assessing and developing competences • Better understand organisational ICT capability based on

Stakeholder	Value Proposition
	aggregate view of individual competences / Identify target competency levels and optimum workforce deployment options • Develop action plan for organisational capability development based on gap analysis activity / Identify training needs for individuals • Facilitate recruitment of suitable job candidates based on standardised view of competences • Support decision-making process for outsourcing/offshoring • Provide insight to support decision-making process pre/post M&A
Practitioners	• Roadmap to develop competences, enhance mobility between countries, support recognition of existing experience.
Government	• Provide structure, supports linking of education system to the IT profession, identifies skills gaps, as well as other benefits as per Employer.
Training provider / educational institutions	• Identification of teaching aims, provision, certification awards, etc • Increased recognition of certification/qualification outside of national boundaries • Clarification of messaging to consumer • Greater comparability between market offering (although this may be interpreted as hampering competition)
Social partners	• clarity of job definition, comparability, gender inequality, workforce development perspective within agreed European framework, sectorial approach to ICT sector - negotiation of labour agreements, specific telecommunications labour agreement,...
EU Commission	• Statistics from a European perspective (skills gaps, skills shortages, in which areas, in which regions,...etc) • Increase the numbers of new graduates in IT • Improved granularity to manage e-skills supply onto the market

Table 12: Competence framework stakeholder value proposition

To date, there appears to be scant content published on the value delivered by competence frameworks – indeed, the potential benefits cited in reports are generally hypothetical, or anecdotal at best.

There is a need to capture and publish case studies where specific ICT competence frameworks have been adopted and assess the level of benefits delivered to the relevant stakeholders.

5.2.3 Issue 3 - Multiple stakeholder approach

Developing, promoting, operating and managing a competence framework is a significant undertaking, requiring the participation of multiple stakeholder communities. Without this broad coverage of engagement, any solution is unlikely to be adopted by the target community as it will be perceived as being inflexible and not suited to the target country, organisation or practitioner.

5.2.3.1 *Multiple stakeholder barriers*

Managing the inputs and demands of multiple stakeholder communities is complex and time-consuming. Moreover, as additional parties become involved, there is the increased potential for the solution to become "diluted" and "stationary" by the sometime competing and contradictory demands of different stakeholders.

5.2.3.2 *Multiple stakeholder lessons learned.*

Obtaining buy-in from the most senior partners at the beginning of the project and agreeing to the level of commitment are considered important criteria determining the level of success.

Further, the process for managing conflicts should be agreed at an early stage so as to enable paths for resolution to be developed without impacting on other aspects of the project indefinitely.

5.2.4 Issue 4 - Timeline / innovation

For competence frameworks to be accepted and adopted, they must reflect the current and to some extent, the emerging environment. Reflecting this market requirement, the competences contained in the more recent ICT competence frameworks differ significantly from previous ones – for example, the balance of technical and non-technical skills has shifted significantly over time.

However, most ICT competence frameworks have been created as an output of a series of workshops with relevant experts, and updates are made as a consequence of feedback obtained from users, as well as further workshops. The e-CF, SFIA, Career Space, and AITTS all appear to have followed this approach.

5.2.4.1 *Timeline / Innovation barriers*

While the workshop-based approach definitely produces results, the timeframe can be a concern: for example, each iteration of the e-CF took approximately 1-2 years. This is not to say that its content is in any way dated, but simply that developing a framework via workshops with multiple stakeholders covering a large number of competences is a substantial undertaking, which requires a significant coordination effort. For this reason, consideration should be given to adopting innovative techniques for developing and maintaining competence definitions.

5.2.4.2 *Timeline/ Innovation lessons learned.*

Interestingly, the US-based O*Net appears to have made use of technology to identify emerging competences in constructing its database of competences. Similarly, LinkedIn recently used its extensive database of CVs to establish LinkedIn Skills which helps identify the volume of professionals and groups with that skill, the relative growth and size trends relating to that skill, as well as the companies where that skill is common. (Although we cannot favour any single body, if we could encourage the mapping of ICT skills contained in say, entities similar to LinkedIn Skills to a given competency model solution, this would encourage far greater and far faster recognition among practitioners).

Technology in this context has the potential to provide content that is not only updated on a more frequent and faster basis, but it is also doing so in a fashion which is potentially more accurate and in a less labour-intensive fashion.

Innovative approaches could also be employed to identify and develop alternative usage models for the competency models – for example, more sophisticated interfaces which would support better integration by relevant agencies (both in terms of contributing to the dataset as well as using it).

Clearly, introducing innovative techniques also introduces potential risks, but the dynamic nature of the industry suggests that consideration be given to alternative approaches to developing and maintaining a competence framework.

5.2.5 Issue 5 - Access and Usability

Virtually all of the ICT competence frameworks developed globally are free to use (although SFIA states that a royalty is required for those using it to support a commercial offering) as well as being open to everyone. This would suggest that this is a requirement to facilitate wider adoption of any potential solution within the industry.

In addition to open and free access to the framework, the issue of usability is important. Until very recently, the extent of competency offerings has been paper-based – that is to say, there were few tools to support adoption by industry participants, the sole focus was on communicating content in its basic form, rather than supporting specific use-cases for different stakeholders. It is important an appropriate range of use-cases for different stakeholders is considered in order to support adoption.

5.2.5.1 *Access and Usability barriers*

The more recent initiatives in this area have attempted to tackle the issue of usability. For example, SFIA offers an Excel version of its framework, and the e-CF offers an online tool. However, both have respective downsides when applied in the workplace by, for example, HR practitioners.

An excel spread sheet will provide the user with a greater degree of flexibility in the manner in which the content can be adapted for use in their own organisation. However, the data content will not automatically be updated as new content is developed.

An online tool can provide the facility to provide access to the most up-to-date content in a graphically appealing fashion; however, it is important to support customisation at a user-level (e.g. the current e-CF tool does not support any amendment of defined skills and knowledge for a competency – consequently, the user is required to copy/paste changes into any job profile incorporating such a competency).

5.2.5.2 *Access and Usability lessons learned*

While the format of the deliverable may seem trivial at first glance, the transition to adopting any new ICT competence framework within an organisation must be as seamless as possible, so as to minimise objections from individuals resistant to change.

Moreover, looking towards the O*Net model, the provision of a database with appropriate interfaces, allows third parties to develop more sophisticated tools which can interact with the core content. In doing so, this removes the need for the O*Net organisation to provide multiple tools to support the diverse stakeholder community. This toolset has also enabled the US Government to obtain multiple data inputs from stakeholders as well, helping to maintain and improve the quality of the data set over time.

This approach suggests that an alternate goal could be the provision of a database to which users have access and can develop their own tools, rather than attempting to centrally develop and maintain different toolsets to satisfy different users. However, the additional effort in constructing an appropriate database and interfaces may prove counter-productive and would first need to be considered in light of the overall professionalism framework proposed. (That said, opportunities for sharing costs with other related initiatives outside of ICT could represent an opportunity to reduce development and operational costs).

5.2.6 Eco-system / Sustainability

To date, most competence framework initiatives within Europe have relied on the development of a framework by a single organisation or group of organisations, which is then offered to the market. This same group of organisations is subsequently responsible for promoting, managing, and maintaining all aspects of the developed framework.

5.2.6.1 *Eco-system barriers*

However, the combination of organisations involved in achieving the development phase of a competence framework may not be appropriate to optimise take-up in the market, or to achieve the greatest return on investment.

5.2.6.2 *Eco-system lessons learned*

The O*Net initiative has adopted an interesting split of responsibilities which may provide insight into alternate funding and sustainability models.

For example,

- US Department of Labor/Employment and Training Administration – provides a grant to North Carolina Employment Security Commission to operate the National Center for O*Net Development. This body manages projects and contracts and provides technical support to O*Net users (Leads partnership of public and private sector organisations which carry out the work of the overall project). In addition to the Center, the partnership comprises:
    - RTI- a not-for-profit HR organisation (to design, implement and supervise survey data collection to populate the database)
    - North Carolina State University – conducts applied and theoretical research in the study of the field of work to support new O*Net initiatives

- MCNC - houses the O*Net database and provides Internet access and dissemination advice
- Maher & Maher – specialised management and workforce development consulting firm, providing web-based training services and products through the O*Net Training academy to promote and support the integration of O*Net information throughout the workforce investment community

However, it should be recognised that while there may be some learning points from O*Net and similar initiatives, the operating environment is very different:

- O*Net covers the entire range of professions within the United States. As such, costs of developing and maintaining the database are shared over a wider range of professions.
- The number of different languages employed in Europe would further complicate analysis efforts and reduce potential economies of scale (although that must already be an important concern with current workshop-based approaches).
- The approach and level of depth provided is different from related European initiatives (stronger focus on job profiles rather than showing progression of proficiency for each competences).

5.3 Analysis of Education and Training (inc Certifications, Standards and Qualifications Initiatives)

Stimulated by annual growth in the volume of ICT certifications and certification providers, the ICT certification landscape in Europe has been the subject of on-going investigation for much of the past decade. Several significant European-wide initiatives have been launched with a view to promoting understanding of this market and increasing mobility and transparency of the certifications offered by providers. Similarly, initiatives have been launched in Japan, India, the US and other countries. To date, several European initiatives, such as "ICT Certification in Europe" and "ICT Certification in Action" have focused on industry-based certifications which are oriented towards role specific task proficiency. On the other hand, initiatives such as the development of a qualification framework for the EHEA, NQFs and the EQF promote greater transparency of the broader university type qualifications, which workshop discussions have revealed to be the more typical entry paths to the ICT profession in recent years. This section provides an analysis of those initiatives, identifying key issues across the initiatives discussed, challenges/ limitations/ barrier to success, and key lessons learned.

5.3.1 Issue 1 - Partnership approach

Both academic degrees provided by universities/technological institutions and industry based certifications provided by ICT vendors are typical aspects of an ICT professional's career. However, much of the earlier initiatives reported the existence of "parallel universes" between educational institutions and market providers. Industry certification providers were regarded as developing skills and product "ability", while traditional education providers were focused on developing education and underlying theory. Similarly, Weiss et al (2009) pointed out that industry based certifications are more focused on the "job perspective", while education places greater emphasis on individual characteristics and traits or competencies. Several reports emphasised the need for the

learner to become more central to the credentialing system. Factors critical to the success of such a system include a partnership approach between industry, education and other groupings. The value of such an approach lies in bridging the gaps between the knowledge and skills required from an academic, specific occupation and employability perspective and would promote lifelong learning where education, training and certifications are mutually supportive components of an ICT professional's career development. Some successes or steps towards this partnership approach are evident:

- The European e-Skills Association (EeSA), which is an umbrella organisation of members including associations, companies, academic institutions, public entities, individuals, SMEs and other stakeholders, supports e-skills development and digital literacy. It builds on European Commission recommendations on e-skills through cooperation between partner organisations across the EU.
- With the development of national qualification frameworks and their linkage to the EQF, both industry certifications and academic degrees can be mapped to a common reference point or framework, thereby increasing transparency and comprehension.
- A "*coalescence of universes*" is evident in the universities of some member states, where vendor qualifications are provided. For example, the Microsoft IT Academy programme in Germany and SAP University Alliance in Germany. ENISA (2007) also highlights how some certification bodies have academic relations programmes, providing professors with materials for use in their teaching.

5.3.1.1 *Partnership approach barriers*

Building partnerships between industry and academia are met with political and academic resistance in some member states. The industry-university alliances are typically evident in more "industry oriented institutions" and in newer universities, where the ability to offer courses by leading vendors may be regarded as a means to build university credibility. More traditional universities tend not to embrace such initiatives as readily and focus on building graduate knowledge that enables students to adapt to several technologies as opposed to those of specific vendors. Similarly, more research oriented institutions are less inclined towards teaching the application of specific vendor technologies. The motivations for such partnership approaches are also worthy of examination from the respect of do they contribute to a more transparent certification market or are they merely stimulated by vendor financial motives?

Confidence in the mapping of certifications to a qualifications framework is reliant on the truthful representation of multiple different vendors. With the increased market size and growing numbers of new market vendors, determining the reliability of certification mapping is complex.

5.3.1.2 *Partnership approach lessons learned.*

It is evident that there is still some way to go to see wider visibility of a partnership approach between industry certification providers and academia. The evidence that these partnerships can often be used to build credibility could perhaps suggest that partnerships are more valuable for institutions earlier in their lifecycle, with maturing institutions able to set their own agenda. The existence of umbrella organisations like EeSA does however offer opportunities for information exchange and potential for enhancing the relationship between industry and academia over time.

5.3.2 Issue 2 - Developing harmonised certification schemes

Talks and efforts at creating a European harmonised certification scheme for ICT professionals stemmed from the CEPIS Harmonise project. An approach allowing cross-referencing and co-existence of different schemes and ability to combine content of different providers was viewed as an important goal in improving learning opportunities. CEPIS's development of EUCIP, which recognises competencies acquired from any course and promoting integration of third-party products content into a transparent qualification, was a contribution in this respect.

5.3.2.1 *Harmonised Certification Scheme Barriers*

Barriers to the success of any such schemes include:

- A need to reflect national market characteristics including attitudes, culture, regulation, structure etc. An important point of consideration here is the Anglo-Saxon divide. In the UK for example, emphasis is placed on professional bodies and qualifications based on education and experience; while the "continental" Europe approach is dominated by academic and state bodies that control formal, theoretical education. A further consideration is the fragmentation of education and training responsibilities to sub country level in some EU states. Different bodies also address certification issues from different angles; for example professional engineering societies may emphasize the types of competencies developed in courses, while other professional societies may place greater focus on interviewing individuals to determine their competencies and experience.
- A vision for "a market driven approach" offering a "win-win" situation where the goals of multiple stakeholders such as industry vendors, practitioners, and professional institutions are met.
- Achieving the support of the major ICT vendors and professional associations, building networks of collaborative relationships and striving for a non-competitive market space, in a growing market where ICT vendors compete for higher revenues.

5.3.2.2 *Harmonised Certification Scheme Lessons Learned*

One of the key success factors in developing a harmonised certification scheme was its separation from market influences and business interests. In reality, this is not readily feasible. In an increasingly competitive climate, the business interests of the key ICT vendors cannot be side-lined; and while they may cooperate in such initiatives and round table discussions, their primary obligation will undoubtedly lie with their company's success and attempts to increase their market share. This is even truer in the current global financial climate.

CEPIS's research to date suggests that at present, the idea of an overriding harmonised certification is not welcome within member states. Many member societies have their own programmes for example, which stimulates an element of resistance towards such schemes. CEPIS have therefore adopted a European "*make things local*" approach, with a view of facilitating member agreement on what certifications should look like in general, and then implementing their own within their member states. This would support for example a certification programme in one member state being recognised in another.

5.3.3 Issue 3 - Common framework

An approach to certification which is based on a Europe wide skills/qualifications meta framework is discussed in several of the European initiatives. For example, the Harmonise project called for a framework for recognising, integrating and combining credits of different certification providers. Significant moves have been taken in this respect including:

- The development of the EQF to which national qualification frameworks can map.
- On-going development of NQFs across 31 European countries.
- The development and maintenance of the e-CF.
- The proposed methodology for mapping vendor certifications against the e-CF, enabling assertion of the particular level of competence a certification maps to.
- Selected vendor initiatives to map their certifications to existing frameworks, e.g. Microsoft's mapping to the EQF and commencement of mapping to the e-CF. Similarly vendor commitment in workshops to map all 74 certifications of CompTIAs roadmap to the e-CF.

The value of these approaches would be to alleviate some of the complexities in individuals selecting a certification product best suited to their developmental needs. They would facilitate comparability of e-certifications and for organisations would for example improve the transparency of the recruitment process through acting as the basis for a comparator of knowledge.

5.3.3.1 *Common Framework Barriers*

The ability to map certifications to such frameworks would represent a progressive step in understanding the EU certification landscape; however there are certain barriers to its success.

- Stimulating adoption of the mapping methodology to the e-CF and promotion of the value of so doing requires significant effort led by the EU. Enticement to vendors to map their certifications to the e-CF is a considerable challenge. A potential motivator is perhaps demonstrating links with the European ICT Professional Profiles project. The current "ICT Certification in Action" project has taken steps in this respect. Vendor buy-in is critical as it would be infeasible to maintain information on certifications in some form of central portal without the involvement of the key certification providers.
- While it is recognised that the mapping of certifications to the framework would need to be self-regulating, it poses questions regarding the transparency and consistency of the mapping process by different vendors.
- The existence of other frameworks, for example SFIA, poses a further challenge to the e-CF being adopted as a common framework.

5.3.3.2 *Common Framework Lessons Learned*

Mapping to a common established framework requires a clear articulation of the value paradigm for stakeholders in mapping their certifications consistently. Some of the certification initiatives completed to date have not followed through on some of their developments/ recommendations. The best means to ensure that such initiatives are built on is to promote the value of such developments/recommendations from the perspectives of all stakeholders: EU, vendor, organisation, practitioner etc. In promoting the value dimensions, alignment of certifications with frameworks such as the e-CF has greater potential to become something stakeholders "want to do".

5.3.4 Issue 4 - Stakeholder viewpoint of certifications

Certifications represent different things to different stakeholders at different phases of a professional's career. For vendors they represent a supporting tool in generating revenue stream; for individuals, they typically represent credentials of value in furthering professional development; while for employers they represent evidence of what an employee "can do" using specific vendor technologies usually a number of years into their employment. CEN (2009) revealed that ICT specialists place greater value on independent certifications, whereby their professional profile is more widely recognised in the labour market. Vendor dependent certifications are more valued by third party specialists as they better qualify their offerings to the end customer.

Workshop discussions revealed that a further issue impacting stakeholder viewpoints is certification relevance with respect to the skills they provide. Specific ICT skills are relatively easily measured in an assessment process; however determining how well individuals can actually apply certain skills to, for example, manage and lead project teams is more difficult to assess. The industry based certification market is heavily oriented towards ICT practitioner skills focused on more technical capabilities for specifying, designing, developing, installing, operating, supporting, maintaining, managing, evaluating, and researching ICT systems. The more strategic and innovation[41] oriented e-business or e-leadership skills tend not to be as heavily emphasised, which suggests that the breadth of work associated with ICT roles is not fully addressed. How such capabilities are developed within organisations needs greater emphasis.

5.3.5 Issue 5 - Standards

Most initiatives to date have emphasised the importance of standards in working towards a more harmonised certification market. Quality standards and accreditation play a critical role in ensuring certification systems comparability and transparency, and in promoting their national and international acceptance. However, such transparency is difficult to ensure.

5.3.5.1 *Standards Barriers*

Barriers to quality standards that promote certification comparability and transparency include:

- Countries differ with respect to legal initiatives, regulations, and accreditation measures. In some cases, quality criteria for different parts of the certification system, e.g. examination and testing, learning materials, applying quality standards etc. also differ within and between countries. While this may not be evident with respect to leading certification vendors who apply standard procedures globally, it was one of the significant findings from the Harmonise study.

[41] The European Commission's Innovation Union Scoreboard reveals that innovation performance in the EU27 lags well behind that of the US and Japan, but has a strong lead on the BRIC countries of Brazil, Russia, India and China (European Commission, 2011).

- As outlined in the Harmonise study, there is no coherent definition of the terms "quality" and "quality standard". Numerous quality standards exist that differ in various respects. While standards such as the ISO/IEC 17024 strive to be globally accepted certification benchmarks, the number of certifications conforming to such standards is difficult to assess.
- Barriers to the popularity of the current IP3 scheme by IFIP include the fact that it is regarded as being too prescriptive and does not recognise local standards.

5.3.5.2 *Standards Lessons Learned*

The desktop research revealed several standards related to ICT certification. Issues pertaining to IFIP's IP3 scheme, as outlined above, suggest that recognition of local standards is an important requirement. One possible approach to ensuring greater transparency would be an overarching standards framework to act as a reference point for the common elements of the various standards.

5.3.6 Final Thoughts on Certification, Standards and Qualifications

The certification initiatives thus far have resulted in a detailed documentation of the certification landscape in Europe. Such increased understanding of the market is central to determining the strategy for achieving a more transparent market, where academic and industry based credentials are mutually acknowledged as building/ key aspects of a professional's career; where the competencies developed by the offerings of different vendor providers, and between academic institutions and vendor providers are comparable; and where portability of certifications across organisations and national boundaries is facilitated. Significant progress has been made over the past decade:

- The industry has witnessed a move from the distinct and parallel universes of academia and industry towards a coalescence of those universes. While this coalescence has not been fully achieved or even embraced by all stakeholders, there is nonetheless widespread recognition that formal education qualifications, training and certifications are vital components of an individuals' career development path. A firm understanding of the importance of convergence and collaboration has been established.
- Initiatives pertaining to common frameworks have been pivotal in the latter half of the past decade. Of particular success is the commitment of 31 European countries, including all of the EU27 to develop NQFs that map to the EQF. This will facilitate greater comparability and portability of the qualifications of all EU countries. The further development of the e-CF and the current initiative to encourage industry certification vendors to position their certifications against the e-CF and thereby the EQF is a significant development. The fact that some leading market vendors, such as Microsoft and Cisco, are committed to this process will be an important step in leading the way for other vendors to "*follow suit*" in positioning their certification products.

Despite these successes, it remains early days in achieving a transparent market that has co-operation of all major stakeholders. Analysis of the initiatives to date suggests that the value paradigm of the various initiatives may not be articulated at an appropriate level or understood by the various stakeholders. This is suggested by the fact that while there has been continuous progression on examining certification landscapes, developments and recommendations coming from some of the initiatives have not been followed through.

5.4 Analysis of Ethics Initiatives

Ethical behaviour is a central principle in many professions, and is regarded as a defining aspect of some. Demonstrating adherence to principles of ethical conduct serves to increase public awareness of a professional's behaviour, establish boundaries of relationships between the professional and society, and ultimately improve the professions' reputation. Due to on-going developments in ICT and their pervasive impacts on all areas of society, incorporating ethics into any framework for ICT professionalism is important. The significance of ethics in ICT is emphasised by on going research initiatives by leading professional bodies such as IFIP and CEPIS in this area. This section provides an analysis of those initiatives, identifying key issues pertaining to ethics in the ICT profession, challenges/limitations/barrier to success, and key lessons learned.

5.4.1 Issue 1 - Universal Code for the ICT Profession

National computing societies have developed Codes of Ethics/Conduct that attempt to effectively regulate the profession's activities and relationships with external and internal stakeholders. Similarly many organisations have developed self-regulatory ethical frameworks. Previous initiatives revealed that the content of such Codes of Ethics/Conduct, their enforcement mechanisms, and their legal application vary across national boundaries. Attempts to overcome this divergence through developing a single, consistent and universal code for the ICT profession revealed that such an approach was not feasible.

5.4.1.1 *Universal Code Barriers*

Ethical environments differ worldwide due to cultural distinctions across national boundaries. Tradition, culture, values, politics, ethical decision rationales, established rules and laws, social characteristics and ethics statuses vary. As outlined in the desktop research, differences are particularly evident between western societies and those of East Asia, e.g. China and Japan, in their views and approaches to ethics. This inhibits the ability to develop a worldwide Code of Ethics for the ICT profession that is applicable to all.

5.4.1.2 *Universal Code Lessons Learned*

Cultural distinctions across national boundaries need to be reflected in national computer society codes. This is necessary to facilitate acceptance and buy in to the codes' values and adherence by members. Therefore, Codes of Ethics/Conduct should be developed within the national computer societies through a democratic process involving consultation and feedback. The establishment of ethics committees may facilitate this development, and subsequent update and evaluation.

Development of national computer society codes should refer to global recommendations on code development. A useful reference point in this respect is IFIP's criteria and procedures, as outlined in the next section. While this would provide national computer societies with the flexibility to develop codes that incorporate organisational and cultural differences, it would also ensure that those developing the code reflect on a standard checklist of elements for inclusion.

5.4.2 Issue 2 - Topics for Inclusion in Ethical Codes

Ethics initiatives to date have resulted in a comprehensive list of elements that should be included in Codes of Ethics/Conduct. Significant work has been done by IFIP in analysing the content of existing codes, resulting in recommendations on their content, and criteria

and procedures for developing them. Comparison between the Toronto Resolutions 12 key elements, the CEI's 10 commandments of computer ethics, and IFIP's recommendations on the content of such codes revealed an overlap in many general areas, for example respect for others, consideration of social consequences, avoidance of harm etc. The CEI's 10 commandments are an example of how consensus can be reached by multi-disciplined, multi-cultural, cross-generational and international backgrounds. It is nonetheless appreciated that these commandments represent high level general moral principles. Achieving consensus on the content of Codes of Conduct is more difficult as they typically emanate from the national context, thereby impacting transferability due to contextual differences.

The list of elements compiled by IFIP in its various monographs provides a comprehensive framework of principles and set of guidelines for organisations/national societies developing their own ethical codes and serves as a basis of comparison and evaluation. They extend the issues typically addressed in Codes of Ethics/Conduct to include more computer specific ethical issues, issues pertaining to Internet governance, and issues identified through other forums of discussion. IFIPs criteria and procedures for developing Codes of Ethics/Conduct are a reference point for this project in terms of the ethical component in the ICT professionalism framework. However, it is noted that this checklist of consensus elements requires on-going revision due to the fast pace of technological change and possible resultant ethical considerations.

5.4.3 Issue 3 - Sanctions

Despite the development of Codes of Ethics/Conduct, the issue of establishing sanctions and enforcing those codes in practice has resulted in some criticism. Further, previous studies revealed that infringement, complaint and redress procedures vary across national contexts. Without necessary enforcement mechanisms, the various codes may result in just paying "*lip service to self-regulation*" without having any real impact on the ethical conduct of individuals.

5.4.3.1 *Sanctions Barriers*

Barriers to establishing sanctions and enforcing Codes of Ethics/Conduct include the following:

- At present professional ICT society members are held accountable through the society's disciplinary procedures. However, many individuals working in the ICT domain are not members of their national computer society. Breaches to such codes do not have the force of impact held in professions such as medicine or law, where gross misconduct results in relinquishing the right to practice. In ICT however, despite misconduct, individuals can still practice their profession outside of the ICT member society.
- Many individuals belong to more than one organisation/society, resulting in difficulties in determining how to act in situations where the codes of the various bodies are not aligned.
- Difficulties exist in establishing and implementing enforcement procedures that do not have a legislative basis.

5.4.3.2 *Sanctions Lessons Learned*

The issue of ensuring ethical conduct within the ICT profession is an important point of reflection. In considering this, it is important to note that the implementation of legislation

in some areas, for example pertaining to protection of personal data, was a successful and necessary initiative. Because adhering to high ethical standards is and will be a key requirement of individuals working within the ICT profession, addressing the issue of ethics and accountability will need to form an important component of our framework.

5.4.4 Final Thoughts on Ethics Initiatives

In many respect, a universal code specifying principles of ethical behaviour that all ICT professionals are required to sign and abide by would resolve many of the issues associated with incorporating the ethics pillar within the European framework for ICT professionalism. The ICT professionals' commitment to an Ethics standard could be demonstrated by assessing their professional practice against an agreed Code of Ethics/Conduct. However, we know from previous research that such a universal code is not feasible. Developing individual Codes of Ethics within the national computer societies that follow a standard set of criteria and procedures for their development is one step. However, a considerable challenge is the issue of accountability, particularly where individuals are not members of their national computer society, and alignment of different codes where a number are adhered to. Consistency in sanctions and disciplinary procedures for breaches of Codes and various degrees of misconduct is a further issue. It is understood that any recommendations from this report needs to be general enough to encompass the various Ethics Codes, guidelines and laws in force.

5.5 Analysis of CIO / ICT Manager Training

The requirement for training for ICT professionals operating near or at CIO level is reflected in the increasing demand for places on part-time postgraduate programmes. This reflects the maturing of the profession and the realisation that to operate as a senior ICT manager within any organisation requires a much broader set of skills other than technical. The lack of formally defined professional and educational requirements for those operating at senior ICT management levels has meant these roles have been open to specialists from other disciplines. This in itself is not necessarily a problem. However, it has identified a lack of the necessary business and management skills in those progressing up through the more established technology focused career paths. Thus further highlighting the point that something needs to be done to help expand ICT profressionals skill sets. It is not the first time that a profession's members have found themselves lacking the necessary skills when operating at higher levels of management.

In the early 20th century the MBA programmes set up at Tuck, Dartmouth and Harvard Universities were established to help engineers, scientists, and specailists in general who lacked business and management experience develop their skills and understanding to a point where they could operate effectively at a senior management / boardroom level. This was a model for education that certainly gained popularity within the US, and then globally.

The delivery of the MBA may have changed with time, however, the basic areas on which it strives to improve an individuals capability have largely stayed the same: accounting, economics, entrepreneurship, finance, international business, management science, marketing, operations management, organisational behavior, project management, real estate, and strategy.

Over time the format of the MBA has been influential in the development of other postgraduate programmes for non-business and management specialists. Many universities now increasingly offer other master's programmes (MSc, MEng, MA) that provide a balance between business and management and advanced specialised topics for the specialists being

catered to. This works well, as the business environment becomes more complex and dynamic, those moving into senior management positions need to develop business and management understanding, but also continue to build on their core specialist knowledge, even though it's at a high level. This continued focus on building the specialist's core knowledge was not part of the original MBA's intention.

However, as in the case of most of the university programmes reviewed in section 4.5 it is evident that the programmes are being developed to build business and management knowledge, whilst continuing to build specialist knowledge around core ICT themes and concepts. This approach is demand-driven in that universities and education providers are responding to pressure from industry partners and local governments to provide vocational programmes. It is also worth noting though that the development cycle for postgraduate programmes can be slow, with most masters programmes taking anywhere between 18-36 months to develop. This can have a significant impact of the currency of a programme in a fast-moving, dynamic business environment.

Through improvements in technology (faster and more accessible broadband, virtual learning environments (VLEs) etc.,) access to programmes has never been easier, with many programmes now accepting students for distance learning via VLEs. However, there are still some issues that need to be addressed if CIO / ICT managers are to fully embrace the need for education in order to improve their performance in their respective roles.

The key issues identified below are not in any order of priority. It is important to note that the issues identified here largely reflect the guidelines as identified in the European e-Competence Curricula Development Guidelines Report (2011).

5.5.1 Issue 1 - Incentivising Participation

The US Government has taken the step of passing into legislation the requirement for CIOs to demonstrate a level of capability and professionalism around specific knowledge bases. How would an approach like this work within an EU context? Certainly the immediate benefit would be to drive up education participation amongst CIOs and senior ICT managers. However, forcing CIOs to undergo mandatory training is no guarantee that the individual's knowledge and ability will improve.

It is a fact that demand driven courses will result in higher levels of attainment for the participant than mandatory courses, which tend to be seen as 'box-ticking' events by the participants.

Therefore, if CIOs are to support any form of role-specific training, they need to be convinced first as to its relevance to them, and their respective organisations. As seen with those universities beginning to provide ICT management course and programmes their relevance, and to a large degree success, is assured by engaging with their respective target groups at the course and programme design stage. This demand-driven approach helps ensure the course remains pertinent to the target group. However, many programme providers are still developing their courses without consultation. In effect, this is amounting to nothing more than a re-branding of older material to attract a newer audience.

5.5.2 Issue 2 - Defining the level for training

As a CIO, or potential CIO, what level of training should be expected? As outlined in Issue 1 there is potential for high levels of inconsistency to develop between courses and programmes around quality of delivery and content, and relevance of content. Once again

many universities are demonstrating a level of consistency between themselves in terms of content, relevance, and quality. However, this is left up to the universities and accrediting bodies such as AMBA, EQUIS, and various other professional bodies to regulate. The issue here is that these accrediting bodies are not assessing the courses and programmes against a specific role type (CIO) but against the professional bodies' education requirements for its members, which in turn may cater to a wider group of professionals.

Therefore, there is a real and identifiable need to assess courses and programmes around the educational requirement of a CIO / senior ICT manager. For this two things are needed:

1. An agreed Demand-driven CIO specific syllabus.
2. A means of ratifying and accrediting CIO relevant courses and programmes.

5.5.3 Issue 3 - Ratifying and Accrediting CIO / ICT Management Training

How do we ensure the training provided for CIOs and senior ICT managers is maintained at a consistent quality across the EU? As highlighted in section 5.5.2 in order to ensure relevance of training at an EU level there needs to be some mechanism to assess and ratify courses and programmes being offered. This is important as by doing so facilitates a clearer understanding around qualifications, and the expected educational level attached to the qualification. This is necessary if the relevance of education and training is to be easily assessed between EU Member States, thus improving professional mobility.

At present there are no accrediting bodies currently engaged in assessing and ratifying courses and programmes from a CIO perspective within the EU. The formation of such a body would help formalise the importance of CIO specific education and training.

5.5.4 Issue 4 - Financial Support

How can we lower the cost barrier to increase the up-take by SME CIOs / ICT managers? And is the cost actually seen as a barrier? If more CIOs and senior ICT managers are to be encouraged to take up more role-specific education then the cost to the individual and sponsoring company needs to be considered in terms of financial cost and time commitment. This is particularly relevant considering that over 97% of businesses within the EU are SMEs.

It will be difficult to convince universities and commercial education providers to reduce their tuition fees, and there are doubts as to whether this is the best option. It is accepted that additional education is required in order to more effectively enable the CIO in the modern organization. However, it is not necessarily a prerequisite that this education and training take the form of a postgraduate master's degree. It should also be remembered that the path to being a CIO can take many different directions, and the qualifications will be varied amongst those assuming the role. Because of this many CIOs / senior ICT managers may not wish, nor need to complete a whole postgraduate degree programme.

To that end other means for packaging the content needs to be considered. A consideration would be establishing a programme similar to CMU's Federal CIO Certification Programme. The content would need to be reviewed in line with a demand-driven requirement by EU CIOs, but such a programme could allow CIOs to select courses that can be used to augment their existing education and qualifications. This model would also allow the participant to develop their capability in a way that is not financially restrictive.

5.5.5 Issue 5 - Lifelong Learning

Traditionally, many universities and commercial education providers offered courses and programmes designed as stand-alone offerings. This is very common for courses offered at postgraduate level. There are signs that this is changing, especially around vocational postgraduate programmes. Many universities are beginning to offer Continuous Professional Development (CPD) programmes to their alumni. This is proving very successful in encouraging alumni to re-engage in education and also in providing universities with an indicator of what the current and hopefully future demands for education will be.

However, once again these CPD events vary in quality and substance, and are designed to relate to a wide audience. The potential to develop and deliver CIO specific CPD training through this mechanism is very good. However, before this can be effectively achieved CIOs need to be incentivised to attend. This can be achieved through accrediting the CPD training as part of an overall accreditation programme.

5.5.6 Final Thoughts on CIO / ICT Manager Training

Certainly all indications are there that education providers are beginning to respond to industry in terms of providing relevant, vocational programmes. However, the landscape of educational offerings is vast. Universities, more so than commercial training providers, base their reputation on their ability to create and transfer unique knowledge. In many cases this manifests itself in the development of what is perceived to be unique course and degree programmes.

Other, more established professions in the case of medicine, engineering (including computing and software engineering), law, accounting, and architecture to name a few have influenced the course and programmes being developed around their respective professions. However, many of these professional bodies ratify and accredit courses and programmes based on admission to the professional institute, and not on any specific roles the student will be expected to carry out (with the possible exception of medicine)[42].

In order to drive some level of consistency across the programmes being offered there needs to be a body that can ratify and accredit training and education in terms of an ICT profession, and also in terms of CIO training requirements. For the ICT profession the accreditation of courses will help drive clarity over qualifications obtained across different countries. Certainly, a lot of work has been done at national levels in terms of ratifying and accrediting educational programmes by professional institutes such as the BCS, IEI, ICS, AFCET, etc., however, the emphasis here is really around ensuring the development of highly effective professional CIOs and senior ICT managers.

Certainly, and so far, the US is leading in driving an accepted training programme for CIOs. However, that said, the requirement for training is based on legislation brought in to

[42] The medical profession have professional exams that are run by the professional medical bodies for graduate medics. These exams are role specific in terms of which branch of medicine the medic wishes to pursue. Successful completion of the exams qualifies the medic to practice at a consultant level.

existence through the Clinger Cohen Act in 1996. What is interesting is that for a legal requirement, the uptake by education providers in the US in offering specific courses has been low – only 8 providers have been approved to deliver the US Government endorsed CIO Certificate. This is because what is required by the Clinger Cohen Act is largely already included in most technology and business related Master's level programmes, which many universities and colleges would traditionally see as the preferred mechanism for delivering further education. However, as US education establishments also feel increasing financial pressure, due to raising costs, and a fall-off in the number of international students, some universities now see the provision of a non-degree programme as a potential feeder for their established Master's programmes.

Japan, India, and Australia have also recognised the need for ICT training. However, their initiatives are based on starting to educate students at 1st level (primary). Their programmes then continue on through 2nd and 3rd level education. For these initiatives the focus is not on developing individuals for specific organizational roles, but on increasing the ICT literacy of the population overall. To date there are no established initiatives within these regions that specifically focus on improving the competence and capability of CIO / ICT managers through the provision of dedicated training.

Within the EU there are positive signs that CIO training is firmly now on the agenda of most of the top-level universities and commercial education providers. However, development of training programmes is happening at a local / national level. This undoubtedly will see the development of excellent training programmes, but without some form of ratification and accreditation body, quality and relevance of the programmes will vary significantly across the EU.

6 Interview methodology

The interview methodology selected was to use a combination of online survey(s) with follow-up face-to-face or telephone questions to probe the responses. The initial contact would be via the online survey. This would be analysed to identify respondents that would yield useful insights from a follow-up.

The respondents selected would assist with the identification of "generally accepted good practice" which could help shape the framework around ICT Professionalism. Follow-up discussions would also look at why companies are not using or are not aware of existing initiatives. This will help understand if communications is an issue or is there resistance to these initiatives because of their structure, approach, cost, process or whatever gets expressed.

6.1 The online survey

A copy of the document based survey is shown in Appendix A (Sample Questionnaire). This is slightly different from the online survey but for the most part is accurate. Due to the breath of scope of the project, it was necessary to define a number of questions in each area. This in turn has meant that the time taken to complete the questionnaire was approximately 30-minutes. This time was at the upper limit of what survey respondents would normally accept and a high dropout rate was encountered.

There were a number of objectives to be accomplished via the on-line survey. Specifically, it was to:

- Validate the desktop research and identify gaps in the scope of the desktop research
- Identify the current appetite for the concept of ICT Professionalism
- Indicate possible sources of "generally accepted good practice"
- Probe the knowledge and use by stakeholders of existing initiatives
- Glean insights and thinking from practitioners on ICT Professionalism and ICT Manager Training
- Understand how well stakeholders felt the various existing possible components were delivering value
- Communicate knowledge about the project and raise awareness in the hope of further submissions.

More detailed and complex questions will be addressed in the telephone conversations. They will be more focused on specific areas that match the background and expertise of the respondent. Thus, it was necessary to ask several questions about the respondent, his or her organisation and the areas of interest and work that they participate in. Contact details were requested so that (subject to permission), we could contact the respondents again.

6.1.1 Targeted respondents

The initial invite list for the survey had representatives from all of the stakeholder groups. We wanted to hear from ICT Practitioners, public and private educators, course developers, body of knowledge developers and/or course syllabi developers. We also wanted to get views from the EU 27 countries and as many others as was practical with an emphasis on Japan, India and USA. The stakeholder communities identified in Figure 1 were also included.

The survey was open to all including non-ICT practitioners. This facilitated human resources, other executive managers, teachers and career guidance staff, students and other potential ICT Practitioners as well as users including SME's and other consumers of ICT services and products.

6.1.2 Stakeholders and their interests

There is an innate tendency in all of us to promote our interests. Thus, we have asked questions to understand what organisations the participants represent. This will help place responses in context. It also allowed us to get a view from the perspective of different stakeholder groups.

A number of fundamental building blocks or pillars for an ICT profession were identified (see 3.1 Approach):

- Bodies of knowledge (BOKs)
- Certification, standards and qualifications
- Competencies
- Professional Ethics

We wanted to hear from participants and understand that respondents participated in activities associated with these fundamental building blocks.

6.1.3 Bodies of knowledge

The desktop research was mainly focused on information provided by the owners and promoters of the bodies of knowledge. While supporting evidence was found for most of the claims, it was difficult to get a feel for the extent to which practitioners actually use these bodies of knowledge.

Further, we had only picked a subset of the bodies of knowledge and we may have missed some important ones.

In this section, we were trying to understand who was using bodies of knowledge? What uses were the bodies of knowledge being applied to? Were they fit for those purposes?

For example, the desktop research shows that a body of knowledge is updated every 5 years or so, but does that meet the needs of the users?

With these questions we had open ended text boxes where experts or people working on them could provide some insightful comments.

6.1.4 Certifications, qualifications and standards

Formal education qualifications as well as certifications (industry, vendor-neutral and vendor-independent) are regarded as one method of advancing career prospects within the ICT profession. This section elicited insights on issues pertaining to their perceived importance, drivers for acquiring them, expected trends, awareness of frameworks, and standards.

Was the perceived value shared across the stakeholder community? Was there an awareness of national or European qualifications frameworks and were they being used?

6.1.5 Competences

Competences are the skills and knowledge that practitioners have acquired during their career. This section gathered views on the usage of competence frameworks in organisations, as well as their potential benefits and barriers to adoption.

6.1.6 Ethics

Adhering to principles of ethical conduct is regarded as a defining aspect of many professions. This section gathered input on Codes of Ethics/Conduct used within the ICT profession, their content, usefulness, compliance requirements, and opinions on enforcement.

6.1.7 CIO Training

In this section, we sought to understand stakeholder views on the need for CIO training, as well as what content could best prepare CIOs to undertake the role successfully.

6.2 Testing

The questionnaire was developed in two formats. One used an online survey and the other was a word form that could be completed off-line.

Estimates were established for each question type; based on the number of each question types a time for the overall survey was initially identified at approximately 45 minutes. We reworked questions in an effort to reduce the time to below 30 minutes which we set as the upper limit of what could be achieved. Some questions were removed and would be addressed by follow-up calls.

The questions were peer reviewed prior to approval for use. A number of participants were asked to complete the survey noting the time as they transitioned between pages in the survey. The results varied from 20 minutes to 35 minutes depending on the respondent.

In terms of the online survey, we initially, loaded the survey using the Bristol On-line Survey Tool but as it did not at that time support the concept of “save and resume”, we decided to use Survey Monkey instead. Retesting using the Survey Monkey tool showed our criteria were met.

6.2.1 Results analysis

We performed a number of analysis and reporting activities on the test answers. We were satisfied that either the Survey Monkey features or manipulation and analysis of the downloadable spread sheets from Survey monkey would meet our needs.

7 Interview results

As part of the first phase of this research project, we contacted many ICT practitioners, representing a wide range of ICT roles and experience[43] to understand the dynamics of ICT professionalism in more detail. 380 of those contacted participated in the survey and provided us with insights into the area of ICT Professionalism.

Most of the member states were represented and a number of non-EU countries also responded. All stakeholder groups are represented in the survey and each person in the sample population had, on average, approximately 19 years ICT experience.

There is a mix of qualifications levels among the respondents. The highest qualification level attained by the respondents is shown as:

Highest attained level	# Respondents
EQF 8 (Doctorate)	69
EQF 7 (Master's Degree)	175
EQF 6 (Bachelor's Degree)	88
EQF 5 (Diploma)	35
None	13

Table 13 Highest qualification levels attained by respondents

We asked if these qualifications were in Technical, Management, Business or Other areas and the breakdown from the respondents was as follows:

286 (75%) had technical qualifications of which 125 (33%) had only technical qualifications.
117 (31%) had management qualifications of which 2 (1%) had only management qualifications.
137 (36%) had business qualifications of which 11 (3%) had only business qualifications.
132 (35%) had qualifications in the other category of which 41 (11%) had only other qualifications.
13 (3%) had no qualifications.

[43] Each person in the sample population had, on average, approximately 19 years ICT experience.

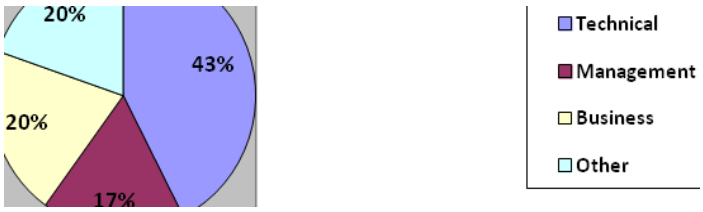


Figure 22 Qualifications mix

Please note that many respondents have qualification in different areas and some 25 respondents have qualifications in all four categories.

Given that one of the drivers for developing an ICT Professionalism Framework is to improve mobility of workers, it is interesting to note that some 45 respondents are working in countries other than their origin. Thus, these respondents are likely to have experienced promoting their certifications and qualifications across national boundaries.

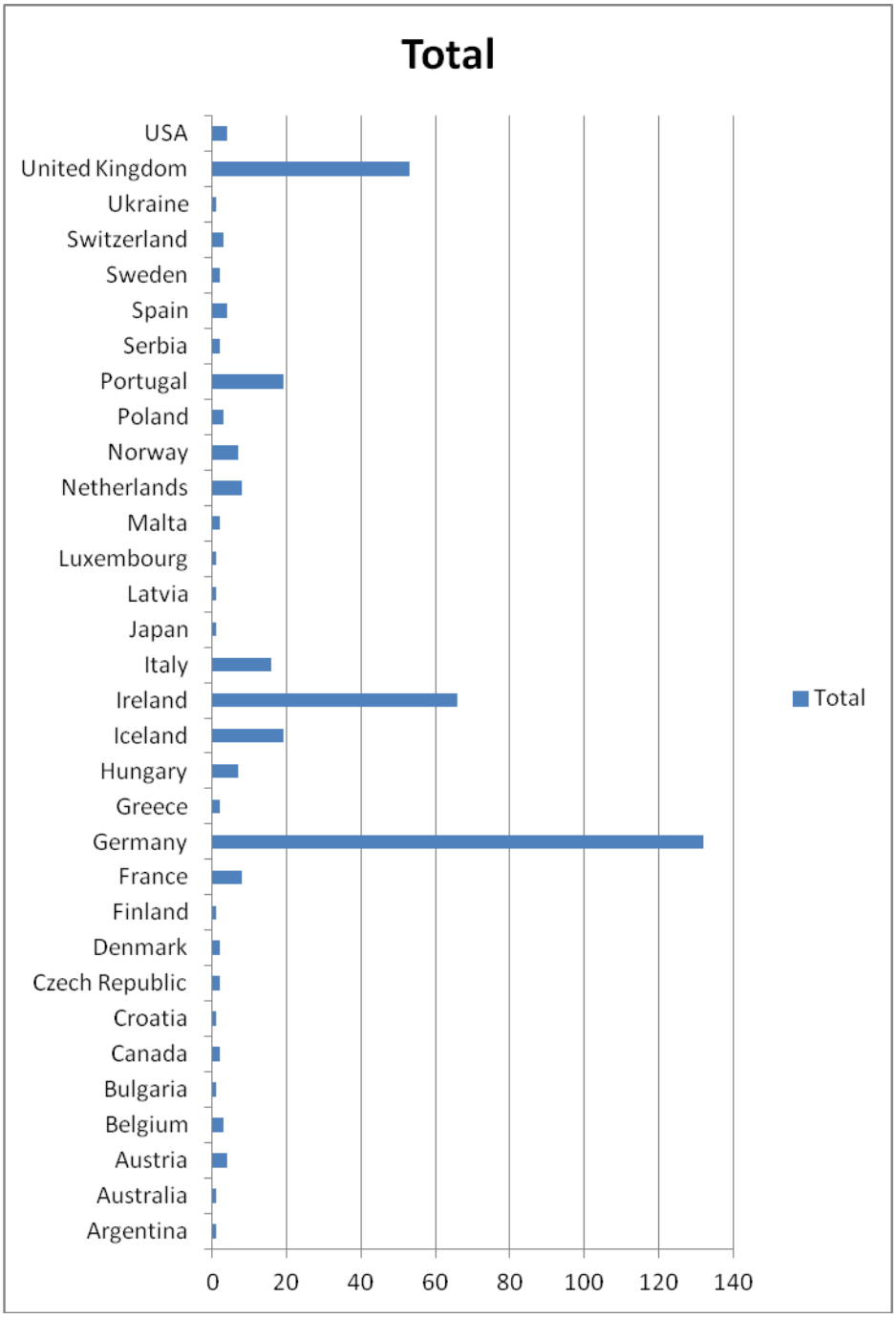


Figure 23 Nationality of respondents

The routes taken by the respondents are varied and reflect many different career paths. Thus, the survey respondents represent the more common paths into the ICT profession.

Route into ICT Profession	Number	Percentage
Directly from college by training on the job	1	0%
Directly from college following a conversion course	14	4%
Directly from college via an ICT related course	214	56%
Directly from school with on-the-job training	3	1%
I do not work in ICT	10	3%

Route into ICT Profession	Number	Percentage
Planned via certification route (vendor and vendor neutral)	10	3%
Role evolved over time to encompass ICT components	49	13%
Self-taught with personal career plan	32	8%
Transferred from another role[44]	37	10%
Other	9	2%

Table 14: Respondent routes into ICT Profession

Clearly the dominant route is via an ICT related college/university course at 56%. This is followed by role evolution combined with inter and intra company transfers accounting for 23% between them. This is followed by self-taught route. All other routes make up the balance. Note that 10 respondents indicated that they do not work in ICT.

The respondents are associated with the organisation types shown in Table 15. The bulk of the respondents at 61% represent private enterprise. Public and private education is represented as well as government, certification bodies and professional ICT organisations. The number for government at 11% includes all levels of government including EU, national and local.

Organisation type	Percentage
Private enterprise	61%
Public educator	13%
Private educator	3%
Certification developer	3%
Unions	1%
Professional ICT association	7%
Government (EU, National or Local)	11%
Other	1%

Table 15: Respondent organisation types.

The survey respondents are actively participating in the identified building blocks for an ICT profession. The rations of involvement are shown in Figure 24.

[44] The survey option was "transferred within a company from another role". However, a number of respondents indicated that they transferred from another role in another company. The figure is the combined number.

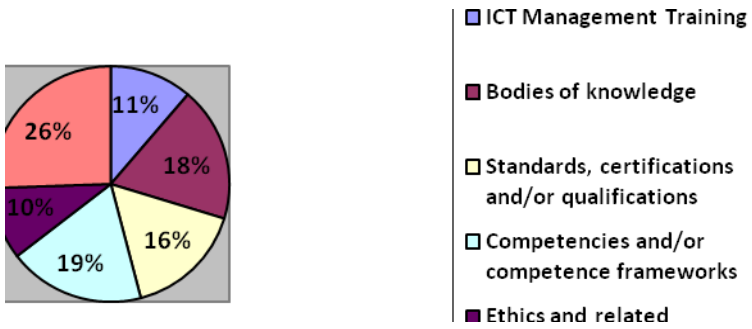


Figure 24 Professional activities of respondents

7.1 Bodies of Knowledge

7.1.1 Industry recognised bodies of knowledge

The industry recognised bodies of knowledge in use include ACM/IEEE Computer Science Curriculum; Advanced Distributed learning; BABOK; CMMI; COBIT; ESSup (Fujitsu Apt); IASA; ISF, SARA & SPRINT; ISO Various; IT-CMF; ITIL; Lean; Managing Successful Programmes (MSP); Mastering Requirements Process; Microsoft Infrastructure Optimisation; Microsoft Operations Framework (MOF); OBASHI; Open Web Application Security (OWASP); PCI-DSS; PMBOK; Prince2; Rational Unified Process (RUP); Sherwood Applied Business Security Architecture (SABSA); SWEBOK; Total Information Quality Management (TIQM) and TOGAF.

ITIL was the most frequently cited body of knowledge. This was followed by PMBOK, Prince2, COBIT, CMMI, IT-CMF, TOGAF, SWEBOK and ISO Various. All others had very few reported usages.

The survey results confirm the desktop research in a number of ways. The bodies of knowledge are considered relevant, current, adequate and appropriate to the tasks assigned. Some variations were observed but these were statistically insignificant or wrapped in specific use cases. The results were consistent across all organisation sizes. There is a slight drop in satisfaction in medium sized companies but overall all users are happy with the bodies of knowledge. All organisation types use the bodies of knowledge. The use differs by organisation type but this is consistent with their objectives.

The bodies of knowledge identified for the desktop research were the dominant ones found to be in use. TOGAF was initially missed and has been added subsequently.

BOK	Uses by Private Enterprise
ACM/IEEE Computer Science Curriculum	defining standards
CMMI	Benchmarking own organisation; Compliance, Gap Analysis; Guidelines for project management; internal certification; Process Improvement; Software development/delivery; Structured Project Maturity

BOK	Uses by Private Enterprise
IASA	Architecture
IEEE	Research and Compliance
IT-CMF	Enterprise IT Management; Organisation Design, Readiness for Services expansion, external certification; value management
ITIL	application management services; Best practice for service management improvement certification exams; Configuration Management; Consulting; define standard processes to governance it; Defining and operating IT Service Management processes; Defining certification for exams, IT service improvements in organisations; defining standards and compliance; Design of IT Processes; Framework for the provision ICT Support Services; Framework of business processes for IT, Networks, Technical, Telecoms services across the business; Framework on which the delivery of ICT services is based. ITIL processes also underpin the banks ISO20000 IT Service Management Framework; Gap analysis at vendor support process level; Guidance on Service Management projects and course delivery; Implement security related IT services; IT management; IT Process Management; IT Production; IT Service Delivery & Management;
Lean	Continuous Process Improvement with focus on eliminating waste
Microsoft Operations Framework (MOF)	Service Lifecycle Management, Planning and Governance
Navision Developer's Guide	Adaption and extension of internal ERP system
PMBOK	base for project management method in company; basis for company standard, basis for individual work; education; Frameworks - overview and initial starting point for developing internal framework; Guides approach to project management; Project Life cycle management; Project Management; project management and project delivery; Project Management training; Project planning and analysis; Project structure; Reference; Software Development Project Management
Prince2	business and program planning; defines standards for teams; Defining Project Management Standards; General Project Management, Enterprise Management, Compliance; PLC Control and Reporting defining standards; Project Management
Scrum	SW development
SSADM	systems analysis
SWEBOK	theoretical background / training
TOGAF	defining architecture standards; Enterprise Architecture; To define training course accreditation criteria and people certification exams and related criteria

Table 16 Sample of private Enterprise BOK usage responses

The following table shows a sample of the response to BOK usages by public educators.

BOK	Use
ACM	literature research
ACM/IEEE Computer Science Curriculum	Curriculum Review; defining standards
COBIT	scientific argumentation and founding; Teaching
Curriculum für ein Basismodul zur Mensch-Computer-Interaktion (Juli 2006), Empfehlung der Gesellschaft für Informatik e.V., erarbeitet von der Fachgruppe Software-Ergonomie **Google translation** *Curriculum for a basic module on human-computer interaction (July 2006), recommendation of German Informatics (GI) eV, prepared by the Division Software Ergonomics*	Course "Human-Computer Interaction" for Bachelor students
IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems (Association for Information Systems)	In part as a basis for our bachelor programme in Information Systems
IT-CMF	Assess business value of IT; development; gap analysis
ITIL	Best practice for service management improvement; Service Management Review, and cloud maturity for adoption
PMBOK	defining standards and certification exams; explain structure of project management
SWEBOK	Teaching

Table 17 Sample Public educator BOK uses

The uses to which bodies of knowledge were applied by the stakeholder groups reflected their objectives.

Some minor surprises were observed. It was expected that the larger companies would be dominant in the use of bodies of knowledge. This was confirmed. However, micro companies also use the frequently reported bodies of knowledge. Small companies did not report much usage of the bodies of knowledge. Although we did not ask if people were working as consultants, we can suggest that the micro companies may be using the bodies of knowledge as a consultancy sales ticket. Effectively, their consultancy may be specialised and focused on the bodies of knowledge reported.

Because the numbers of respondents from some countries was too low, it is not possible to make significant statements about country-to-country differences. However, one difference is that Prince2 seems to dominate the project management world in the UK.

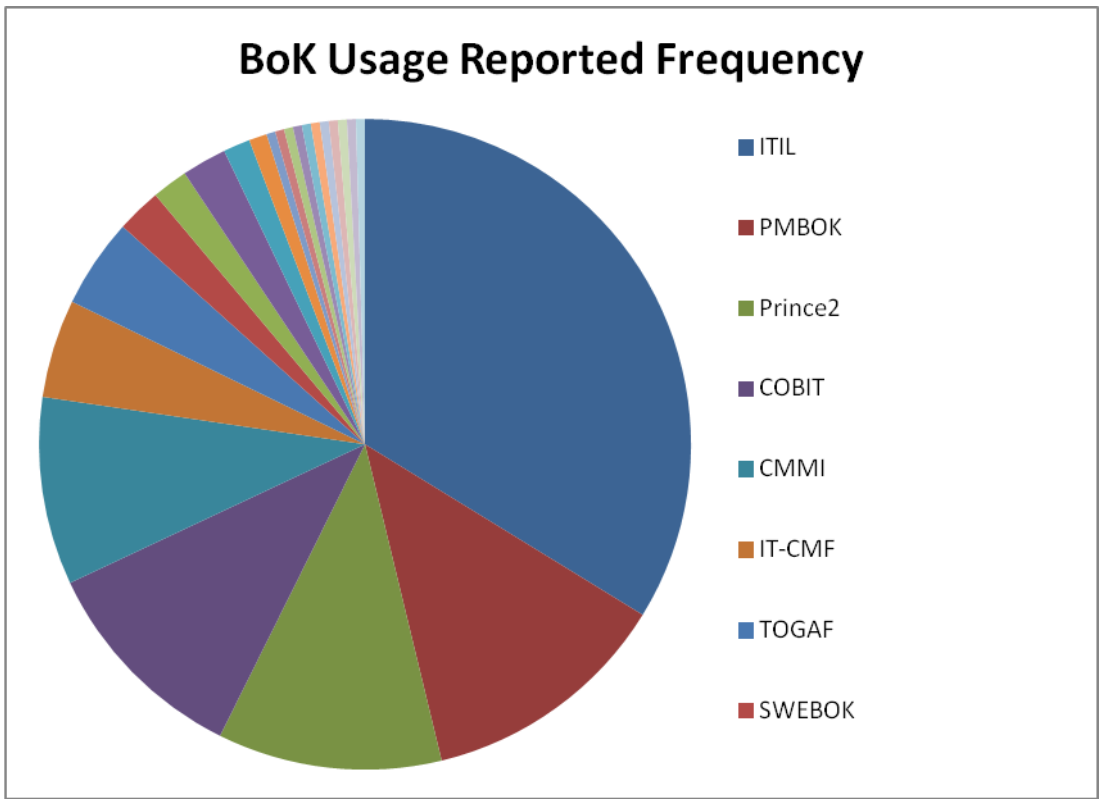


Figure 25 Industry recognised BOKs

7.1.2 In-house or self-developed bodies of knowledge

The results here did not identify any common trends. There does not appear to be a common gap or knowledge area that several companies are addressing. All seem to be specific to solving particular issues for the organisations involved.

It is worth noting that none is developed based on in-house technology roadmaps.

7.1.3 The nature and structure of bodies of knowledge

Industry established bodies of knowledge had different formats:

- Syllabi (community driven)
- Body of knowledge in text and diagram
- Syllabi with bibliography
- University syllabi
- Capability maturity models

Many bodies of knowledge are targeted at the ICT entry level. Others encompass a wider scope in terms of the level or seniority at which they are targeted.

7.2 Competence frameworks

7.2.1 Framework awareness

Awareness of competence frameworks was low.

- 66% were not aware of any ICT-specific competence framework,

Framework awareness is important: low levels of awareness will clearly impact adoption across all stakeholder communities. Moreover, the impact is self-reinforcing. The less one stakeholder community knows about the framework, the less interest related stakeholders are likely to show in the framework as the potential benefits from investing in adopting the solution are unlikely to deliver recognisable benefits. That said, the opposite is true, in that there are opportunities to enter into a virtuous cycle: that is, if companies adopt the proposed framework to specify the competences required for roles in their organisation, HR companies will adopt it in their job advertisements, practitioners will demand courses which are aligned with the framework to help them develop their careers, and education/training providers will deliver courses which meet these needs, which supports companies in finding a supply of suitably skilled workers.

While a small majority of participants (55%) indicated that their company defined job roles in terms of competences, the level of awareness of specific ICT competence frameworks was relatively low among the population sample.

- 9% of respondents were aware of the e-CF
- 11% of respondents were aware of SFIA

We have not included separate figures for national frameworks as the responses for national frameworks were too low to be considered meaningful. Interestingly, almost 13% of respondents were aware of the IT Capability Maturity Framework (to assess organisational maturity rather than individual competence proficiency) but this could reflect bias in the population sample, due to the framework's relationship to the main project contractor. Similarly, figures for SFIA awareness may be influenced by the fact that the survey sample included a relatively high number of UK and Irish respondents.

7.2.2 Framework adoption

When asked which ICT competence frameworks were in use in their organisation, the level of adoption indicated was very low.

- e-CF 2.6%
- SFIA 3.0%
- Unaware of usage within organisation 81%

However, this stated low level of adoption was not altogether unexpected: furthermore, many CIOs may be blissfully unaware of the specific competence framework in use in their organisation preferring to "leave it to HR".

7.2.3 Balanced Skillset

When asked about the skills focus of the ICT competence framework in use in their organisation, only 36% of respondents noted that there was a mix of technical and non-technical skills. Given the growing importance of frameworks that have an appropriate balance of technical and non-technical competences, this represents a potential opportunity to create a more balanced solution in many organisations.

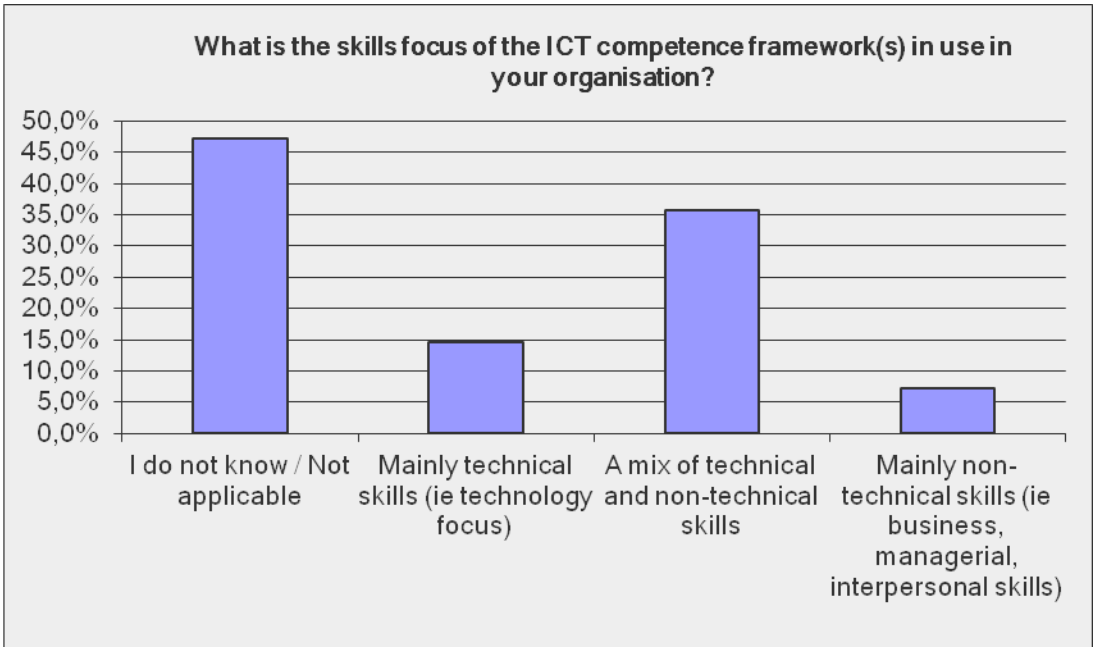


Figure 26 Skills focus of competence framework

7.2.4 Benefits of an ICT Competence framework

Where companies have an ICT competence framework in place, respondents were asked to identify the top two benefits of adopting an ICT competence framework within their organisation.

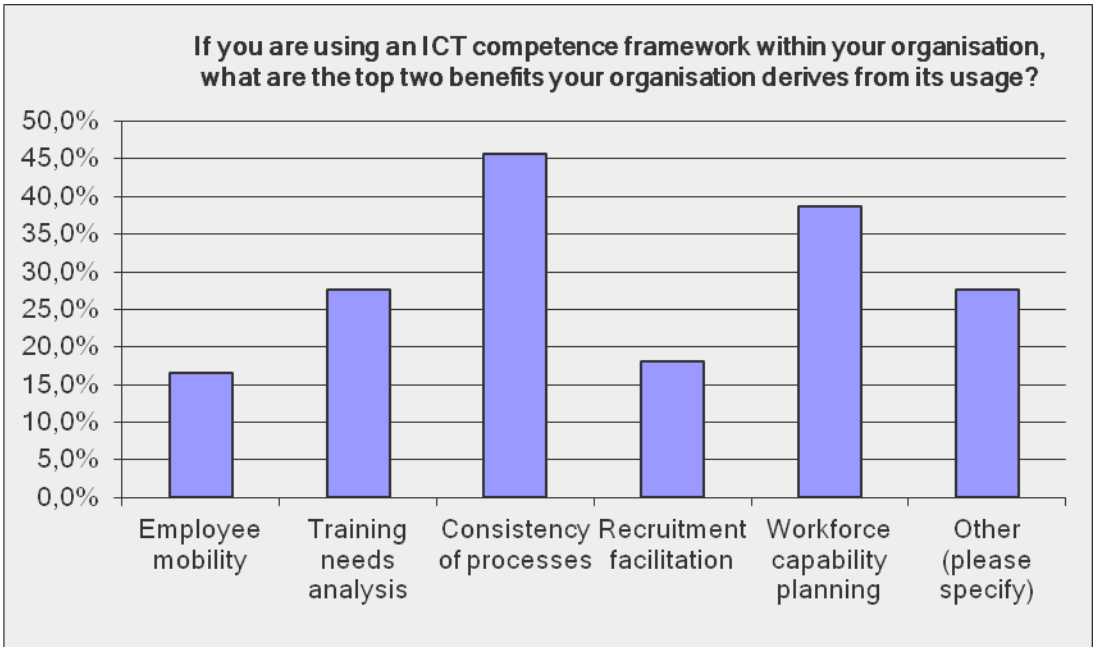


Figure 27 Benefits of Competence frameworks

Consistency of processes (46%) and Workforce Capability Planning (39%) were the leading responses.

Interestingly, employee mobility scored relatively lowly, but as candidates were only invited to select the top two benefits, this result is most likely to represent relative priorities for organisations.

Indeed, when asked "what trends do you see in your organisation relating to the number of workers employed outside of their country of origin?" most respondents forecast an upward trend.

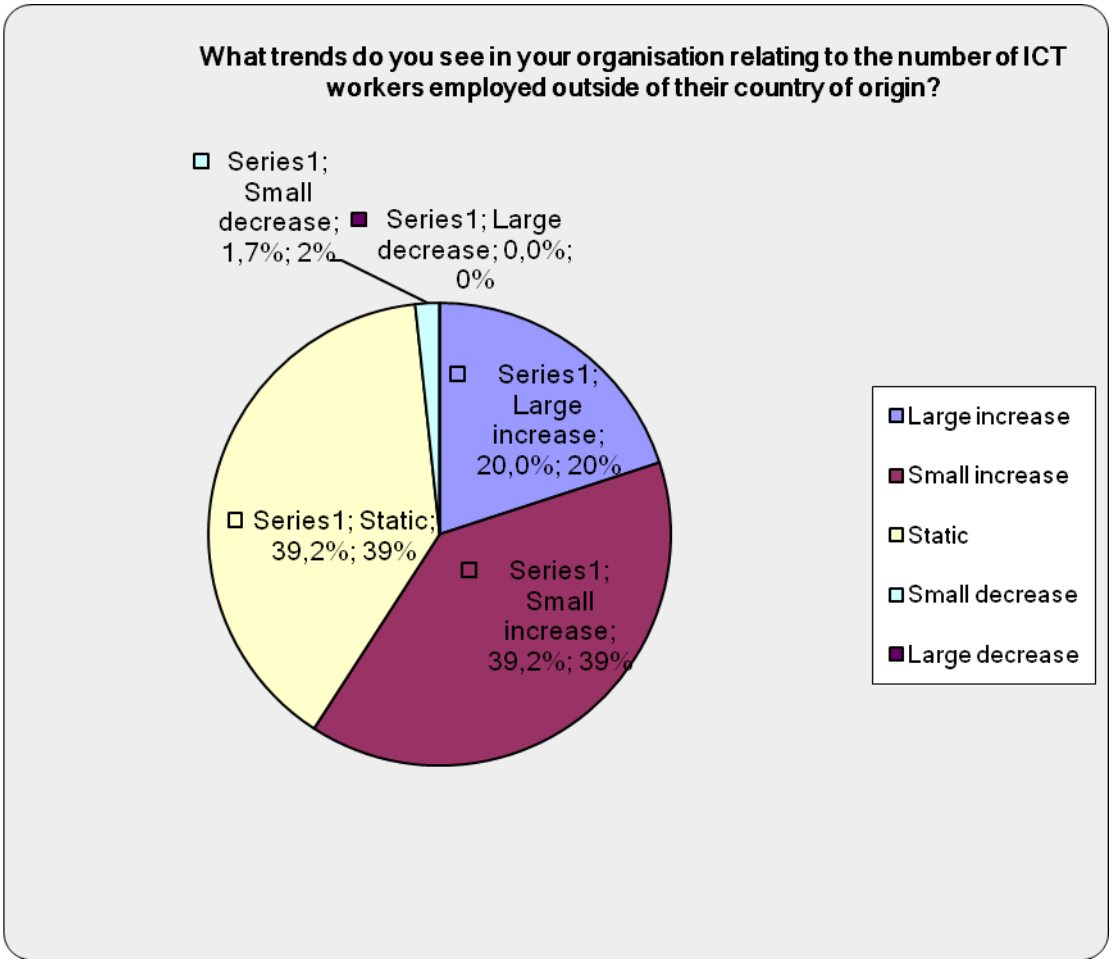


Figure 28 Mobility trends

Accounting for the leading perceived benefit, namely consistency of processes, would suggest that the frameworks were particularly helpful for large companies wanting to enable consistency across and between countries. However, smaller organisations wanting to outsource parts of their ICT function may also benefit from increased consistency when dealing with potential suppliers.

The second most significant benefit listed, workforce capability planning, raises a separate concern. While ICT competence frameworks support identification of a robust set of competences for all ICT job roles across an organization, they are in essence showing only one part of the problem as ICT organisational capability is not being assessed. That is to say ICT competence frameworks show individual capabilities, and these can be aggregated in theory, but practical operational output may not be realised and this could only be identified using a separate ICT organisational capability assessment (e.g. IT-CMF, eValIT,…). Thus, it may be useful to investigate options as to how the assessment of organisational capability could be undertaken so as to support potential gap analysis activities.

7.2.5 Obstacles to adoption

We identified that a lack of awareness of the existence of a competence framework and lack of perceived benefits were the two main obstacles preventing companies from adopting an ICT competence framework.

This would reinforce the earlier findings that branding is of paramount importance, and the value proposition for stakeholders needs to be clearly communicated.

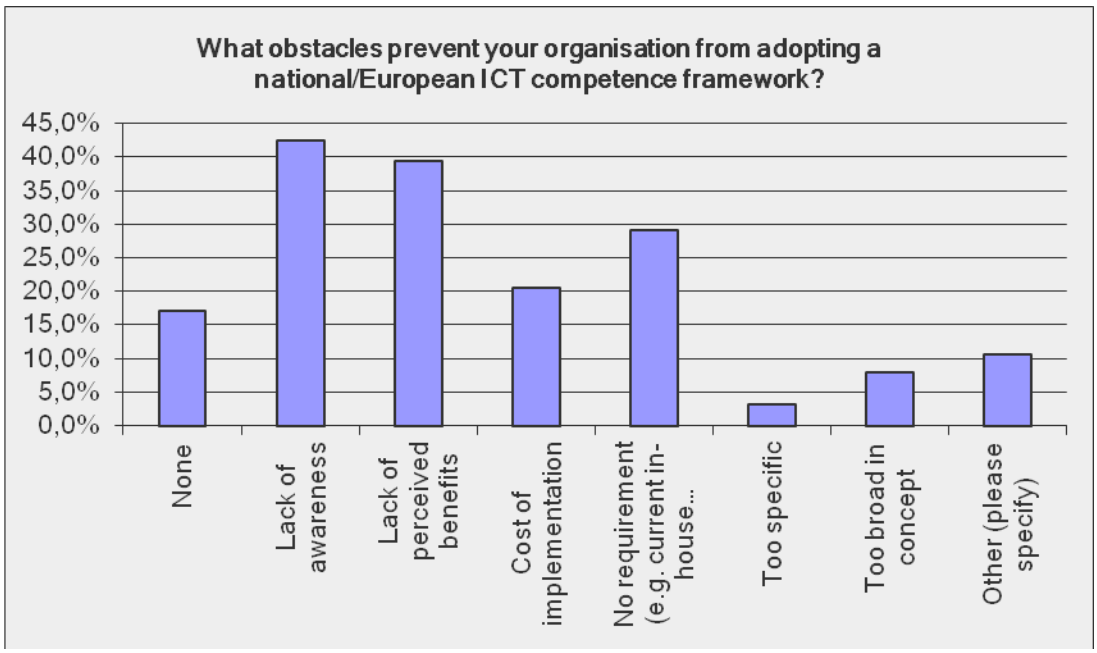


Figure 29 Obstacles to adoption

7.3 Certifications, Standards and Qualifications

7.3.1 Perceived Importance of ICT Certifications and Formal Academic Qualifications

Respondents provided their views on the importance they attribute to both ICT certifications and formal academic qualifications as a factor for recruitment and for continuous professional development. In terms of recruitment, greater than 72% of respondents regard certifications and greater than 88% regard formal education qualifications as at least "a factor" in recruiting for ICT jobs at any level of seniority (In other words they consider it "very important", "important" or "a factor").

	Certifications			Formal Academic Qualifications		
	Very important	Important	A factor	Very Important	Important	A factor
Entry level	12.5%	23.9%	40.4%	40.7%	34.7%	18.9%
Senior/Experienced	20.3%	30.8%	33.9%	25.1%	41.0%	29.5%
Managerial	13.4%	21.2%	37.7%	25.9%	32.8%	29.4%

Table 18 Importance of ICT certifications and academic qualifications during recruitment

Closer analysis of these responses reveals the following distinctions:

- Entry level positions:
  - Greater importance is attributed to formal academic qualifications than to certifications for entry-level positions. 40.7% of respondents suggest that formal academic qualifications are "very important" at entry level, compared to 12.5% for certifications.
  - 94.3% of respondents suggest formal academic qualifications are at least "a factor" in recruiting for entry-level positions (In other words they consider it "very important", "important" or "a factor"). This implies that in order to work in the ICT industry some level of formal qualification is required.
- Senior or managerial positions:
  - The degree of importance attached to academic qualifications appears to reduce for senior and managerial positions. The number of respondents who suggested formal academic qualifications were "very important" in recruiting for senior and managerial jobs were 25.1% and 25.9% respectively.
  - The importance attributed to ICT certifications increases, with 20.3% suggesting ICT certifications were "very important" for senior positions.

In terms of Continuous Professional Development (CPD), greater than 74% of respondents regard certifications and greater than 75% regard formal education qualifications as at least "a factor" in further developing their professional careers.

	Certifications			Formal Academic Qualifications		
	Very important	Important	A factor	Very Important	Important	A factor
Entry level	20.5%	33.0%	29.9%	19.2%	26.5%	38.7%
Senior/Experienced	18.1%	39.7%	28.9%	12.9%	31.8%	37.1%
Managerial	12.0%	26.8%	35.9%	15.2%	25.8%	34.6%

Table 19 Importance of ICT certifications and academic qualifications for CPD

Greater importance is attributed to ICT certifications compared to formal academic qualifications for entry and senior level positions:

- At entry-level 53.5% said ICT certifications were "very important" or "important", compared to 45.7% for academic qualifications.
- At senior level, 57.8% stated certifications were "very important" or "important", compared to 44.7% for academic qualifications.

Less than 18% suggested that formal academic qualifications were not relevant or unimportant as a component of CPD at any level of position seniority, which points to the significance of the current European initiative in terms of developing an education programme for CIOs and their equivalent.

Given the importance attached by respondents to both formal academic qualifications and certifications throughout an individual's career, the statistic cited in Brady (2009) estimating that up to 50% of ICT staff in the UK do not have formal ICT qualifications is somewhat surprising. Yet our survey also found that in terms of formal academic qualifications, 25.3% did not have ICT technical, 69.2% did not have ICT management, and 63.9% did not have business type qualifications.

7.3.2 Motivators and Deterrents in Acquiring ICT Certifications/Qualifications

Figure 30 and Figure 31 provide a representation of the factors motivating individuals to acquire certifications or formal academic qualifications, and those factors deterring against acquiring such certifications or qualifications.

Figure 30 Motivators for acquiring ICT certifications/ formal education qualifications

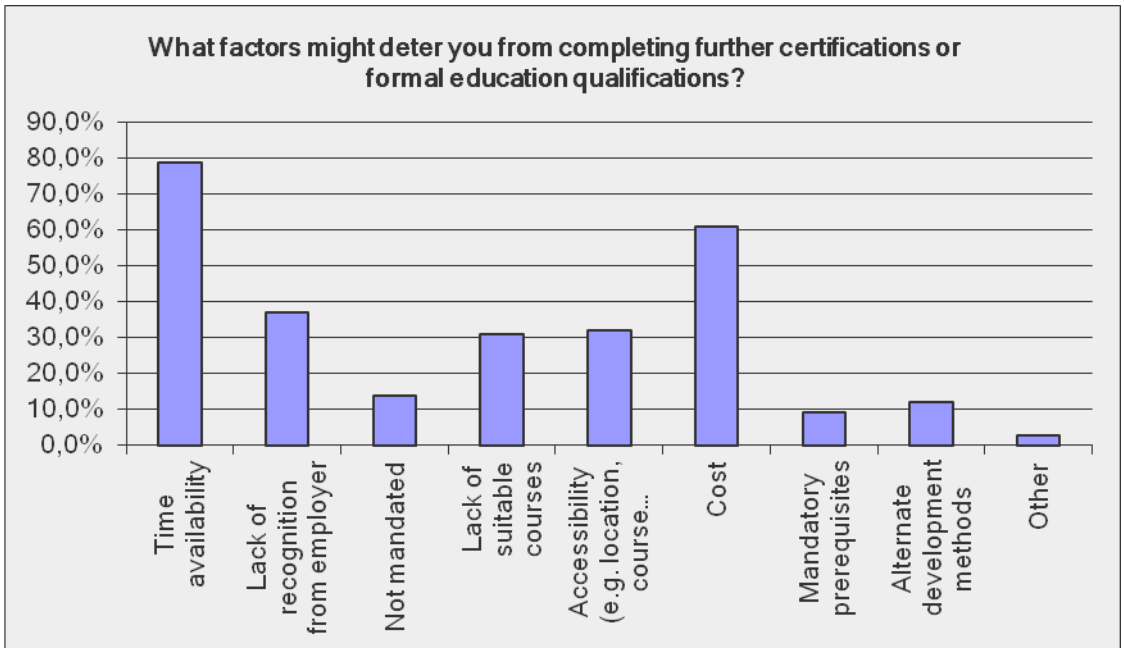


Figure 31 Deterrents for acquiring ICT certifications/formal education qualifications

Career development, knowledge acquisition, and professional recognition were the three motivating factors identified most frequently (68.8%, 66.4% and 58.7% respectively). These findings show an evolution from the 2005 survey[45] conducted by CEPIS where the top five drivers identified at that time for ICT professionals to acquire certifications were:

1. To increase credibility;
2. To assess knowledge;
3. To prepare for a new job;
4. To improve personal productivity; and
5. To meet job requirements.

Of interest is that only 35.9% recognise job requirement as a motivator. Yet from analysis of the importance respondents attributed to certifications and formal academic qualifications above, it is evident that for either entry level, senior or managerial positions:

- At least 72.3% of respondents regard certifications and at least 88.1% of respondents regard formal academic qualifications as at least a factor in recruiting for a specific job.
- At least 74.7% of respondents regard certifications and at least 75.6% of respondents regard formal academic qualifications as at least a factor in continuous professional development.

Furthermore, 34.6% of respondents identified job mobility as a reason for acquiring certifications. This issue of mobility may hold greater importance as a factor in the future, with 59.5% of respondents suggesting that an increase in the number of ICT workers being employed outside of their country of origin is/will be experienced.

It is unsurprising that time availability (78.9%) and cost (61.1%), are the leading deterrents for completing further certifications or formal education qualifications. Issues such as lack of recognition from employers (37.2%), accessibility (32.2%), lack of suitable courses (30.9%), and the fact that they were not mandated in the job (13.8%) were also noted. Some individuals rely on alternate development methods (12.1%), perhaps acquiring the knowledge through self-study but avoiding the expense associated with certification or registering in formal education institutions. This may be a consequence of less access to funding from employers given the tighter financial environment. It may also be tied to the value and impact attached to certain types of certifications, or the general culture towards attaining certification in a country. While learning and training in new developments is critical, some certifications are the product of multiple choice examinations which could be argued not to be an effective validation of competencies. This is exemplified in the following quotation from a survey respondent: “certification does not necessarily indicate expertise in the application of knowledge. Some certification needs to be backed up with formal recognition that the subject matter has been applied”. Where such multiple choice exams are the “final hurdle”, it could be argued that the value attached to such certifications may be diluted. However, given the perceived importance attached to certifications by respondents during both recruitment and CPD, this viewpoint appears not to be widely supported.

[45] CEPIS (2005). ICT-Skills Certification in Europe. Available at: http://www.ictliteracy.info/rf.pdf/eSkills_Certification_final_report.pdf

7.3.3 Industry-Academia Collaborations

61.2% of respondents were not aware of any industry-academia collaborations on ICT certifications and qualifications. For those individuals who were aware of such collaborations, many suggested a growing trend in this area in the future. Possible trends include a growth in the number of innovation centres and technical labs within universities; and greater use of collaborative technologies and online, interactive approaches similar to those adopted by Harvard. The following quotations support a growing trend:

> "Moving forward it will be necessary for both industry and academia to pull together to offer courses that will meet the needs of industry".
>
> "Academic initiatives sometimes don't reach the business world – there is a need to tie the knot and close the gap between them"
>
> "In a sector as volatile as ICT, academia needs to be more agile/responsive to educational needs. The inclusion of industry practitioners on academic boards is very valuable"
>
> "[There is a] need for higher course content direction from industry leaders to improve readiness of graduates for industry"
>
> "My view is that academic / formal education, professional development, and even non-formal learning need to align more closely to enable knowledge workers to continue to develop over the course of their careers. I would like to see acceleration in the pace of this convergence/alignment".

EuroCIO which is the European CIO professional organisation, connected to approximately 600 companies, provided insight on its educational programme for CIOs and other ICT staff. This serves as an example of some of the collaborations taking place in development of training/education material at present. EuroCIO is undertaking development of a three layer professional education programme for CIOs and their employees which has international accreditation and is compliant with the e-CF and EQF. This programme aims to meet the demands of ICT professionals. Layer One is targeted to the future CIO; layer two is targeted to those individuals reporting to the CIO; and layer three to other ICT staff. The layer one programme was developed by EuroCIO together with Nyenrode and Delft University, and was piloted in October 2010 in the Netherlands. This Executive MBA which currently has greater than 50 students, will be rolled out across Europe in several Business Schools, and is endorsed by CIO organisations, ICT industries such as SAP, Cisco, HP, IBM, PWC and multinationals such as Philips, DSM, RaboBank etc. A number of those companies are members of the Programme Review Board, providing input to the demand driven approach. The second layer of the programme is currently under development for the enterprise architecture function, incorporating input from a number of French multi-nationals such as AXA, Total, and Michelin. The third layer of the programme has not yet been developed as numerous courses already exist in the market for this area.

Other examples of industry-academia collaborations include:

- (ISC)²s' engagement with several universities in the UK who are "*interested in providing a certification slant to the qualifications that they offer*".
- Many of SEI's certifications are created through collaborative initiatives with government and industry representatives.
- ICCP's engagement with many US colleges and development of test instruments/normalised standards that can be used for benchmarking purposes.

In terms of the value of industry-academia collaborations, respondents offered mixed views. Some individuals suggested that they were very important, with a number of respondents identifying examples of these collaborations, e.g. Cisco Academy, as a useful means for spreading ICT knowledge. Further, "*because the speed of technological evolution is forced by commercial interests*", these collaborations can add value in terms of ensuring there are suitably qualified individuals entering the ICT market. A further respondent recognised that they provide an opportunity for individuals to gain formal qualifications that are relevant to their area of work. However, one respondent suggested that the value dimension for these collaborations rested mainly with the course delivery and training organisations, who benefit financially irrespective of course pass rates. Finally, it was suggested that unless these collaborations result in more recognised qualifications their value contribution to the ICT profession would be low.

7.3.4 National and European Qualification Frameworks

77.2% of respondents were not aware of their NQF. While it can be argued that many countries are in the development stages of their national framework, it should be noted that 31.6% of respondents are of Irish or UK nationality. 32.6% of respondents currently (or most recently) work in Ireland or the UK. Both of those countries have established NQFs, but awareness among ICT practitioners is still poor. Furthermore, 80.5% of respondents were not aware of the EQF. These findings point to important concerns regarding publicity surrounding these initiatives at both a European and national level and their subsequent adoption and value.

The survey also sought insight on the benefits to be derived from the use of such frameworks when comparing certifications and qualifications. Of the 298 respondents who answered this question, 169 individuals derived no or limited benefits or were not aware of any. This is unsurprising given the lack of awareness of these frameworks. The relevant benefit categorisations identified by the other respondents include:

- Basis of comparison for certifications and qualifications. For example, such frameworks:
    - Facilitate comparisons of "like with like" and "consistency between qualifications"
    - Provide a standardised and independent approach across the industry
    - Facilitate recruitment "when foreign qualifications can be readily assessed"
    - Facilitates transfer of credits
    - Enable comparison of the certification's/qualification's level, quality and learning outcomes
    - Enable more informed decisions regarding courses/certifications to undertake and support self-selection
    - Acts as "a baseline", "provides a common language" and "a common ground for evaluation"
    - Provides transparency and better understanding of certifications/qualifications value and relevance.
- Enhanced mobility between industries and countries through use of a common approach
- Improved knowledge on certifications and qualifications
- Provides a "level playing field" for candidates, employers etc.

7.3.5 ICT Certifications/Qualifications Support for Worker Mobility

74.1% of respondents believe that ICT certifications support worker mobility across national boundaries. The international recognition of ICT certifications and standards e.g. ITIL, PRINCE2, ISO 20000, CISSP etc., is a key facilitator of mobility for individuals holding those credentials. One respondent stated "*as most ICT certifications are universally recognised, be it by technology or framework, they are universally respected*". Use of a standard assessment process across different countries provides a useful comparator. One respondent suggests ICT certifications typically only support a limited set of knowledge and skills relevant to specific domains, and these are portable. Further, certification in for example programming languages and methodologies are typically not culture related, and can therefore help work integration abroad. However, the degree to which ICT certification contributes to mobility depends not just on the international recognition of the certification but also the certifications reputation and trustworthiness. Some certifications are awarded, for example based on a two day course and a simple examination. As stated by one respondent "*contrast this to the Cisco network professional qualifications CCNA, CCNP, which require significant effort and professional experience to acquire. A qualification like this sets a globally comparable baseline of competence*". Further, "*if the certifications can be trusted and are proven to indicate real capability, then the applicant is more mobile*".

One individual maintains that because worker mobility across Europe has been operating without difficulties for decades, in theory such frameworks as discussed above are unnecessary. Some respondents feel that it is factors such as language, culture, personal circumstances, regulatory issues as opposed to certifications held by individuals that inhibit movement across national boundaries. A number of respondents suggested that experience and implicit ability are more important factors for mobility. Judgment in recruiting abroad often needs to be based on work experience and achievements "*given the plethora of certifications across countries*". This comment links to the "certification jungle" experiences of the early years of the past decade.

74.4% of respondents believe that formal education qualifications support mobility, particularly if the primary and postgraduate degrees are internationally recognised. "*General concepts and principles obtained in academic studies are transportable*" noted one respondent and such qualifications are becoming "*more and more harmonized*". However, despite suggesting that qualifications support mobility, one respondent stated that "*employers are not fully aware of the true level of foreign academic qualifications*". A further respondent suggested that while the abilities developed through ICT qualifications are portable, soft skills are often poorly represented in existing qualifications. Support for mobility is also dependent on the awarding university/institution and its reputation and prestige.

Respondents who felt ICT qualifications do not support mobility made some interesting comments. The issue of comparability and consistency of qualifications across countries was one inhibitor, with problems such as comparing quality across boundaries identified. For example "*I think the situation is improving (with frameworks and models) but I still have the impression that academic qualifications vary in quality and level internationally*". Further, "*each country has more or less hidden walls that makes it very difficult to accept foreign academic qualifications*" and "*from my experiences most universities prepare for the national market*", with for example qualifications issued in one country not recognised in another. Greater publicity and awareness of NQFs and their more widespread development may alleviate perceptions such as these. Two respondents further stated that academic qualifications provide less support for mobility across national borders than professional ICT certifications, as "*internationally recognised ICT certifications make validating suitability for a role easier*" and "*formal academic qualifications in ICT are less relevant than vendor*

specific certification". As stated by one respondent "*it is very difficult to assess the standards of colleges between countries so often the professional qualifications are a more useful benchmark*". Similar to above, some individuals attach greater importance to experience in supporting mobility as opposed to academic qualifications.

7.3.6 Involvement in ICT Certification/Qualification Development

44.1% of respondents were involved in developing certifications or formal academic qualifications. 32.9% stated that the certifications their organisation develops were based on ISO, national, industry or other recognised standards; 31.3% said they were not; while they remainder did not know. Many of those who commented were working towards basing their certifications on ISO standards, or relevant industry standards tailored to the specific industry needs. Education providers in Ireland linked to HETAC governing body standards i.e. Level 6 - Level 9 on the NFQ.

7.3.7 Mapping of ICT Certifications to Competence Frameworks

Respondents were questioned on how a mapping of ICT certifications to a national or European competence framework may benefit their organisation. Approximately 45% of the respondents who answered this question were not aware of what benefits this may deliver or suggested it would deliver no benefits. Benefit categorisations identified by other respondents include:

- Provides guidance for recruitment and staff development
- Provides a common standard/consistent process or evaluation mechanism for matching qualifications/certifications to competencies required for specific jobs
- Provide evidence of the "real value" of certifications in terms of knowledge and skill levels
- Increases awareness, understanding and cross border recognition of ICT certifications
- Facilitates benchmarking and comparison/equivalency
- Provides internationally recognised proof of competency levels
- Supports workforce mobility
- Supports more targeted education/training initiatives; and identification of training/competency gaps
- Assists in competency planning and career planning
- Improves ability to determine capability of teams/individuals across organisations
- Provides a reference point from which to map to job functions and needs

It can be suggested that benefits such as those outlined above would be of significant interest to small and medium enterprises (SMEs). Certifications can prove costly to those organisations, and given the expanded certification landscape, this mapping could provide better transparency for SMEs, which may act as incentives for them to adopt certification schemes. One respondent however suggested that benefits are unclear as he/she was concerned that the mapping process may be biased by the certification developers. The success of any such initiative as stated by one respondent depends on "*availability, marketing, access, and ability of individuals to interpret it*"

Figure 32 provides an overview of factors that may encourage education or certification providers to map their qualifications or certifications to a competence framework. 53.5% of respondents suggested a need for improved brand recognition among practitioners and employers of competence frameworks. This is in line with the finding that only 12.4% of

respondents were aware of the e-CF. Approximately a quarter of the respondents identified the need for a simpler mapping process; this is an important finding with respect to the ICT certifications/e-CF mapping initiatives being undertaken in the current ICT Certification in Action project. Closer analysis however, reveals that it is mainly private enterprises that call for a simpler mapping methodology and not the certification developers who would be responsible for the process. The need for legislation was identified by 26.1% of respondents, as according to one respondent "*it will be of limited use unless all certification developers do it*". Discussions with respondents also highlighted that a key motivator must be an actual requirement within the industry for this competence framework mapping to be successful. The need to demonstrate the value of the mapping exercise to all relevant stakeholders is critical.

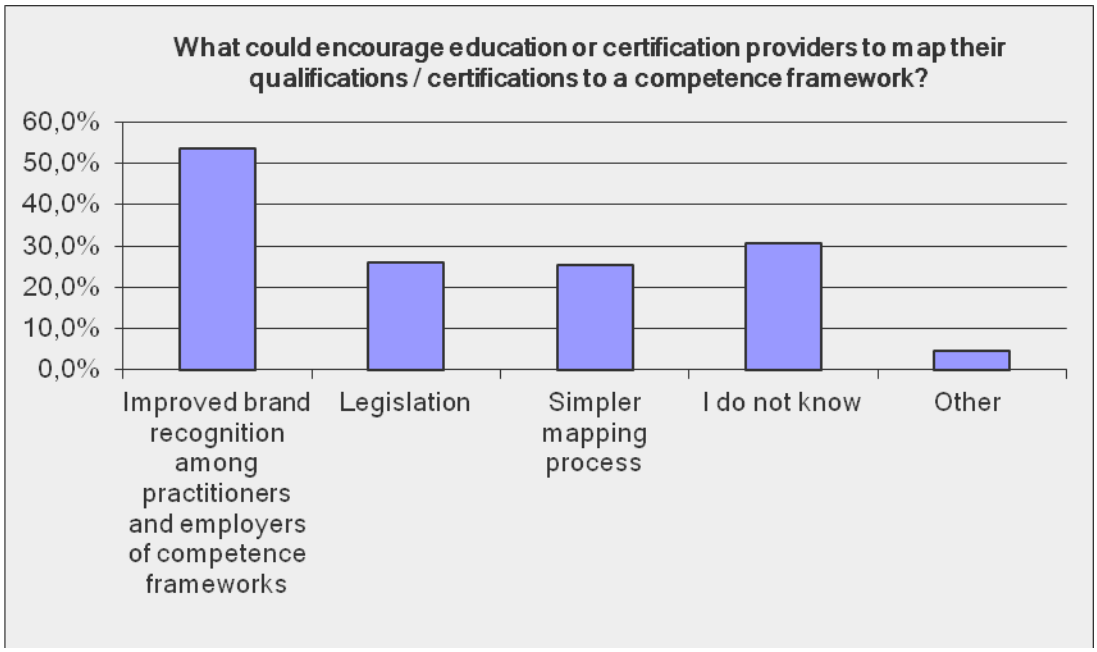


Figure 32 Factors influencing mapping to competence frameworks

Barriers to mapping ICT certification or qualifications to a national or European level ICT competence framework are outlined in Figure 33. Three key factors were lack of demand from employers (39.3%), no demand from practitioners (33.2%), and no clear benefit for education providers (24.7%). Approximately 60% of respondents were either unaware of the mapping process or could not identify any barriers. One interesting comment by one respondent was that due to the competitive certification market "*the certification providers don't want to bare theirs internals about their certifications*".

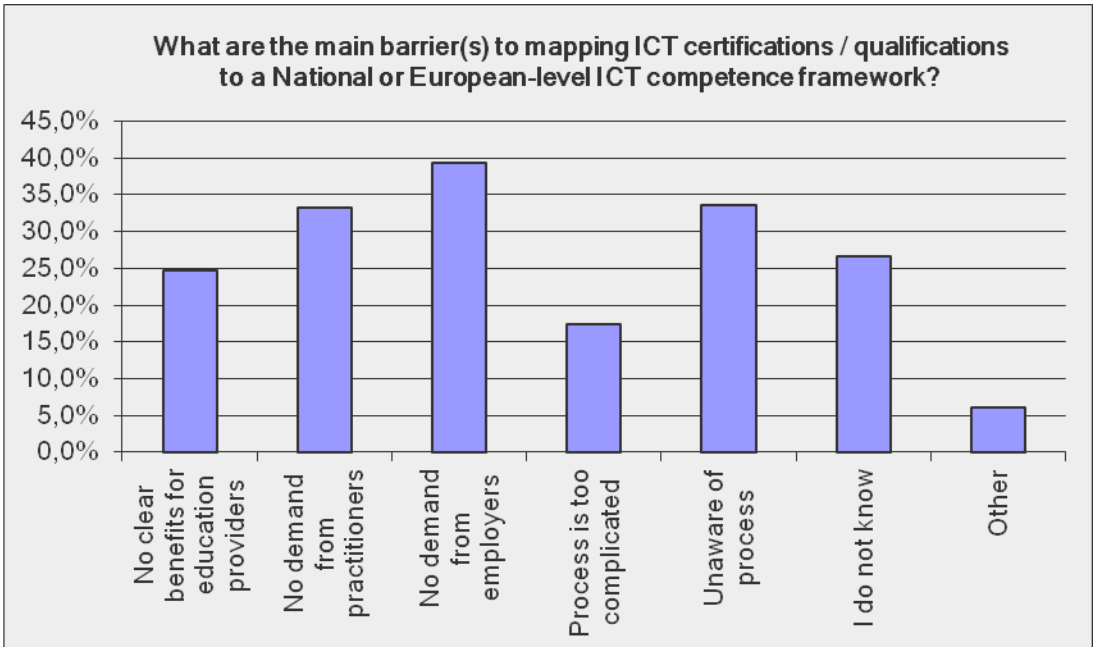


Figure 33 Barriers to mapping to competence frameworks

7.4 Ethics

7.4.1 Adherence to Code of Ethics/Conduct

70.8% of respondents adhered to a professional Code of Ethics/Code of Conduct. These Codes ranged from company internal corporate Codes (e.g. CISCO Code of Business Conduct, Fidelity in-house Code of Ethics, Dell Code of Conduct, NUIM Research Ethics Code of Practice), to codes of professional bodies (e.g. IEEE, IEI, IET, UK Engineering Council, Institute of Directors UK, BCS, ISACA, ISC2, Association of Information Systems, Icelandic Engineers Association), to individuals own personal Codes. Commenting on the usefulness of the Codes in practice, approximately 90% of respondents felt they were at least useful. Such Codes help to "*provides guidelines and directions in order to utilise competencies*", "*sets expectations for behaviour*", "*provides a philosophy and overarching framework*", "*sets important restrictions in the use of personalized data*", and helps "*levels of trust to rise steadily*". However, their "*usefulness and applicability is situational and role dependent*". A small minority felt the Codes were not useful as for example they were "*too general, not policed, and not reviewed for improvement*". Further, "*[they are] not useful in practice but useful as a reminder that I have a duty of care to my clients (internal or external)*". 3.4% felt they restricted business operations as for example they result in "*putting principles ahead of profit*".

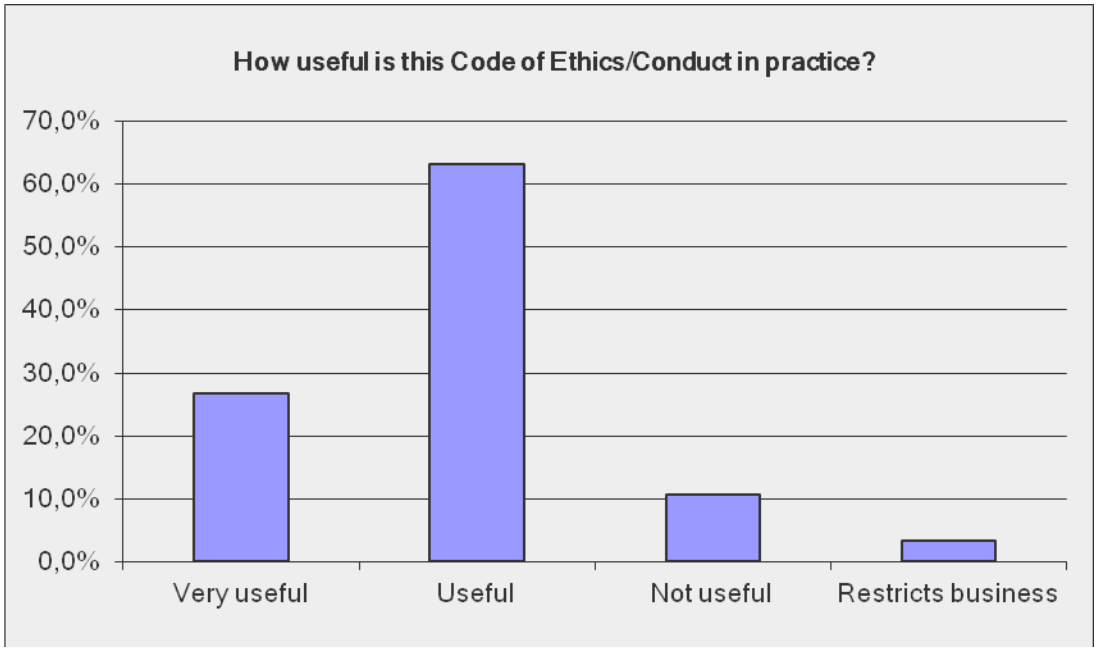


Figure 34 Usefulness of Codes of Ethics/Conduct

7.4.2 Content of Ethical Codes

The survey sought respondents insights on the content of the Codes adhered to. The following chart highlights the areas addressed. These topics reflect the criteria for inclusion in Codes of Ethics/Conduct as identified through IFIP's research. Of the five main areas that were addressed in the 30 national Codes examined by IFIP, computer specific ethical issues were the factor identified least often in the Codes respondents adhered to (42.2% of respondents). This is similar to the findings of IFIP discussed in the desktop research, which suggested that computer specific ethical issues were not adequately addressed and needed greater inclusion in ethical codes. Contrary to the findings of IFIP however, attitudes towards regulations were recognised by approximately 68% of respondents as a component of their Code(s); previous IFIP research suggested this was addressed in less than half of the Codes examined. 6.9% of respondents were not aware of their codes content. Other factors included in respondents' codes were "*competence, accuracy and fairness of advice and guidance*", "*legality*", "*security practices, financial accountability, performance*" and "*environmental issues*"

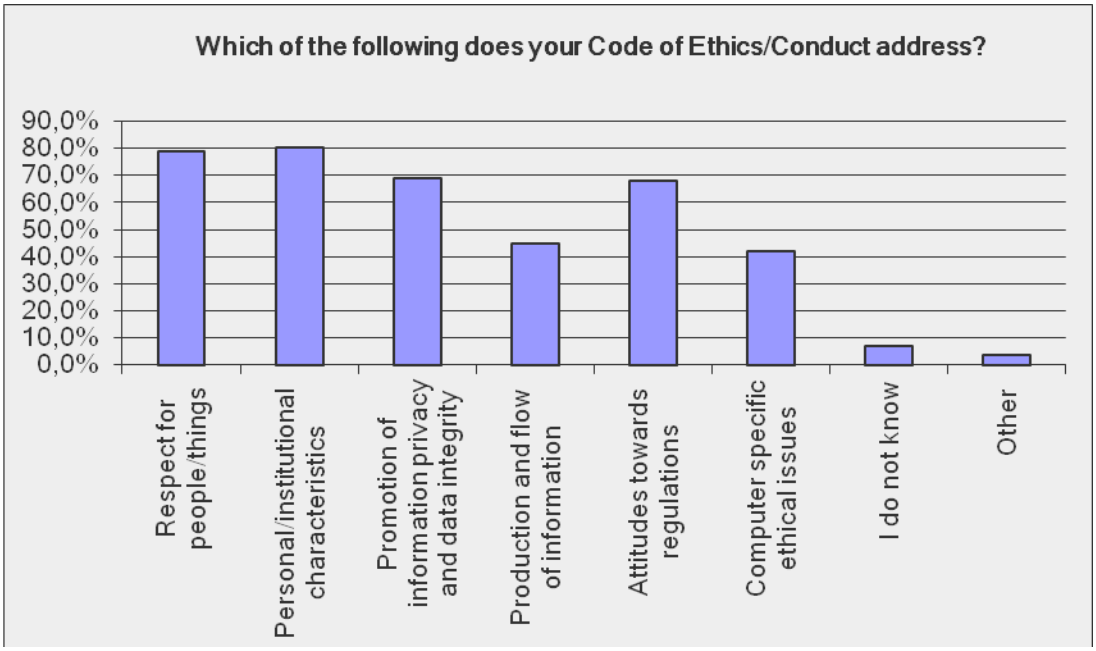


Figure 35 Content of ethical codes

The majority of respondents felt that there were not any important aspects excluded from their Code of Ethics/Conduct. Some felt that their Codes needed to be updated to address issues such as culture, internal company relations, data protection, health and IT, meeting customer needs and duty of care, self-assessment of competence, innovation and ICT specific aspects such as social networking, cloud computing and use of social media tools. In terms of the last issue, comments by 2 respondents are as follows: "*there is a bit of a lag behind new technologies*" and there is "*slow adoption of new technologies due to lack of trust and proper managerial oversight*".

7.4.3 Consequence of Non-compliance

Consequences of non-compliance with the stated codes were varied including for example:

- Potential termination of employment
- Disciplinary action/hearings
- Loss of membership from professional association/disbarring
- Verbal/written warnings
- Negative impact on individuals performance management review
- Negative impact on reputation including loss of credibility
- Potential loss of certification
- Criminal proceedings/legal action/prosecution
- Fine
- Personal liability
- Suspension
- Shame
- Customer/client dissatisfaction

5 respondents were unaware of non-compliance consequences; while 15 individuals stated that there were no such consequences.

7.4.4 Need for Greater Enforcement Mechanisms

54.9% of respondents feel that there is no requirement for greater enforcement and penalties where Codes of Ethics/Conduct are breached. Some respondents feel that codes are for guidance purposes and therefore the onus should be on the individual to decide how to use them. Responsibility should rest with employers to ensure their codes are enforced. According to 2 different respondents "*there is adequate legislation in this area already with appropriate sanctions for breaches in the law*" and "*more education is better than penalising for violating the professional code of conduct*."

On the other hand, 45.1% of individuals suggest the need for greater enforcement mechanisms as "*minimum ethical standards are a reasonable expectation from any profession*" and at present in some cases culture dictates what is permissible. "*Too often … we see unethical behaviour…non-disclosure agreements signed and then infringed*." Further, "*the ICT profession has access to considerable private and personal information. In the absence of penalties and enforcement, society is merely trusting that no misuse is occurring*". It is recognised that the issue of enforcement and penalties needs to be linked to the severity of the breach. One respondent feels that there is a need for greater awareness in order to improve professional standards and compliance. There is also a suggestion for developing codes at a European level that are linked to professions according to the e-CF.

7.5 CIO / ICT Manager Training

7.5.1 Understanding the demand for CIO training

Of all the respondents surveyed the opinion was equally split between those who felt that CIOs required some form of certification or qualification to practice. Of those that did not feel certifications or qualifications were necessary, they did largely agree that experience was the important factor. They also stated *"That (it) would be daft, it would prevent outside skills coming in",* a sentiment designed to reflect the fact that to enforce a requirement for qualifications, training and / or certification would restrict the flow of skilled professionals into the area of CIO management.

Some also felt that whilst they disagreed with the notion of ICT certification and qualifications there was a requirement for CIOs to possess either certifications or qualifications in business and management. As one respondent put it "*No, and this is the crux of the matter! CIO's must speak the language of business, and have the same level of senior qualifications as do other Exec Directors*".

Across all the responses there was common agreement that whilst the role of CIO will vary dramatically between organisations and indeed industry sectors, the role of the CIO needs to be more clearly defined.

7.5.2 Regulating the role of CIO

Considering the polarised view concerning certification and qualifications, and the fact that the perceived view amongst respondents is that the role of CIO is not clearly defined it was interesting to understand the view concerning the regulating of the role of CIO. This in effect asks the respondents if they think the role should be regulated in the same way it has been for the Federal agencies in the US (Clinger Cohen Act 1996).

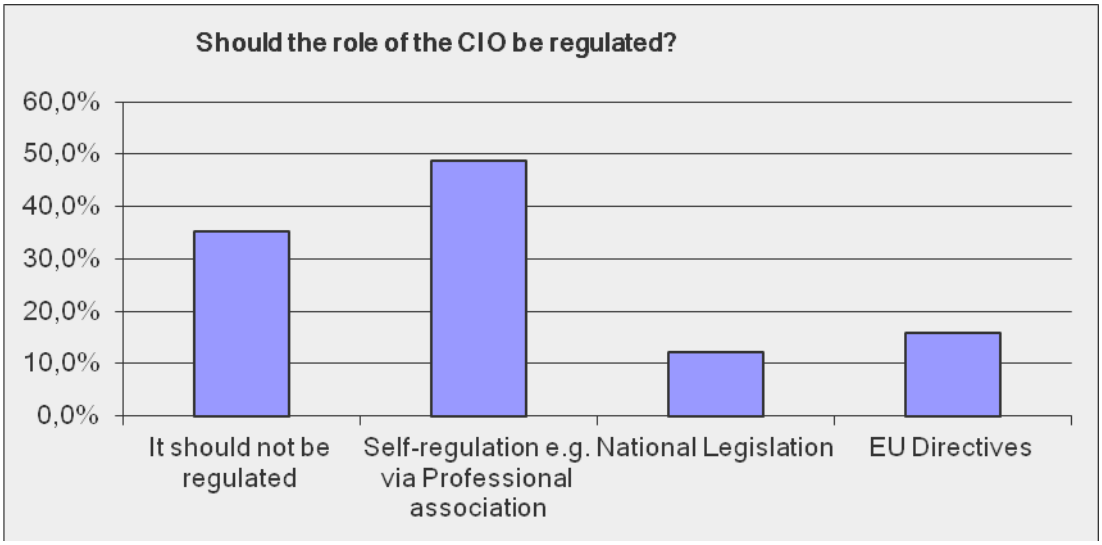


Figure 36 Views on regulation

Only 28.2% of the respondents felt that some form of National or EU legislative regulation was required. Of the remaining respondents just under 50% felt that some form of self-regulation would help, whilst 35% were totally against the idea.

This provided an interesting insight, as the indication is that to impose some form of national or EU level regulation would not be seen as a positive move by CIOs. However, self-regulation was more acceptable. This maybe attributable to the variations in how CIOs operate, and regulations would be seen as a 'one-size fits all' solution.

7.5.3 Understanding the demand for training required for CIOs

To gauge the focus of education and training required by CIOs the respondents were asked to assess the topics as identified within the Clinger Cohen Act (1996) for suitability to their respective roles.

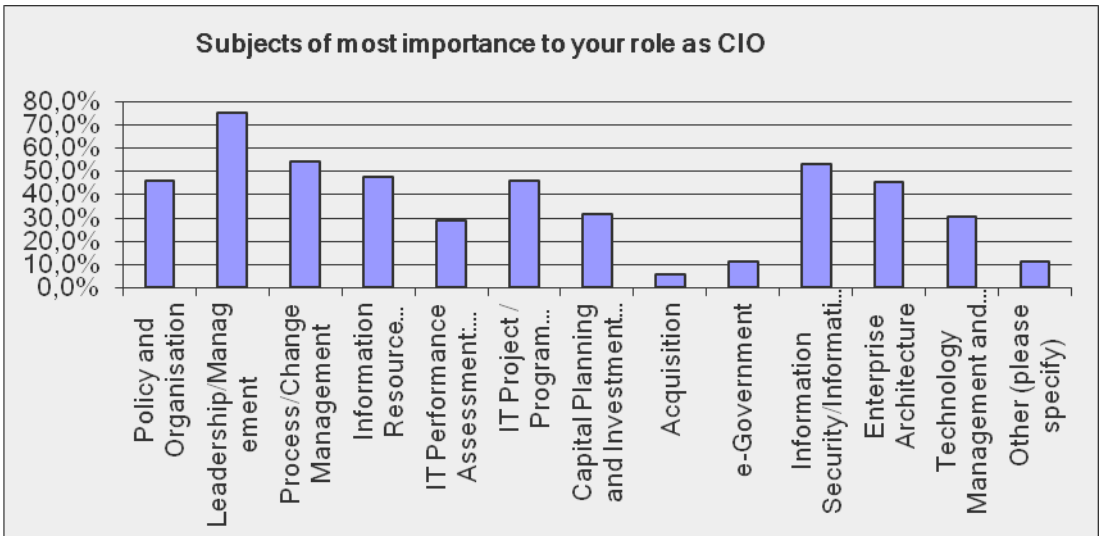


Figure 37 Key topic areas

The top five topics selected were in order of importance; leadership & management, process/change management, information security & assurance, information resource strategy, and policy & organisation. Under the 'Other' category many respondents also

highlighted, once again the need for business awareness and alignment, innovation, and stakeholder and relationship management.

Interestingly enough the direction the respondents are taking is very much towards identifying training and education that builds, not just the technical capability of the CIO, but the ability to communicate and interact with senior managers across the organisation.

When the question was expanded to understand how well education providers were meeting the demand for training the response was not good.

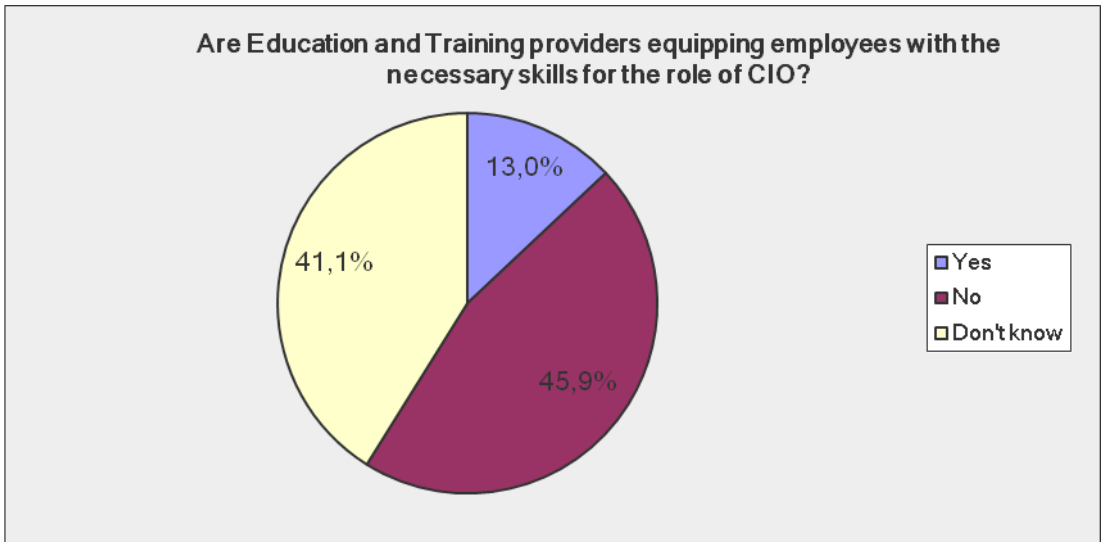


Figure 38 Provision of skills for the role of CIO

Only 13% said that education providers are meeting their needs in terms of CIO / ICT management training. Many reflected the view that "*Education providers only address the basic foundations for people starting within the profession*". The inference being that the type of training and education needed by CIOs is encapsulated within master's (postgraduate) programmes, which in turn may not be suitable due to their cost and time commitment.

Many also commented on the fact that the training provided is too specific, and that the broad range of skills required by the CIO means that any programme specifically for the CIO will need to cover a broad range of concepts. This issue is further complicated by the fact that not all CIOs are starting from the same education and training base.

7.5.4 Demand–driven Education and Training

Considering that education and training provider's offerings were not perceived by respondents to equip CIOs with the necessary skills, the question was asked if there was a need for these providers to be more responsive to the demands of industry. The response to this was not a surprise.

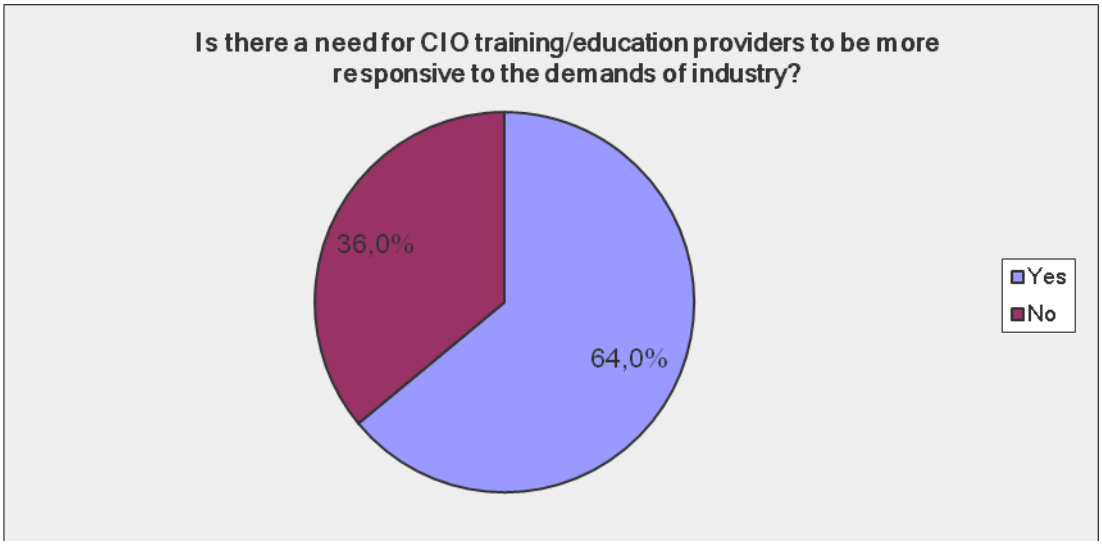


Figure 39 Need for greater responsive

Of the 'No' responses (36%) many were followed up with the view that the respondents were not aware of the training and education offerings available. This highlights a further issue concerning the communication and marketing of CIO specific training and education programmes.

Another important factor identified in the respondent's responses was the fact that "*Academic research is useful but not sufficient* ". In essence the view is that academic content must be supported with real-world examples. This would make the programmes more relevant to the participating CIO, but also ensure the programme provider's understand the changing demands being placed on the CIO in terms of their ability to contribute to the organisation at a strategic level.

7.5.5 Education Qualification Mix

The role of CIO / ICT manager is not an entry-level position, and it is accepted by the respondents that some level of education / certification is required for those holding this position. However, what is interesting is the mix of business / management and technical qualifications / certification the respondents felt was necessary to perform the role effectively.

When asked the question "*If you were recruiting a replacement CIO or senior IT manager, what would you expect in terms of educational background?*" 216 respondents provided the following insight.

Business Certification / Qualification						
Answer Options	Certificate/ Diploma (EQF Level 5)	Bachelor's Degree (EQF Level 6)	Master's Degree (EQF Level 7)	Doctoral Degree (EQF Level 8)	I do not know	Response Count
Minimum Level	27.01%	41.23%	19.43%	0.00%	12.32%	211
Desired Level	6.16%	23.22%	54.03%	9.00%	7.58%	211

Table 20: Business certifications and qualifications

ICT Certification / Qualification						
Answer Options	Certificate/Diploma (EQF Level 5)	Bachelor's Degree (EQF Level 6)	Master's Degree (EQF Level 7)	Doctoral Degree (EQF Level 8)	I do not know	Response Count
Minimum Level	23.61%	48.61%	19.91%	0.00%	7.87%	216
Desired Level	4.23%	24.88%	52.11%	10.80%	7.98%	213

Table 21: ICT certifications and qualifications

What is interesting from the survey is that nearly 74% felt that a bachelor degree (EQF level 6) in technology was required, as opposed to 64% who felt a business related degree was required. However, when it came to a master's degree qualification the preference was reversed with 72% favouring an IT related master's degree with 74% favouring a business related master's degree. This supports the belief that a mix of technical and business qualifications is desirable.

What is also worth noting is that less than 34% of respondents believed that some form of certification (Technical or Business) was necessary for the role of CIO.

7.6 A European ICT Profession

7.6.1 Benefits of a Europe-wide ICT Profession

When asked about the possible benefits of a Europe-wide ICT Profession, approximately one third of respondents cited increased worker mobility across countries, and one fifth of respondents indicated increased standardisation as being probable benefits.

Together with other data points, initial analysis suggests that respondents believe that worker mobility will grow across Europe in the coming years, and that while ICT competence frameworks play a significant role, they are currently only perceived as being one part of the solution.

7.6.2 Risks of a Europe-wide ICT Profession

Respondents perceived numerous potential risks in the establishment of a Europe-wide ICT profession. Concerns over bureaucracy and timeliness featured widely in the responses: "Trying to do too much and taking too long to execute", "that it's content will be slow, and too far behind the pace of the ICT sector", "too much bureaucracy", "another set of euro-legislation that costs money to work with!", "difficult to manage, who controls it?".

Concerns were also raised about the risks of establishing a solution which was not market driven and did not obtain critical mass "developing a big framework that no one uses", "may have little impact if not driven by leading companies in all sectors", "lack of relevance".

A third strand of concern revolved around the risk of over-emphasising qualifications to the detriment of experience "assumption that the qualification is more important than proven experience", "a reliance on qualifications and neglect of experience".

Other concerns raised by some practitioners related to the risk of job losses as a consequence of companies potentially exploiting offshoring opportunities; also, some respondents emphasised the need to position any proposed framework in a global context, reflecting the growing requirements of global organisations.

These raise important guidelines for any proposed solution;

- Simplicity: the more complicated and unwieldy the solution, the less likely it is to achieve any traction
- Demand-driven: unless the value proposition to all stakeholders is clear, we will not achieve the required critical mass to make this initiative successful
- Experience counts: any framework which relies on formal qualifications and certifications to the detriment of experience will be resisted by existing ICT practitioners
- Transparency: while the risks of offshoring do exist, the risks of inactivity are undoubtedly greater in the long term

Project Phase 2

8 Overview of the Framework for ICT Professionalism

This section provides an overview of the proposed European Framework for ICT Professionalism.

The diagram below is a summary-level view containing many of the key components of the proposed framework. We have also included in this section, an introduction to many of the key elements and characteristics of the framework. More detailed descriptions of the framework building blocks and its operation are provided in Section 10 of this document.

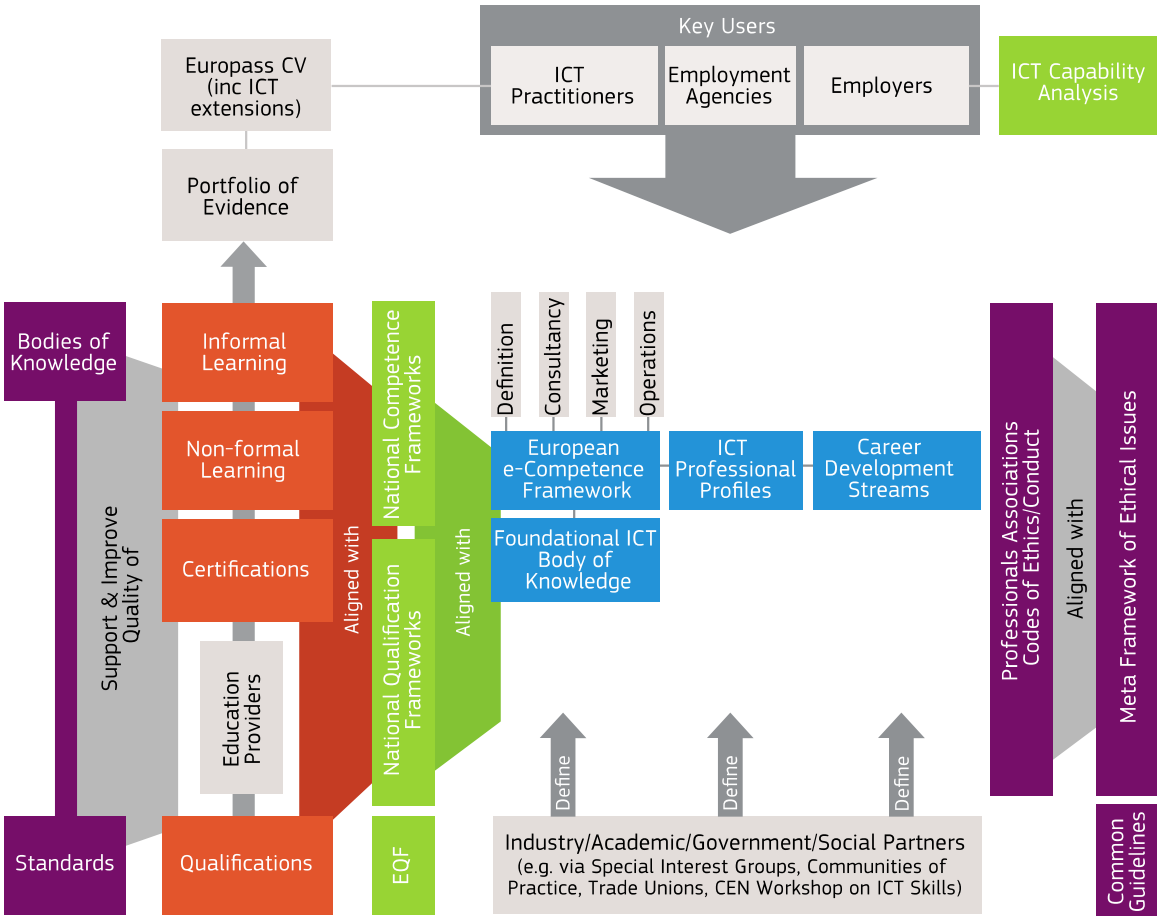


Figure 40 High-level view of the European ICT Professionalism framework

8.1 Framework "Users"

Reflecting the objectives of supporting mobility of ICT practitioners across Europe, the main target audiences of the framework are ICT practitioners and ICT managers/employers (as well as Employment Agencies who facilitate employment opportunities). However, as we can see in the diagram and in the supporting text, there are many other stakeholders who have key roles to play in the creation, maintenance and operation of the framework.

8.2 Education

Education is considered one of the cornerstones of, and key enablers for, the adoption of the proposed professionalism framework. Equal recognition and importance is given to formal qualifications and certifications as well as non-formal and informal learning.

8.3 e-Competence framework

One of the key components of the proposed solution is the broad adoption of the European e-Competence Framework (e-CF), in which a set of 36 ICT competences and five levels of proficiency are defined. Using this framework, ICT practitioners can assess their competences and proficiency in an objective and uniform fashion. ICT job roles can be defined in terms of competences and proficiency levels that practitioners can understand consistently across Europe. Certifications and qualifications can be promoted in terms of the ICT competence improvements that they, in turn, will deliver. As such, this represents a significant step forward for promoting a common language and shared understanding of ICT competences across Europe.

The e-CF is, in essence, only a framework. It is envisaged that an eco-system of organisations will develop around the e-CF in order to provide toolsets to facilitate its use among stakeholders, as well as providing support and promotion in its adoption.

Accompanying the e-CF are related initiatives aimed at defining a series of ICT role profiles and ICT career paths/streams; all of which have been defined against the competences and proficiencies of the e-CF.

8.4 Self-Assessment

Self-assessment of competences against the e-CF is an important characteristic of the proposed solution (see Section 9). While external validation paths can offer higher levels of consistency, the costs and effort of external validation for practitioners would, in most countries, prevent widespread adoption.

However, in countries and/or industry sectors where the demand does exist for external validation, there are clearly no restrictions preventing its adoption, but for most practitioners, we believe self-assessment will play a more prevalent role, at least in the short-term.

In addition to facilitating employment opportunities (as outlined above), the data obtained from this self-assessment process could, if pooled appropriately, provide the basis for powerful benchmarking functionality, providing new insights into the level of ICT competences of organisations, industry sectors and countries. Similarly, if data were pooled from employers surveyed on the demand for ICT competences, this could help provide a granular view of ICT competence supply and demand across Europe.

8.5 Mapping Process

Mapping of education and training against the e-CF will occur, in the first instance, against existing national competence and qualification frameworks, which in turn, will map to the e-CF. However, in some Member States, no such national competence, and/or qualification framework has been developed as yet – in which case, a direct mapping to the e-CF will

significantly enhance transparency (with adequate audit processes in place to enable consistency).

8.6 Europass CV / Portfolio of Evidence

Practitioners will be able to document their skills for employers in a consistent fashion using a standard Europass CV with appropriate ICT-specific extensions (based on e-CF competences).

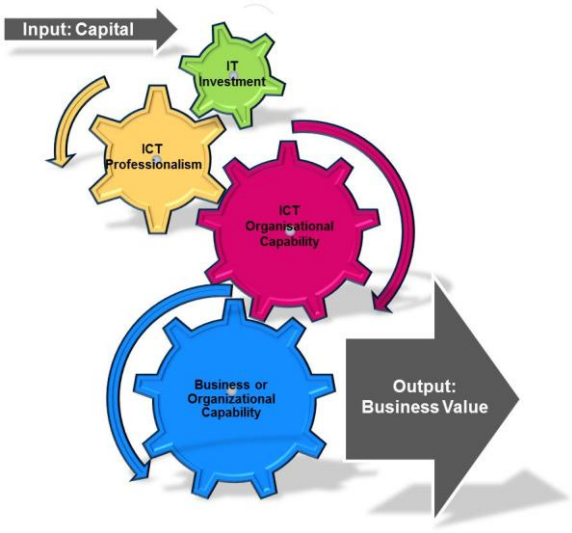
8.7 Foundational Meta Level ICT Body of Knowledge

Many ICT practitioners in Europe lack a solid understanding of important concepts of ICT. This contrasts with other professions where professionals are required to have an understanding of a common body of knowledge.

We therefore propose that all practitioners wanting to be classed as "ICT professionals" (see section 9) should first possess an understanding of a foundational ICT body of knowledge. This should cover a wide range of topics (both technical and non-technical) in order to provide a solid platform for future professional progression. Education providers will be encouraged to map their offerings to the Foundational meta-level Body of Knowledge in order to facilitate this process. As this common meta-level ICT body of knowledge does not currently exist, an initiative should be launched to define it. This endeavour should build on work undertaken in academia and industry. It is envisaged that this proposed ICT BoK will most likely be defined as a meta-model in order to facilitate its usage by multiple organisations and to minimise the level of effort required to maintain it on an on-going basis. For example, this meta-model can then be used to help education providers define appropriate and relevant course curricula.

8.8 ICT Capability Analysis

The ICT capability of an organisation represents the sum output of its ICT workers, its ICT enabled processes, as well as its technology. Assessing an organisation's maturity on this holistic basis provides a valuable input into setting the strategic ICT direction, by identifying gaps between where it currently is and where it wants to be. This knowledge, in turn, can be used by organisations to identify gaps in ICT competences within the organisation, which can be filled via setting development/training goals for individual workers or via recruitment/outsourcing.



The distinction between organisational ICT capability and individual competence is important as one cannot measure organisational capability by simply "summing up" the competences of individual practitioners in a firm. However, professional competence is an important enabler of improved organisational ICT capability, as can be seen from the diagram on the right.

8.9 Codes of Ethics / Conduct

Our proposed framework recognises the infeasibility of creating a universal code of ethics for the ICT profession due to cultural, legal, social and political differences. However, there is a need for a more consistent approach towards ethics across the EU. We highlight the need for national computing associations to align their codes of ethics/conduct with a meta framework of ethical issues. While each national computing association would have responsibility in developing and maintaining its own code, such alignment would nonetheless assure that a common core set of ethical issues are discussed in the ethical codes across Member States.

8.10 Register of ICT Education (not shown in diagram)

During the interviews conducted with stakeholders in the course of this project, approximately half of them have expressed an interest in the development of a Register of ICT Education. In essence, this would contain the qualifications and certifications held by a given practitioner. Development of any such register, in the future, would need to be undertaken by a commercial entity in the countries that see this as a viable option.

Although various operational and funding models are possible, one model is that the respective education providers would populate this database, and in doing so this would provide a level of assurance over the validity of the data. Employers would, therefore, be able to examine the qualifications and certifications of practitioners (e.g. during the recruitment process) and understand what competences and proficiency levels had been achieved (using the consistent series of e-CF competences and proficiencies). This is something which is currently difficult given the range of certifications and qualifications on offer. We envisage that while education providers would most likely be prepared to populate the database with data from current and future courses, there would be no desire (nor probable revenue stream) to compile and submit data retrospectively. Such data would therefore have to be submitted by the individual practitioners if so desired.

In the event that a commercial entity chose to establish such a register, data protection laws (at national and international levels) would have to be carefully followed with practitioners opting-in to permit the education provider to transmit this information to the Register holder.

At this stage, it is unclear if one party could maintain a single register, or if in practice multiple registers (e.g. per education provider, or per country) might be established. We anticipate that national registers would be more readily managed and accepted than a single, all-encompassing register on a European scale; and these may perhaps be hosted by the national computing associations/national audit bodies or a third party agency/consultancy. In any case, for the full potential benefits of the solution to be realised, it is envisaged that there would have to be consistent, accountable, and transparent interfaces defined to support visibility at a practitioner level. Prior to initiation of any development activities pertaining to such a register, more widespread investigation into the industry demand, e.g. among employers and practitioners, and into the appetite of education providers to submit input needs to be established.

Most importantly, any movement towards a register would have to be entirely demand driven – by both industry and professionals. The notion of introducing legislation forcing practitioners to possess certain levels of certification for specific roles would understandably be viewed negatively by many practitioners, and is therefore advised against.

8.11 One size does not fit all

The proposed professionalism framework is intended to improve the overall level of maturity across Europe and provide a basis for alignment. However, it is important to recognise that Member States often have different levels of maturity and different approaches to many of the key aspects of ICT professionalism, such as the existence or otherwise of a national ICT professional association, the process and bodies responsible for mapping qualifications to the EQF, and the provision or otherwise of a national ICT competence framework. Rather than dictating a single approach to the solution that must be adopted in every country, we have tried to identify points of commonality, and propose a solution that provides the desired benefits across Europe while offering enough flexibility to support and respect the need for national solutions.

For example, some countries already have a relatively high level of maturity with regards to ICT competence frameworks – in which case, the e-CF is unlikely to result in a dramatic step forward for assessing competences within a single organisation. Nevertheless, by introducing consistency across Europe, organisations will be able to better understand the competences of ICT practitioners in a more consistent fashion, thereby contributing to improved efficacy; likewise, practitioners will be better placed to plan how best to improve their professional prospects across Europe. In countries where no national ICT competence framework is in place, the e-CF would represent a logical step forward. However, in countries where a national competence framework is in situ, the introduction of the e-CF would not require the national competence framework to be discarded – instead, a mapping from the national competence framework to the e-CF would allow both to co-exist.

8.12 European Commission involvement

It should be recognised that the European Commission is primarily acting as a catalyst, helping to bring together key stakeholders in order to facilitate the maturing of a profession that if left unchecked could have an adverse impact on Europe's economic and social development.

In facilitating the construction and adoption of key components of the European ICT Professionalism framework (e.g. e-CF, ICT Profiles, and definition of ICT career streams), the European Commission is undertaking a vital role in maturing the ICT industry. However, it should be noted that its involvement in this area is solely restricted to supporting the development of components which could not realistically be delivered in a sustainable, scalable and timely basis by any single stakeholder, and where the pooling of efforts is likely to reduce the overall development costs and reduce fragmentation – significant risks if such developments took place solely at a national/industry level.

In this respect, the European Commission's commitment to the area is important from the perspective of industry and stakeholders who wish to have confidence that their investments in adopting and promoting aspects of the framework will have some longevity – something which is facilitated by the predictability of funding for the development of these key components from the European Commission.

8.13 Industry alignment

While concerted efforts can be made to bring together industry participants in workshops and meetings to help foster discussions on identifying potential benefits and mechanisms for realising these benefits, the reality is that industry must organise itself if the profession

is to be self-sustaining. Aligning participants across the Member States will require careful effort and engagement from participants if the potential benefits of the solution are to be realised.

For example, if multiple education providers choose to establish their own separate Register of ICT Education, this will provide benefits to practitioners and employers, but if the Registers are linked together via common interfaces, to support a common view of the entire educational portfolio of a given practitioner – this would clearly represent a more significant benefit for employers and practitioners.

Questions on industry alignment issues such as marketing, self-regulation, information sharing and compliance will also require a consensus opinion to be formed.

8.14 Stakeholder value

Clear value/revenue streams must exist for relevant stakeholders if the proposed framework solution is to be sustainable.

The table below shows some potential sources of value/revenue to help foster discussion and encourage engagement from interested parties. This reflects some of the most obvious sources of value/revenue – in practice, industry will move to identify and foster the creation of further innovative value/revenue streams.

Stakeholder	Value/Revenue Stream
Practitioners	• Improved (international and national) recognition and understanding of professional competences and ICT knowledge achieved (via formal, non-formal and informal paths of education over the course of one's career) • Improved prospects for mobility across an organisation or across countries • Visible, flexible career paths within ICT – enhanced prospects for employment in an ICT career • Improved public perception of ICT professionals
Employer	• Reduced cost, effort, and time to recruit, deploy, train and develop suitable ICT resources, as well as improved capability to align ICT resources with business requirements • Improved transparency of education across national barriers, removing artificial barriers to employment • Potential to facilitate outsourcing opportunities through consistent, agreed definitions of roles and competences • Competitive advantage from a more credible and competent professional IT workforce, which matches the demands from industry • Greater awareness and adherence to ethical standards and codes of conduct
Education Providers	• Increased market size opportunities resulting from improved transparency and comparability of educational offerings • Improved demand for education to support life-long learning requirements • Alignment of competences with role profiles will increase practitioner understanding of what education will support increased competence proficiency • Enhanced alignment with demand from industry • Additional demand for ICT education stemming from the proposed Foundational Meta-level ICT Body of Knowledge

Stakeholder	Value/Revenue Stream
Employment Agencies	• Facilitates definition of requirements for ICT roles • Common understanding of competence/proficiency across borders increases potential size of the pool of applicants for a role • Opportunities to develop toolset to support identification of candidates most suitably qualified for given roles
Local/ National / European Government Entities	• Enhanced visibility of supply and demand of ICT skills, helping to provide a robust and granular basis for informed policy setting at national and European level • Enhanced competitiveness on a global stage resulting from improved efficiencies within industry
Professional Associations	• Opportunity to mature the ICT profession • Increased membership / influence • Educational offering opportunities • Stronger role in communicating/shaping emerging industry practices • Possible role in validating certification/training providers as well as consultancies
Trade Unions	• Promote interests of ICT workers at organisational, national and international level (e.g. employment prospects, security) • Potential for increased union strength and coherence resulting from a focus solely on ICT Professionals (i.e. opportunities to develop a single voice for all ICT professionals across Europe)
FOSS Movement	• Promotion of interests and adoption of FOSS within the ICT profession • Improved recognition of the importance and contribution of FOSS • Opportunities for involvement in FOSS to make significant contributions to a practitioner's portfolio of evidence (enhancing their contribution to the computing community, and employment prospects if desired)
Consultancies	• Improved consistency and transferability of ICT competence frameworks (typically, a key component of an ICT Operating Model) across clients • Elimination/reduction of costs related to in-house development of proprietary competence frameworks • Facilitates client buy-in to competence development plans which are in use across industry (vs. a proprietary solution). • (In return, consultancies help propagate rapid adoption of the solution across their client organisations) • Revenue opportunities (see e-CF)
Society	• Reduction in risks emanating from an increasingly ICT-enabled society • Improved employment prospects • Long term potential for greater ICT-enabled innovation resulting from ICT professionals possessing a stronger ICT skills base (being able to see "the bigger picture")

Table 22 Stakeholder value perspectives

The table below shows how each component of the framework can contribute towards opening up the possibility of value/revenue generation.

Component-related	Value/Revenue Stream
	•
e-Competence Framework	• Provision of toolsets to facilitate Practitioners in self-assessment against e-CF • Provision of toolsets to facilitate Employers/HR Agencies in defining ICT job roles (defined against e-CF) • Provision of toolsets to support benchmarking of ICT competence for individuals, departments, organisations, industries, countries • Provision of toolsets to monitor/survey employer demand for ICT competences/role profiles • Provision of toolsets to facilitate mapping of educational offerings to the e-CF • Consulting opportunities to facilitate organisations adopting e-CF throughout their ICT organisation • Consulting opportunities to conduct ICT competences gap analysis / organisational ICT capability analysis / strategic ICT development plans / role-specific training / benchmarking insight • Specialist agencies supporting education providers in mapping certifications against e-CF • Specialist agencies supporting organisations mapping in-house competence frameworks against e-CF • Marketing of e-CF to encourage wider adoption among employers and practitioners (with income derived from service organisations benefitting the most from greater usage of e-CF) • Some responsibility for auditing the mapping process against e-CF may lie with industry, particularly if a model based largely on self-regulation is adopted • Provision of approval process for certification providers/consultancies (if deemed necessary to enable compliance)
Foundational Meta-Level ICT Body of Knowledge	• Specialist agencies to facilitate education providers mapping certifications/qualifications against the meta-level ICT Body of Knowledge • Provision of education courses (including qualifications/certifications) to practitioners wanting to develop a broad understanding of ICT to support their future career objectives • Online assessment tools to test practitioner's knowledge
Career Paths/Streams	• Provision of consultancy services to organisations wishing to migrate towards aligned career streams • Careers advice to practitioners
EQF	• Provision of toolsets to facilitate mapping of educational offerings to the EQF • Provision of consultancy services to education providers to support mapping of certifications to the EQF
Standards	• Provision of information/education on relevant, emerging ICT standards to professionals
BoKs	• Development of specialist BoKs (e.g. Information Security Principles) • Education relating to specialist BoKs

Component-related	Value/Revenue Stream
Register of ICT Education	• Usage of a register by employers to validate the educational achievements of potential employees (particularly across borders) • Usage of a register by practitioners to store all of their ICT educational achievements, which could be shared with prospective employers. • Provision of granular supply/demand statistics on ICT Education trends to interested parties • Development and operation of interfaces between multiple registers

Table 23 Component value perspectives

9 Professionalism in practice

Section 10.5 provides an overview of the main entities, organisations and relationships of the proposed EU ICT Professionalism framework. In contrast, this section provides an introduction to how ICT professionals will be classified in practice.

9.1 Differing perspectives of a 'professional' across Europe

To define any individual as a professional is difficult to reconcile as the term and concept of the 'professional' is not uniformly accepted or indeed recognised across the many different countries, industries, and professions that make up the rich tapestry of work cultures and identities across the EU. Whereas more mature professions such as engineering, medicine, and law, have worked hard to identify their members by obtaining levels of competence recognised by 'professional titles', even these are not consistent or wholly recognised across the EU. However, one thing these professions do insist on, irrespective of where within the EU they are based, is the requirement for all those seeking professional accreditation or recognition to demonstrate a level of foundational knowledge. This is a key differentiator between established professional accrediting bodies and the embryonic ICT profession.

We recognise that presently, in some countries, individuals can operate as an ICT practitioner with little prior experience or knowledge in the area, whereas, in other countries the market is more controlled, and only individuals with relevant qualifications and competences can be considered as practitioners/professionals.

9.2 Light-touch approach

We have attempted to develop a framework that reconciles the many differing views of stakeholders across Member States of the EU and still provides clear benefits in the short and long-term for interested parties. Moreover, we have opted for a pragmatic solution that does not introduce any regulatory requirements, create complex structures of new organisational bodies, or impose mandatory membership fees on practitioners. It is important that the framework is simple, accessible and flexible.

9.3 Professionalism assessment

The diagram below shows the five levels of professionalism as defined within the e-CF. The five e-CF level descriptions are contained in the Annex of the European e-Competence Framework Version 2.0 (CWA Part 1, September 2010, www.ecompetences.eu)

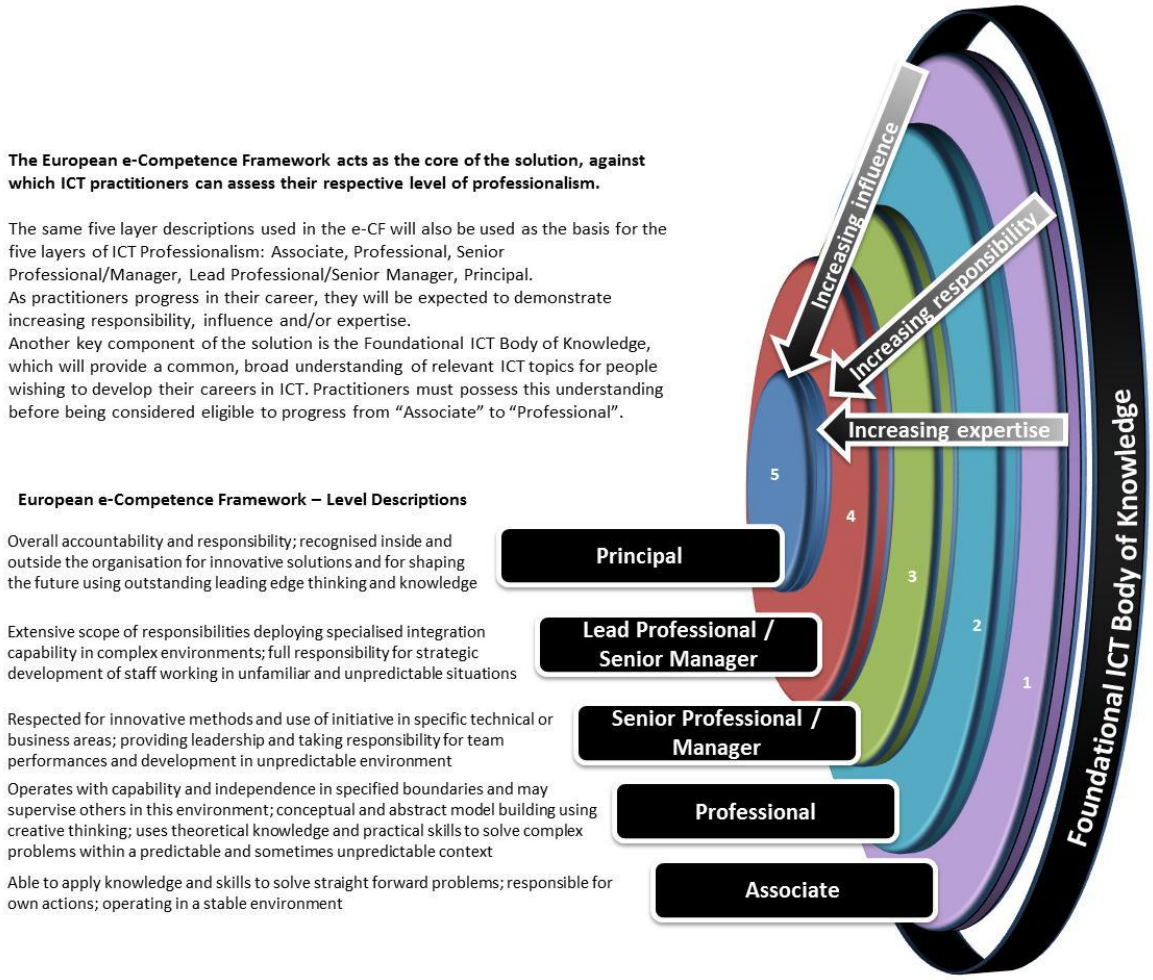


Figure 41 e-CF Proficiency levels

9.3.1 Education as a foundation for change

In examining other professions, we identified a consistent pattern of requiring all professionals to understand a common body of knowledge prior to developing specialist expertise, as this provides the basis for informing successful application of the knowledge in practice.

Reflecting this pattern, we propose the creation of a common, foundational meta-level ICT Body of Knowledge (BoK). This BoK would provide aspiring professionals with a broad understanding of ICT so that they have the potential to progress professionally and are able to "see the bigger picture" rather than solely understanding their immediate domain. This would also help ensure that all professionals are starting from an acceptable baseline of knowledge on which they can then start building their professional capability.

In order to encourage aspiring professionals into the profession, our view is that practitioners would be permitted to join the profession at the Associate level and develop their understanding of the Foundational Meta-level ICT Body of Knowledge at the same time.

9.3.2 Multiple Entry Points

A number of recent surveys (Didero, Husing, & Korte, 2009; Brady, 2009; CEPIS 2011) suggest that many ICT practitioners did not study Computing as the main aspect of their degree course - indeed, only 30% of ICT practitioners surveyed in Denmark possessed such a qualification (Didero, 2009). Our view is that while Computing degrees provide an excellent basis for a career in ICT, they should not act as the sole conduit. Moreover, the demand from industry for "dual thinkers" suggests that if anything, we should be actively encouraging ICT professionals to have a depth of competence outside of ICT.

For this reason, we propose that practitioners can enter the profession via many different routes. Consequently, we propose that practitioners can acquire their understanding of the Foundational Meta-level ICT Body of knowledge via multiple paths – including via university degrees, via certifications, and via non-formal and informal learning.

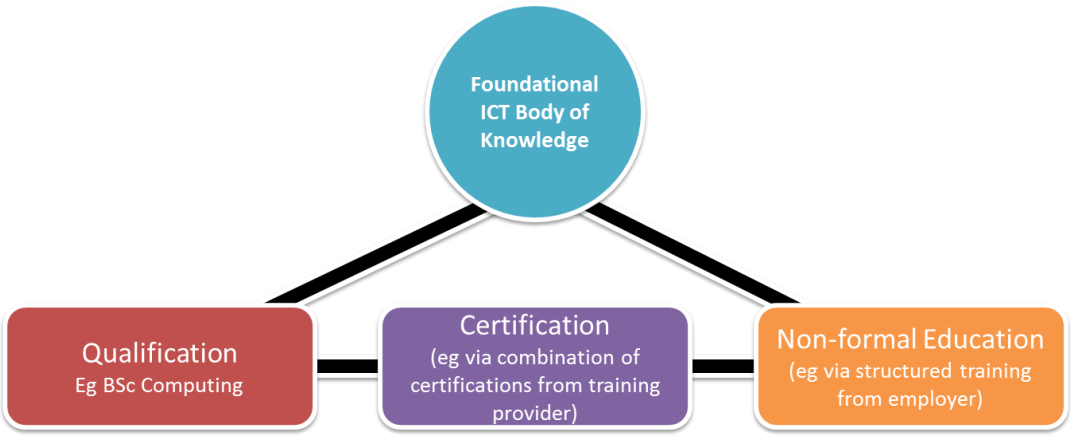


Figure 42: Understanding of Foundational ICT body of knowledge can be acquired via multiple channels

9.3.3 Self-Assessment

It is envisaged that, in the first instance, practitioners will self-assess their competences. In order to support this practice, it is recommended that an appropriate tool is developed. Given the success of the self-assessment Professional e-Competence survey conducted by CEPIS in 2011[46], one suggestion is that such a tool supports self-assessment for practitioners on an on-going basis. Any such tool should reflect the spirit of competence definition as applied by the e-CF, supporting the ability to connect an individual's real-life experiences with specific competences and proficiency levels. However, the provision of and the nature of such a toolset would be driven entirely by industry and stakeholders – as such, multiple tools (perhaps catering to the specific demands of individual industry segments or reflecting the interest of existing national organisations) may emerge.

[46] http://www.cepis.org/professionalecompetence

In supporting a self-assessment process, the e-CF will serve as a lens, in order to bring into focus the relevant competences of an individual, of a role profile, or of a certification, and so on. The diagram below shows how this might operate.

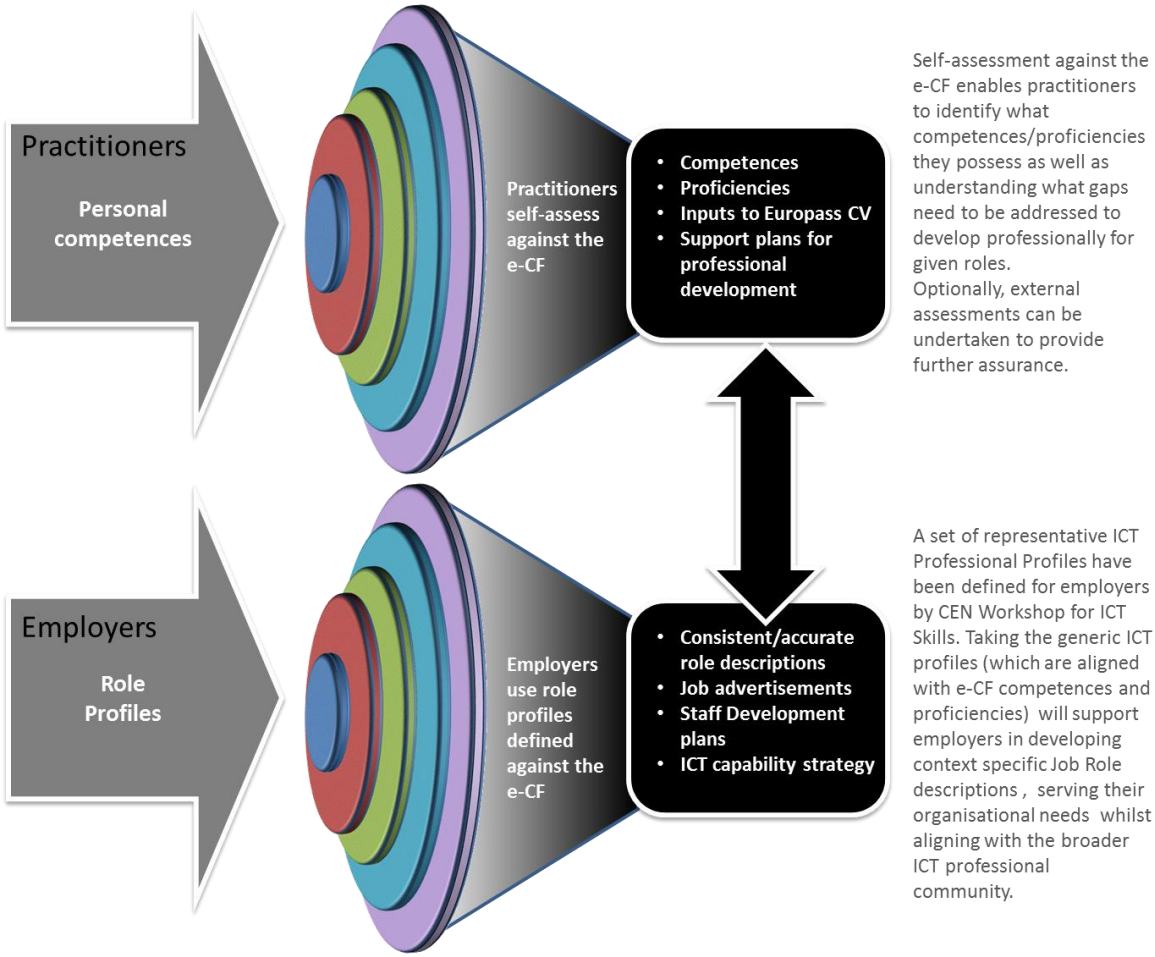


Figure 43: Self-assessment against the e-CF

Notes on progression between levels

1. New entrants to the profession will join at the Associate Level, assuming they are performing ICT tasks requiring ICT competences at proficiency level 1 of the e-CF.
2. Individuals cannot be considered for admission to any higher level until they have obtained an understanding of the Foundational meta-level ICT Body of Knowledge (this may be achieved as part of an approved tertiary level degree, or as part of a certification programme, or via a non-formal or informal learning path).
3. In order to progress to the second level of the framework, and be classed as a Professional, the individual must also acquire relevant professional experience so as to fulfil the competence requirements for a role with level 2 competences. This stipulation emphasises the importance of acquiring experience, and thereby competence, over time. For example, a recent

graduate could not class themselves as a “professional” until he/she has been able to demonstrate how he/she puts into practice the knowledge and skills that he/she acquired during tertiary level education.

4. Similarly, to progress to higher levels of the framework, practitioners must be in roles that require level 3, level 4 or level 5 competences. Reflecting the requirement to accumulate experience over a protracted period of time, practitioners must have acquired relevant experience (and thereby proficiency in a relevant competence for a given role) at each preceding competence level.
5. Employers will typically utilise the generic role profile definitions (as established under the auspices of the CEN Workshop on ICT Skills *European ICT Professional Profiles* project) as a guideline for developing context-specific job role descriptions that highlight the key competence requirements for each role.
6. Practitioners will typically self-assess their competences in order to determine the level of the framework to which their competences and experience correspond. Practitioners may also seek external validation of their competence, expertise and professionalism by ratifying their education and experience with an independent professional institute.

9.3.4 Industry alignment

The way in which industry aligns itself to fulfil the self-assessment function is important, as it will have an influence on the type of data available. For example, if a single organisation undertakes this function, there will be a single source of data on the ICT competence levels of ICT practitioners – a potentially rich stream of data to support benchmarking activities (across organisations, industries and countries). In contrast, if the data set is fragmented and not shared, the scope for benchmarking data is reduced.

9.3.5 Progression examples

The table below provides an overview of how three types of practitioner might enter and progress within the ICT profession.

Entry point	Progression
ICT Graduate	• Graduates starting out on their ICT careers are likely to enter the profession as an Associate, working under the supervision of others. • Undergraduate Computing degree courses, which have been mapped to the Foundational Meta-level ICT Body of Knowledge, will provide graduates with the necessary broad base of understanding of ICT to facilitate their progression from Associate to Professional. However, knowledge is only one component of progression: practitioners can only be accurately classed as "Professionals" once they are performing in roles where they demonstrate competences at level 2. • In a small number of countries, graduates may already have acquired sufficient experience, knowledge and proficiency as part of their degree course to facilitate direct entry to level 2. • Online tools to facilitate self-assessment of competence will support individuals in identifying their current level of professionalism.
ICT Manager with Computing Degree and relevant ICT Certifications	• An experienced practitioner in possession of a Computing degree (which has been mapped against the Foundational Meta-level ICT Body of Knowledge) will by default possess an understanding of the core knowledge components required of an ICT professional – a requirement for all levels above Associate. • The manager, just like any other ICT professional, is thereafter free to self-assess his or her own competences, most likely using an online assessment tool. This will identify the level of professional competence in the role they are performing.
ICT Practitioner with 10 years' experience but no qualifications or certifications	• An ICT Practitioner who has no ICT qualifications or ICT certifications but many years of experience will firstly need to demonstrate an understanding of the Foundational Meta-level ICT Body of Knowledge. • Practitioners who have participated in non-formal learning initiatives could have their learning "validated" (e.g. via a Higher Education Institute) or, alternatively, could self-assess their knowledge against the foundational ICT BoK to facilitate their progression from Associate to Professional.

Table 24 Sample progression paths for ICT professionals

Where it exists, professionals who have achieved 'chartered' status via their respective national computing association will find that they would most likely be classed as Senior Professional/Manager or above using the proposed scheme. Clearly, this is a generalisation, but most current chartered schemes require a broad base of knowledge of ICT (fulfilling the proposed requirement for knowledge of a foundational meta-level ICT Body of Knowledge) as well as demanding several years' experience in a relatively senior position (managing others and/or influencing others with deep technical competence).

9.3.6 Foundational Meta-Level ICT Body of Knowledge (BoK)

In alignment with our definition of an ICT professional, and in alignment with other professions, the European ICT Professionalism Framework proposes that all ICT professionals possess a broad understanding of a common, foundational meta-level ICT Body of Knowledge.

By establishing a common language and level of understanding for all ICT professionals, we are able to increase opportunities for better communication between professionals, as well as reducing risks within ICT projects.

At this point in time, there is no single, agreed European foundational meta-level ICT BoK in existence, and therefore, we recommend that further research is undertaken to establish such a BoK. Recognising that ICT is a dynamic environment, our belief is that it would be more appropriate to construct the BoK in the form of a syllabus rather than as a detailed, comprehensive BoK complete with full written content on each topic. This research, outside of the scope of this project, can build on the considerable work which academic institutions and industry bodies have already undertaken in the sphere.

We foresee that, in future, universities would align some modules of their undergraduate Computer Science courses with the components of the Foundational Meta-level ICT Body of Knowledge so that students would have covered the content of the Foundational meta-level BoK as part of their respective coursework. This would support graduates in being able to progress rapidly within the profession from Associate level to Professional level and beyond. Notwithstanding, we recognise that other paths must be available to acquire this knowledge (e.g. via certifications or non-formal or informal learning).

Note: We are not suggesting that there is a single education course for all ICT professionals. Instead, we are proposing that tertiary level providers cover the relevant components within the Meta-level BoK as part of their course. (This is not unprecedented – for example, in Ireland, students in one university (DCU) successfully petitioned that their Computer Science course was mapped onto the BCS framework so as to facilitate their progression against SFIA).

9.3.7 Mapping of the EQF to the Professionalism Framework

At present, a notional mapping from the e-CF to the EQF exists. However, this is solely a high-level mapping reflecting a need for innovative thought leadership at the highest levels of the profession, and less demanding knowledge requirements at lower levels of the profession. There is no granular mapping of individual courses/modules to specific competences/proficiencies.

Moreover, the current notional mapping suggests, for example, that EQF level 4/5 maps to e-CF level 2 (Professional). In this current form, this would suggest (at least in some countries) that a student who had successfully completed high school had acquired the knowledge requirements of an ICT professional (for example, in Ireland, EQF Level 4 equates to a school leaving certificate which is a high school level qualification). In practice, the knowledge and competences delivered by educational courses must be assessed directly against individual competences/proficiencies, rather than simply adopting a notional mapping which cannot hope to provide the level of accuracy required.

Furthermore, we must emphasise that students who do possess the knowledge requirements at a higher level cannot presume to enter the profession at a higher level – qualifications must be supplemented by relevant and adequate experience. It is also imperative for the credibility of the professionalism framework that this process is able to stand up to external and independent scrutiny. If industry or potential employers do not value or trust the framework, its adoption will be limited.

9.3.8 External validation

As indicated previously, the proposed framework is based on a self-assessment approach; however, we envisage that in some countries and industry sectors, there will be increased demand for external validation, and we envisage that professional associations will most likely assume a significant role in this area.

We are also likely to see a growing demand for external validation in specific competences or role profiles. For example, Information Security and Enterprise Architecture play such essential roles in ICT solutions that the requirement to minimise the risks to society will dictate a need for increasing levels of rigour and control.

Reflecting this requirement, we imagine that industry protagonists (again, most likely, professional associations) will offer a form of Professional status award (similar to the 'chartered' model or equivalent) to professionals whose competence has been externally validated at the required level. This would most likely be role specific, comprising clusters of competences (possibly identified via the CEN ICT Skills workshop European ICT Professional Profiles) – rather than granting such an award on an individual competence.

10 Proposed Framework for ICT Professionalism

This section provides further detail into the operating model for each of the key components of the proposed European Framework for ICT Professionalism. It tackles this by providing a narrative around each of the four building blocks of professionalism:

- Bodies of knowledge
- Ethics
- Education, and training
- Competences

The narratives explain the operationalization of the framework, the roles of various bodies and interconnections between them.

The proposed framework reflects the inputs and expectations of the various stakeholder groupings – however, it should not be perceived as a static solution. Invariably, as stakeholder needs evolve and become clearer, the framework itself will require updating in order to accommodate these new requirements. In this respect, obtaining feedback and identifying potential updates from stakeholders on an on-going basis is both an essential and expected part of the journey in maturing the profession.

10.1 Bodies of Knowledge

10.1.1 Development of Bodies of Knowledge

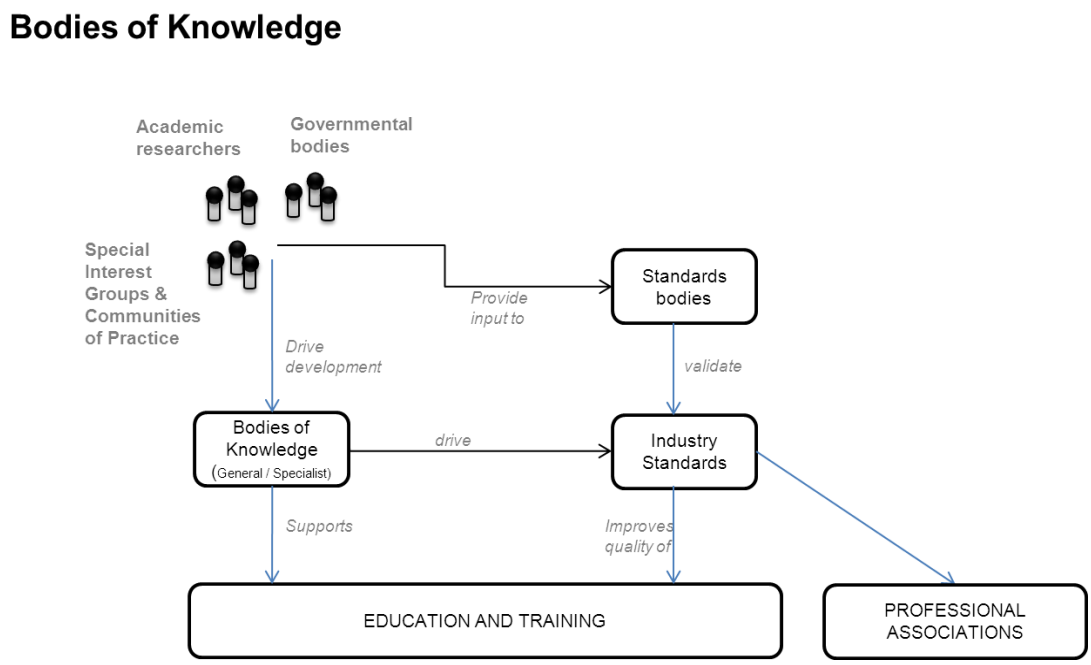


Figure 44 Bodies of knowledge in an ICT professionalism framework

Bodies of knowledge are developed as a means of documenting accepted good practices, being used to competently complete tasks in a specific area of interest. Bodies of knowledge can be initiated by special interest groups or communities of practice working on advancing and standardising specific areas. Likewise academic research can lead to the development of bodies of knowledge, as can government initiatives. Combinations of all three contributors

will often work together to produce and maintain bodies of knowledge. New bodies of knowledge are typically developed around new competences or technologies that lack a standards approach to language, scope, proficiency levels, certification or qualifications.

10.1.2 Use of Bodies of Knowledge

Bodies of knowledge are used extensively in practice. They reflect a record of current understanding in a particular area and often indicate currently accepted good practice. They are used to disseminate knowledge to practitioners and can form a basis for enhanced breadth and depth of understanding by educators, employers and professionals in a subject area. Many bodies of knowledge, for example the Project Management Body of Knowledge (PMBOK) have international support.

Professional associations also use bodies of knowledge as a basis for their professional development programmes and as a basis of evaluating membership grades. Bodies of knowledge in turn drive proficiency standards against which certifications and qualifications can be issued. They can also act as the syllabus for courses and provide a definition of the core content of the knowledge. Higher education institutions' course syllabi are also determined by the R&D undertaken internally in colleges as well as the periodic and regular review of research in industry and other colleges. Professionals are required to have a comprehensive understanding of this knowledge. Further, as BoKs become more established, Standards bodies can use them as a basis for industry standards.

Professionals use bodies of knowledge to learn. Professionals also use them as a basis against which a competence gap analysis can be completed to guide their on-going professional development decisions.

10.1.3 Industry Standards

Professionals (often via Special Interest Groups) contribute to both bodies of knowledge and standards bodies. Industry standards for interfaces and interoperability are essential to the global ICT business, and are often mandatory in the environments in which the professional is working. A knowledge and understanding of these is essential to the professional in requisitioning or providing competent service. Educators use industry standards as a basis for course development and certifications.

Professional associations can play a part in recommending or purchasing relevant bundles of standards and bodies of knowledge to provide cost-effective access for their ICT practitioners. These might be focused for specific career streams.

10.2 Ethics

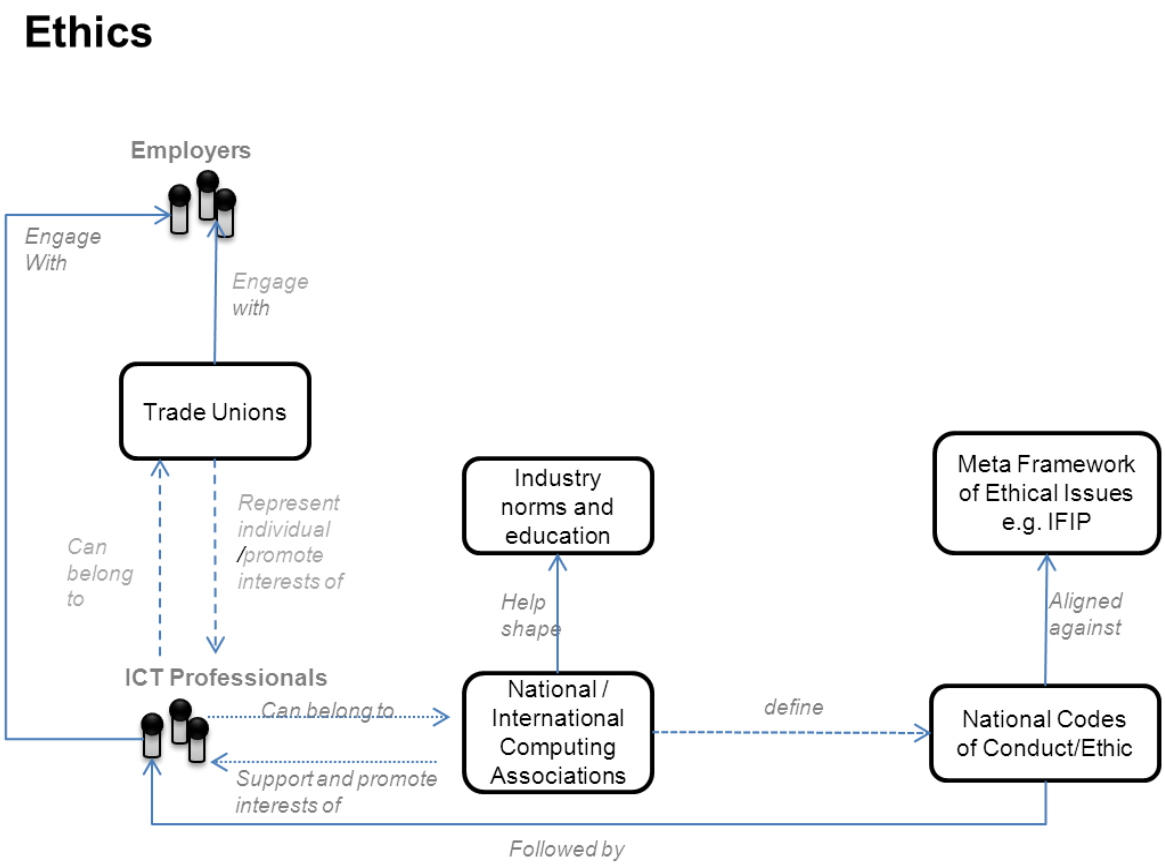


Figure 45 Ethics in an ICT Professionalism Framework

10.2.1 Meta Framework of Ethical Issues

From previous initiatives, it is evident that a universal Code of Ethics for ICT practitioners/professionals is not possible to mandate given the diversity of individuals with respect to:

- Cultural, traditional, legal, social, and political differences across countries,
- Differences in ethics status across member societies, and
- Divergences in the meaning of ethics and professional conduct.

Our proposed framework recognises these challenges, but nonetheless it takes steps to encourage a more consistent approach towards ethics across national boundaries. We propose that National Computing Associations should align their Codes of Ethics/Conduct with a Meta Framework of Ethical Issues. While each National Computing Association would have responsibility in developing and maintaining its own Code, such alignment would nonetheless assure that a common core set of ethical issues are discussed in the ethical Codes across Member States.

It is recognised that National and International Computing Associations are usually members of bodies such as CEPIS in Europe, and internationally of International Federation for Information Processing (IFIP). IFIP has issued a set of guidelines/criteria which can be used as an aid to defining specific codes of ethics/conduct. These criteria, among others, may help inform the development of a Meta Framework of Ethical Issues.

10.2.2 Adherence to Codes of Ethics

Each of the International and National Computing Associations facilitates the agreement of a Code of Ethics/Conduct by its members. Members of the various associations are often required to adhere to the code that has been agreed by their association(s).

In the research, only subtle differences were found in the Codes of Ethics/Conduct reviewed. Practitioners who were members of multiple associations did not have a difficulty signing up to more than one code. While the low level of adoption and enforcement do not pose problems at this point in time, it is envisaged that hypothetically, issues may arise from conflicts between national codes for professionals who operate across borders and who, in doing so, have signed up to more than one Code of Conduct (however, the risk posed currently is negligible).

Note: Enforcement or policing of the codes and the imposition of sanctions for violations differs among professional associations. Some of the larger national and international professional associations (e.g. PMI) do have violation reporting, adjudication and appropriate appeals mechanisms in place. Smaller associations do not have the resources, skills (in particular the legal skills) or manpower to implement such systems. For the most part, adherence to the Code of Ethics/Conduct is voluntary.

10.2.3 Representing the Profession

National and International Computing Associations typically represent the profession as a whole in communications with employers and government agencies, and can help shape industry norms and education.

Trade unions also play a role in representing the profession in communications with employers and government agencies. However, trade unions also play a role in representing groups and individuals through engagement with employers. Many ICT professionals are not members of either trade unions or computing associations and effectively represent their own interests with their employers and political representatives. As an ICT Profession matures, membership of national and international computing associations will grow.

10.3 Education and Training

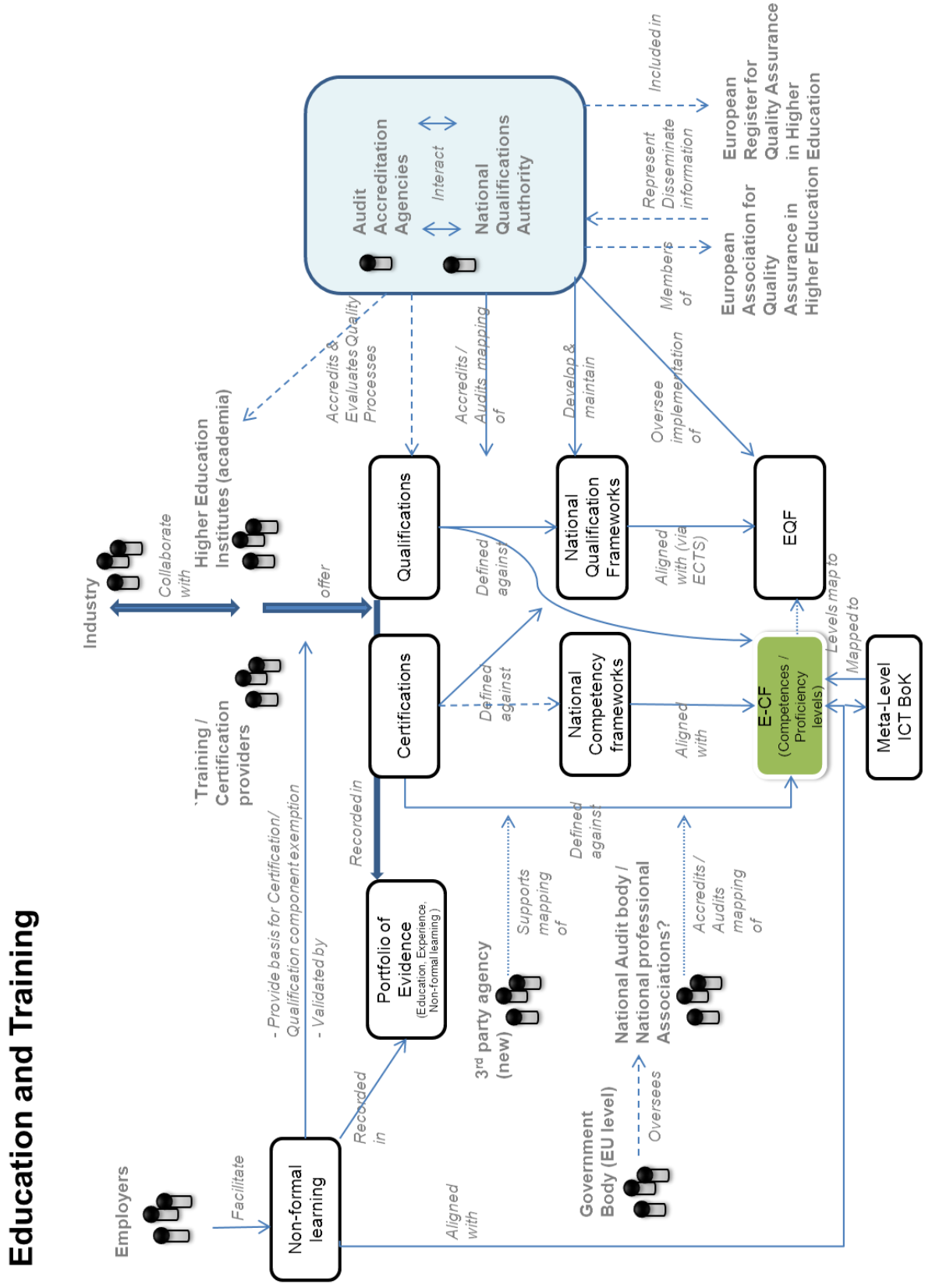


Figure 46 Education and training in an ICT professionalism framework

ICT professionals' commitment to continuous professional development (CPD) is recognised through acquiring relevant ICT certifications and qualifications and through non-formal and informal learning experience and demonstrated competences in the delivery of products and services to clients.

10.3.1 Non-formal and Informal learning

Non formal learning is typically not provided by an education or training institution but is intentional on the part of the learner and has structured objectives, times and support. This may often be facilitated by employers. Informal learning, on the other hand, results from daily activities related to work, family life or leisure. It is not structured, usually does not lead to certification and it often unintentional on the part of the learner. Given the high number of practitioners who have not been formally trained in ICT, the potential impact of non-formal and informal learning within the industry is significant.

While non-formal and informal learning typically does not lead to certification, it nonetheless may form the basis for exemptions from certification/qualification module components. In addition, this framework also proposes that through submission of details on non-formal and informal learning experiences and supporting evidence by employers, non-formal and informal learning may also be validated by a higher education institution resulting in a formal qualification mapped against the competences of the European e-Competence Framework (e-CF)[47]. Non formal learning may also be directly aligned with the e-CF and the proposed meta-level ICT BoK in terms of the learning structured objectives, and is recorded in the individual's portfolio of evidence, which forms an important basis for employer's recruitment/promotion decisions.

10.3.2 Formal learning – Importance of Collaboration

Formal learning, on the other hand is typically provided by training/certification providers and higher education institutions and results in a specific certification/qualification that is recorded in the individual's portfolio of evidence. There is a recognised need for increased collaboration between training/certification providers, higher education institutions and industry. Due to the dynamic nature of ICT, education course providers need to be more agile/responsive to emerging technological developments in order to ensure suitably qualified individuals are available in the market and to enable ICT professionals to effectively develop over the course of their careers. Collaboration between these entities results in the availability of industry relevant certifications and qualifications.

10.3.3 Mapping to Frameworks

The certifications and qualifications offered by providers need to be mapped to recognised European frameworks e.g. competence frameworks and qualifications frameworks to improve their transparency and understandability.

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[47] The e-CF is a reference framework of 36 ICT competences, structured from four dimensions: 5 e-competence areas, a set of reference e-comptences for each area, proficiency levels of each e-competence, and related sample knowledge and skills. http://www.ecompetences.eu/

10.3.4 Mapping of Certifications/Qualifications from Certification providers/training institutions

With an excess of 1300 certifications being offered by over 100 certification providers and many other training institutions, the mapping of these to a standard framework would be of significant benefit to ICT professionals and employers due to improved comparability and increased transparency of certification/qualification offerings. From a competence perspective, in cases where national competence frameworks exist and are aligned with the e-CF, certifications/qualifications may be defined against those. Alternatively, certifications/qualifications may be directly mapped against the e-CF. This would provide visibility on which of the 5 e-competence areas a certification/qualification relates to, which e-competences it develops, the proficiency level assignments related to each competence and possibly examples of skills and knowledge acquired[48].

However, this mapping process needs to be transparent. While it is anticipated that the leading vendors may undertake this mapping process themselves (and one could foresee a situation where such organisations are "approved" to undertake mapping of their courses, in the same way that large universities are "approved" to map to national qualifications frameworks – see below), due to the number of training/certification providers, it is suggested that there is also a key role for a 3rd party agency to undertake/support the mapping to the e-CF. With the involvement of different parties, such a process needs to be effectively audited in order to ensure quality and transparency and to build and maintain confidence in the mapping initiatives. National professional computing associations/national audit bodies may undertake the role of auditing/accrediting the mapping to the e-CF on a national scale. Similarly, to ensure consistency across national borders, an EU level body could act in a monitoring/"watchdog" type role to oversee consistency in these initiatives across the EU.

10.3.5 Mapping of Qualifications/Certifications from Higher Education Institutions

Depending on the academic institution in question, either National Audit/Accreditation agencies or the universities themselves are responsible for accrediting qualifications and ensuring they are consistently mapped to their National Qualifications Framework. Audit/accreditation agencies are also responsible for periodically evaluating the quality processes of the higher education institutions. It is important to note, that while the framework depicts audit/accreditation agencies and National Qualification Authorities as separate entities that interact, in some countries these agencies are combined in a single entity. Many of these entities are members of the European Association for Quality Assurance in Higher education (ENQA), which represents its members and disseminates information et cetera and some are included in the European Register for Quality Assurance

[48] Initial efforts in mapping a select number of certifications to the e-CF and other competence and qualifications frameworks were undertaken as part of the recent CEN Workshop on ICT Skills "ICT Certification in Action" project. The European Commission launched a new project in January 2012 (Quality Labels for Training Fosteringg e-Skills for Competitiveness and Innovation) aimed at developing quality labels for industry-based training and certification (IBTC) in line with European Quality Assurance Reference Framework for Vocational Training and Education (EQAVET).

in Higher Education (EQAR). Membership of these bodies promotes confidence in the quality assurance processes adopted and the quality standards that national higher education qualifications adhere to.

The National Qualification Authorities (NQAs) are also responsible for the development and maintenance of the country's National Qualifications Framework (NQF). Although only a small number of countries currently have established NQFs, all 31 states are working to develop NQFs that can be related to/aligned with the EQF 8 reference levels. The NQAs act as the co-ordination point for overseeing the implementation of the EQF within their country. This mapping of qualifications and/or certifications to NQFs and ultimately to the EQF, acts as a translation mechanism, that enhances understanding of qualifications within and across national boundaries in Europe. It also provides a mechanism for relating a qualification on the EQF to the e-CF, as the 5 e-competence levels of the e-CF directly relate to levels 3-8 of the EQF.

However, relating qualifications/certifications to e-CF levels alone does not provide sufficient support for an ICT professional/aspiring ICT professional with respect to understanding the specific competences developed through a higher education course. The framework proposes that higher education qualifications/certifications should also be mapped to the competences of the e-CF, in order to increase transparency for the ICT professional regarding the specific competences and competence levels developed through attaining certain qualifications. While this mapping would be carried out by the higher education institutions, it is proposed that in addition to auditing the mapping of qualifications against the NQFs, the national audit accreditation agencies/National Qualification Authorities will also be responsible for auditing the mapping of higher education qualifications to the e-CF.

10.3.6 Creating a Register of ICT Education

The development and maintenance of a "Register of ICT Education" by a commercial entity within each country could provide an up-to-date list of qualifications/certifications undertaken by ICT professionals, the date they were undertaken, and an overview of the resulting competences and competence levels achieved. With a view to creating and maintaining these registers, the various bodies included in this framework would play an important role in providing input. It is proposed that national registers may be hosted within each country by for example the National computing associations/national audit bodies or a third party agency/consultancy; and a European interface to these national databases for search purposes may be developed. The registers could initially include input from the ICT certification and training providers in terms of recipients of ICT certifications. The long term vision may be to also include input from the universities and National Qualification Authorities in terms of the higher education institutions qualifications awarded. Universities and third level colleges typically maintain a register of all qualifications issued by the institution; it may be possible to electronically upload these to a new register.

However, any progress on developing such a register would have to take into consideration the respective data protection and privacy laws as well as interest levels in each Member State. Moreover, it is likely that such a database would operate on an opt-in basis, favoured by job-seekers, rather than for all practitioners. Also, we view the provision of historical data on legacy courses by education providers to be unlikely – such data would therefore be submitted by the individual practitioners and identified as "un-validated".

The creation of a register would have to be driven by demand from industry and practitioners in order to support its long-term sustainability. As part of such an initiative, the potential value to professionals would need to be clearly identified and articulated.

10.3.7 Recognising the EU Professionals Qualifications Directive (2005) and its Potential Future Implications for IT

Across the EU 27 there are approximately 800 categories of regulated professions, contained within the European Commission's Regulated Professions Database. Across the various EU Member States, it appears that the practice of IT falls within the regulated professions categories on a limited basis. Given the diversity across the EU 27, naturally some exceptions occur. For example, the Security Systems Professional is regulated in Poland and the Czech Republic; the Information Systems Practitioner is regulated in Portugal and Italy.

The EU Professionals Qualifications Directive (2005), which provides for the automatic recognition of qualifications for specific professions in other EU Member States and a 'general system' for the mutual recognition of other professions qualifications, is currently being modernised to accommodate twenty first century and evolving labour market requirements. The modernization of the Directive aims to smooth qualifications recognition in order to better support mobility. In the countries, where the practice of some aspects of IT is regulated, the framework for ICT professionalism will need to be cognizant of the proposed Directive changes, and recognise core elements which may become more important and more widespread in the practice of IT in future years.

The modernization proposals put forward 12 keys elements. Of significant interest, is the introduction of a European Professional Card for interested professions, which aims to support quicker and simpler recognition of qualifications, and enable temporary mobility through the provision of an electronic certificate that enables the professional to work in another Member State. This certificate will be exchanged between relevant authorities of the required Member States via the Internal Market information System (IMI)[49], and as a result administrative burdens and costs on the professional will be reduced. With the card, recognition times would be reduced from 12 to 6 weeks (for automatic recognition) and from 12 to 10 weeks (for non-automatic recognition). Other proposals of interest include the requirement for Member States to provide and justify the list of regulated professions within each country, and mutual evaluation by the EC with the objective of avoiding *'situations in which qualification requirements create artificial barriers to the free movement of EU citizens';* rules on the partial access to a regulated profession, which would permit the practice of some activities of a certain profession in another Member State; the ability of not fully qualified professionals to carry out remunerated traineeship in other Member States; the establishment of common training frameworks or common training tests based on a common set of knowledge, skills and competences required for a specific profession, thereby providing a possible new route of automatic recognition, among other proposals. While for many countries, where IT is not regulated, the above changes will have little

[49] The IMI is "a secure online application that allows national, regional and local authorities to communicate quickly and easily with their counterparts abroad. IMI is accessible via the internet without the need to install any additional software".

impact at present; nonetheless it is important to recall that the roadmap towards ICT professionalism will require initiatives over many years; hence some of the above proposals may hold greater implications for the practice of IT in the future.

10.4 Competences

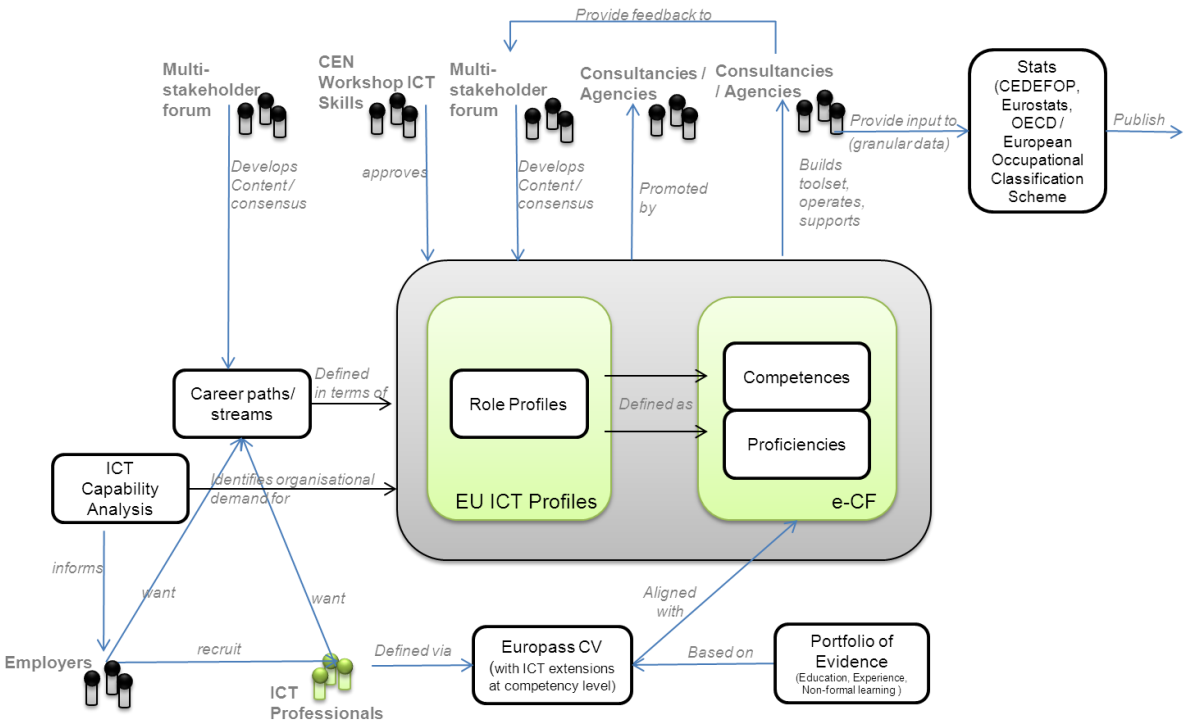


Figure 47 Competences in an ICT Professionalism Framework

10.4.1 Career paths

Employers and ICT professionals alike have a desire for visible career paths/streams that facilitate the planning of an individual's career, and the identification of appropriate development methods to pursue those career plans. A multi-stakeholder forum would be responsible for developing and agreeing the proposed career path content. These career paths could be defined in terms of the on-going European ICT Professional Profiles project within the CEN Workshop for ICT skills[50].

[50] The CEN Workshop on ICT Skills, is a pre-standards body that brings together relevant stakeholders from industry, human resources, academia and IT associations, and contributes towards the long-term e-Skills agenda of the European Commission (EC) via a series of projects and initiatives (typically resulting in the publication of a CEN Working Agreement).

10.4.2 ICT Role Profiles and e-CF

The defined ICT role profiles include accountability, deliverables, and main tasks for a particular job, and specify the related competences and proficiencies against the e-CF. These ICT profiles identify a number of the 36 e-CF competences pertaining to role titles as well as the requisite proficiency levels from e-1 to e-5. Therefore, employers' recruitment decisions can be based on the degree to which an ICT professional's portfolio of evidence/Europass CV is aligned with the required competences and proficiencies for a specific role profile.

A common understanding of the competences contained in the e-CF, and the related proficiency levels, will mark a major step forward for the industry. The ability to define a job role in terms of its competences and be understood across Europe will be tremendously helpful. Similarly, the ability of individual practitioners to assess themselves against the e-CF to identify which competences they need to develop in order to shape their career will help drive long-term career progression as well as shorter term professional competence development.

Practitioners will be able to document their skills for employers in a consistent fashion using a standard Europass CV with appropriate ICT-specific extensions (based on e-CF competences).

10.4.3 ICT Capability Analysis

An assessment of the organisation's ICT capability (using a maturity framework such as IT-CMF) provides insight into gaps in the organisation's current ICT capability. Such an analysis would consider multiple dimensions of the organisation's ICT capability, including people, processes and technologies (including toolsets). In doing so, this activity can help inform the strategic direction of the IT organisation.

In undertaking this gap analysis, the activity identifies where additional people capabilities are required – tackled by recruitment, developing skills in-house, or outsourcing. By providing visibility of organisational capability, this activity complements the individual practitioner perspective provided by the e-CF.As the e-competence proficiency levels of individual practitioners increase, the organisational capability of the organisation can mature, helping to drive increased business value.

10.4.4 The role of multi-stakeholder forums

Multi-stakeholder forums are responsible for developing content and deriving consensus surrounding the ICT profiles and e-CF projects, with the relevant outputs being reviewed and approved by the CEN Workshop for ICT Skills.

A feedback loop from organisations (using the e-CF), practitioners, consultancies, and agencies will help provide input into the development process in order to enable the content of the e-CF to be continually improved.

10.4.5 Embedding the e-CF

Third party organisations/consultancies/agencies will play an active role in establishing the e-CF across industry.

There is a need for various toolsets to support industry participants in their adoption of the e-CF, as well as a range of consultancy/advice services to support organisations and practitioners in this change.

For example:

i) to support employers in defining job roles in terms of e-CF competences/proficiencies
ii) to support practitioners in assessing their ICT competences
iii) to support education providers in mapping their offerings to the e-CF
iv) to support benchmarking of ICT competences at individual, departmental, organisational, industry, and national levels
v) to support capture of employer demand for ICT competences

Marketing of the e-CF is a key activity in order to drive adoption across industry. While individual industry protagonists (certification providers, consultancies, HR agencies, government bodies) will play an active role, there is also a probable need for a marketing agency (or agencies) to promote the adoption of the e-CF. Raising awareness is essential in order to gain traction within the industry – an important step to establishing a virtuous cycle of adoption.

10.4.6 Spectrum of Adoption

It is important to recognise that many organisations have already made significant investments in the development and adoption of in-house or externally developed competence frameworks. Moreover, many organisations view their in-house competence framework as a key component of their competitive advantage. In such instances, the prospect of an organisation transitioning all of its internal processes to the e-CF in the short-term is very unlikely.

However, it is envisaged that many such organisations will still choose to map their in-house competence framework to the e-CF, for the simple reason that it will facilitate recruitment, particularly of potential employees from other countries. Using this approach, companies could advertise across Europe for relevant competences in a standard way that will be understood by all potential employees in a similarly consistent fashion. In this way, employers looking to fill positions will potentially have access to a wider pool of suitable applicants, and those who apply are more likely to possess the competences and proficiency levels desired.

In contrast, other organisations (particularly smaller ones) may find no need for a separate in-house competence framework, and benefit from solely using the e-CF within the organisation. In this way, there is likely to be a spectrum of adoption in the way that different organisations choose to engage with the e-CF.

10.4.7 Compliance

Over time, it is envisaged that the e-CF will become an industry standard (reinforced by the possible future transition of the CEN Workshop on ICT Skills to a Technical Committee). However, as an open standard, it is possible that some enterprises offering services will take the published framework and amend/adapt it significantly, before engaging with clients.

This in itself is to be expected and indeed desired, but certain restrictions should be placed on the nature and extent of the changes which can be applied. If no restrictions are in place,

it is probable that we will see innumerable variants of the e-CF in circulation, all purporting to reflect the e-CF standard, but all with different definitions of the competences and proficiency levels; eliminating the key objective of the framework which is transparency and consistency in the interpretation of competences across Europe.

To overcome this scenario, we can see benefits from preventing any changes to the published competences and proficiency levels definitions, but permitting organisations to add further competences to reflect the needs of particular organisations so long as they are clearly identified as an Addendum. Further work on developing a clear set of guidelines / labelling for users will be required.

A small number of interviewees commented on the possible need for agencies to be in place to "approve" consultancies wishing to provide services regarding the e-CF. If this is required (and further investigation would be required to confirm this), it is envisaged that responsibility for such a task would vary on a country by country basis, similar to the approach proposed for auditing the mapping process (e.g. national professional associations or national audit bodies).

10.5 ICT Professionalism Framework (overview).

The diagram below provides an overview of the European ICT Professionalism Framework. In doing so, it collates the key components from the preceding four sections on Bodies of Knowledge (upper left corner of diagram), Ethics (upper right), Competences (lower right), and Education and Training (lower left). Each segment has been covered in detail in the respective earlier section; the narrative below focuses on the links between the segments.

Bodies of Knowledge, developed by industry, academic researchers and governments, support the development of relevant qualifications and certifications, offered by industry-based certification and training providers, as well as Higher Education Institutes (HEIs). These educational offerings can be mapped directly against the e-CF, or alternatively mapped via national competency frameworks and national qualification frameworks (where in existence). In doing so, this will support the transparency of education for ICT practitioners across Europe.

The task of mapping certification to the e-CF could be undertaken by educational providers or specialist third party agencies. A national audit body (possibly even a national professional association) could oversee this activity, overseen by a supra-national EU-level body to enable consistency. For the mapping of qualifications to EQF, the existing audit accreditation agencies / NQAs could continue in this role, but may also be involved in the accreditation of HEIs to map educational offerings to e-CF as well.

As a consequence of practitioners assessing themselves against the e-CF, they are able to define the specific ICT competences and related level of proficiency they can bring to an employer, facilitating their employment prospects across Europe. Through increased transparency of the knowledge and competences delivered by educational offerings, practitioners and employers would be better placed to understand what education should be undertaken to provide the relevant competences required for specific role profiles, thereby supporting practitioners in achieving their desired career plans.

National Computing Associations, represent practitioners in different forae, and facilitating the creation of industry norms and education. Similarly, trade Unions promote the interests of ICT professionals, and engage with employers to facilitate continued employment. These bodies also have a role to play in facilitating the adoption of consistent codes of ethics across

their respective membership, thereby facilitating confidence in the behaviour of ICT professionals across Europe.

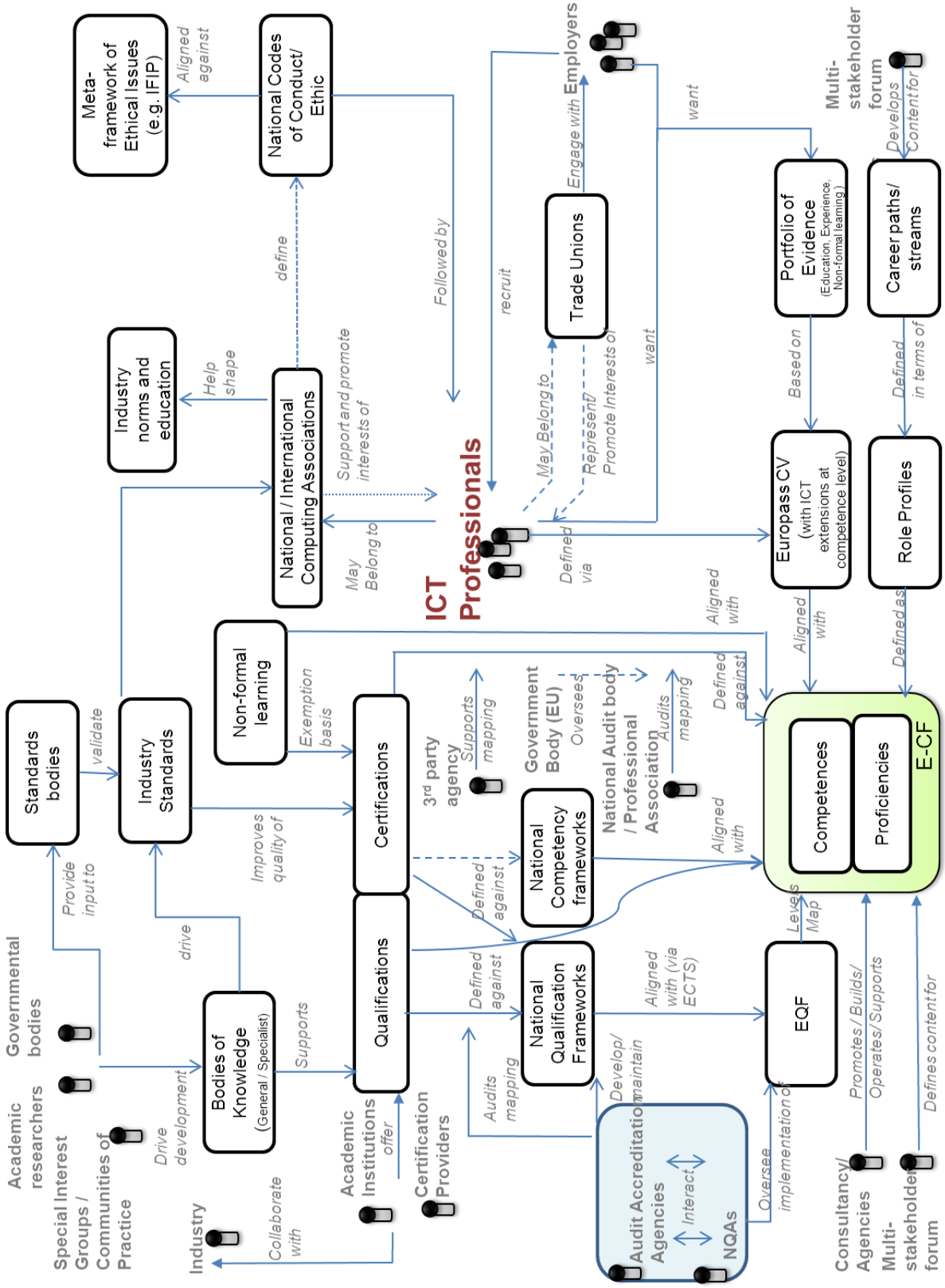


Figure 48 ICT Professionalism Framework

11 Senior ICT Manager Training and Education

11.1 Introduction

The development of a training programme for ICT Managers, while a challenging task, can nonetheless build on best practices exemplified across a number of leading tertiary institutions in the delivery of ICT managerial level training. Listed below are some case examples of how a selection of third level education establishments are developing and delivering training to CxO, CIO and senior ICT managers. Across all examples the delivery mechanism is different. These establishments have responded to a recognised need at a local or national level. Although, each establishment looks to provide a training programme that is internationally recognised, the starting point will be largely predicated by national reputation, and local demand.

11.2 Delivering ICT Manager Training – Case Examples

11.2.1 University of Glasgow

The University of Glasgow is one of the oldest Universities in the UK. It is part of the Russell Group that comprises of the top 25 research focused Universities in the UK. In terms of reputation Glasgow's Computing Science (CS) department is within the top 100 CS departments in the world.

In terms of courses being offered, the department offers both research and non-research postgraduate courses such as Computing Science, Information Retrieval Systems, Information Security, Information Technology, Software Development, Software Engineering, and Mobile & Ubiquitous Systems. What is obvious from the courses on offer is that they have been developed with the 'advanced practitioner' and academic in mind. In terms of assessment philosophy, the courses follow a 'progressive / developmental' approach. This is where processes dominate and interaction and student-teacher partnership plays a central role. The courses are designed to develop the individuals cognitive /problem-solving skills. Although most postgraduate level courses now have electives included covering management and organizational issues, the emphasis of the course is not to develop or prepare the student for management, but to increase specialist knowledge, thus increasing the students' worth to industry / academia.

For those in management positions, the university does offer courses to support the development of an individual's management capability. However, this is not specific to a job role or position. What is interesting is that the Business School does now support combined engineering and management postgraduate degrees, but not IT and management degrees. The reason for this is simple economics. The professional institutes that ratify engineering degree courses have identified 'management' as a weak component of an engineers training and therefore recognised a demand within the engineering profession. In terms of IT, most business schools would view this as a resource to be managed, and would support aspects of this education through programmes such as the MBA or MSc in Management.

All engineering, science, medical, and business-related courses are designed with industry guidance, and are validated by various UK and international professional institutes (BCS, IET, APM, CIPD, BMA, GMA, GDC etc).

11.2.2 National University of Ireland Maynooth

The National University of Ireland, Maynooth (NUIM) is part of a network of Universities across Ireland. Of all the NUI campuses, Maynooth is the smallest, and youngest. The Department of Computer Science was founded in 1987 in the Faculty of Science. In addition to offering a number of undergraduate and postgraduate courses, the department offers a comprehensive postgraduate programme including research degrees leading to the award of Ph.D. and M.Sc., the taught M.Sc. in Software Engineering, the Postgraduate Diploma in Software Engineering, M.Sc in Geocomputation, and a Higher Diploma in Information Technology conversion course that is also targeted at students with non-computer science primary degrees. These courses are very much focused towards the needs of the practitioner and not the needs of a technical manager.

That said, the University, as a whole is keen to ensure industry as well as academic needs are met when developing both undergraduate and postgraduate courses. This need to ensure industry relevance is largely driven by a key metric used in ranking universities across the world, and that is the number of graduate students who have secured work on completion of their studies.

One area that the university has recognised as a potential area for demand is around IT Management. The NUIM Business School has looked to develop and launch in 2011 a Masters's of Science in IT Management. The focus of this course is on helping executives (CxO level) better understand and realise the value of Information Technology within their organization. This course is not seen as a replacement for the more traditional MBA programmes, which sought to provide the specialist (originally engineers) with an understanding of business management theory, but to enhance the CIO's understanding of how technology can be used as a key enabler for competitive advantage. The course focuses more on the use of technology in a competitive environment, as opposed to focusing on the technology itself.

This is the first year NUIM has run the course and the number of students has bucked the general falling trend in IT postgraduate course attendances. From NUIM's perspective a key factor in the success of the MSc in IT Management is the fact that the course content has been developed through direct industry engagement around identifying core business drivers where the CIO can influence performance improvement.

Unlike the UK, professional institutes do not validate many of the courses. However, this is changing as many students see this validation by a professional body as a way of translating academic qualifications to industry levels of professional competence.

11.2.3 Innovation Value Institute

Intel and the National University of Ireland Maynooth formed the Innovation Value Institute (IVI) in 2006. It is supported by a growing membership of international companies that together form a consortium that governs, funds, and contributes actively to the Institute. It is a non-profit research organisation 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.

The objective of the Innovation Value Institute is to develop and provide a comprehensive framework of best practices for the management of all aspects of ICT to support organizations in deriving the maximum value from their investment in ICT.

To deliver this objective IVI has formed a membership network of companies, government bodies, and Academic institutions at a worldwide level. The operating model of the IVI is based on the very active contribution of its members. To date more than 80 companies/entries have been involved in IVI's research and development activities, across the full spectrum of industries, size, and geography.

IVI's research capability is only as good as its ability to disseminate the knowledge to practitioners, and more importantly, CxOs across the organization. As part of this process of dissemination, the IVI has produced a set of professional training courses that cover all aspects of the IT Capability Maturity Framework. The education is targeted at two main groups; CxOs who need to understand their IT capability, and practitioners who need to know how to assess aspects of the organizations IT capability. The unique aspect of this approach is that participants are subsequently able to draw upon the framework and supporting toolset in order to assess the relative maturity of their own ICT organisation, and identify a plan for maturing the organisation. While the IT-CMF focuses on organisational ICT capabilities, this ideally complements the personal competences which can be assessed using a competence framework (e-CF). In doing so, organisations are better able to understand how to develop both organisational and ICT employee capabilities to deliver enhanced business value.

The IT-CMF was developed using the triple helix of industry, academia and government. The research leading to the IT-CMF was design science (Hevner, 2007) based. The IT-CMF was designed to assist in the management of IT from a business value perspective. The framework is comprehensive and addresses the widest spectrum of ICT activities for the CIO. The diploma for IT Business Value course is frequently run.

The courses are based on Mode 2 research, which in turn is developed through interaction with industry and a drive to understand the issues impacting IT performance in real-time. The courses are between 1-3 days in duration and are presented in a modular fashion. In terms of curriculum design, the courses would draw from all five philosophical approaches

as defined by Toohey (1999)[51] which are, discipline based, systems based, cognitive, personal relevance, and socially critical.

These courses are also engineered to allow the participant to use the course credits to achieve higher professional recognition through the IT-CMF professional certification programme, or put the credits earned for the courses towards a postgraduate degree in IT Management.

11.2.4 INSEAD

INSEAD is one of the world's leading and largest graduate business schools. INSEAD brings together people, cultures and ideas from around the world to change lives and to transform organizations.

With campuses in Europe (France), Asia (Singapore) and Abu Dhabi, and a research centre in Israel, INSEAD's business education and research spans three continents. INSEAD has 141 renowned Faculty members from 35 countries, and inspire more than 1,000 participants annually in their MBA, Executive MBA and PhD programmes. In addition, more than 6,000 executives participate in INSEAD's Executive Education programmes each year.

What is different about INSEAD's approach is that they do not deliver any IT specific postgraduate degree education. The focus is not on developing an 'advanced specialist' in any aspect of technology, let alone business, but to provide professionals from all disciplines with the understanding of the complexities of business, and organizational performance. INSEAD does this very effectively through the MBA, executive MBA, executive training and PhD programmes it offers.

In common with the other institutes discussed within this section, INSEAD works very closely with their industry, academic and government partners to ensure that they are tailoring their courses to specific segments of the education market. Where INSEAD would also compare quite closely with more traditional providers of MBA programmes is that the programmes offered are more level-specific than role-specific. This can be seen in the type of executive training provided; finance and banking, operations management, leadership, and strategy.

This does not mean that there is nothing at INSEAD to meet the needs of the CIO. INSEAD have an extensive knowledge base on issues relating to CIO management and IT enabled leadership, and many CIO's have come to value the education, experience, and networking gained through INSEAD's education programmes. All the components provided as part of

[51] Toohey, S (1999) *Designing courses for higher education*. Buckingham: Society for research into higher education and the Open University Press.

the INSEAD suite of education offerings have relevance to CIO (and CxOs) irrespective of sector, or industry.

11.2.5 Nyenrode Business University

Nyenrode is the only private university in the Netherlands. In 1946, captains of industry from leading Dutch corporations as KLM, Shell, Unilever, Philips and Akzo, took the initiative to start an institute where an action-inclined, internationally focused generation of new business leaders would be educated. Their main goal was to rebuild the economic position of the Netherlands and Dutch enterprises after WWII.

'For business, by business has been the University's motto from the day the institute was established. It still defines the university and assures that practical relevance is the main importance to its faculty. Nyenrode's close contacts with the business world, its education and its research reinforce and inspire each other. The international perspective is deeply rooted in the University's way of being. Nyenrode receives and exchanges students from all over the world and has a strong international focus in its education. Several centres zoom in on international topics such as globalization, offshoring, international diplomacy and business in significant countries like China and India. Nyenrode also leads exchange programs with counterparts all over the world.

The strong link the University has with industry has shaped the manner in which it engages and delivers relevant content. As such, the University's link with professional groups such as the CIO Academy, CIO Platform Netherlands, and EuroCIO have enabled the University's Business School to respond to a growing realization and need for role-specific education, in cases relating to CIO education.

Like most business schools they have embedded their role-specific education within an MBA programme. However, the difference here is that the modules are not designed to increase the students' knowledge of technology, but to enhance the CIOs understanding of how the technology can be used to improve business performance. Because of this role-specific education, the business school has directly targeted CIOs. The programme is proving very relevant with high demand for the course at a time when ICT education across the EU at undergraduate and postgraduate level is falling.

11.2.6 EuroCIO

EuroCIO, established with the support of CIGREF and Finaki, provides a platform for CIOs to exchange best practice and raise awareness of key ICT issues. It represents the European CIO professional organisation, and is connected to approximately 600 companies. Further, it has developed educational programmes for CIOs and other ICT staff.

EuroCIO's educational offering serves as an effective example of some of the collaborations taking place in development of training/education material at present. EuroCIO is undertaking development of a three layer professional education programme for CIOs and

their employees which has international accreditation and is compliant with the e-CF and EQF. This programme aims to meet the demands of ICT professionals.

Layer One is targeted to the future CIO; layer two is targeted to those individuals reporting to the CIO; and layer three to other ICT staff. The layer one programme was developed by EuroCIO together with Nyenrode and Delft University, and was piloted in October 2010 in the Netherlands. This Executive MBA which currently has greater than 50 students, will be rolled out across Europe in several Business Schools, and is endorsed by CIO organisations, ICT industries such as SAP, Cisco, HP, IBM, PWC and multinationals such as Philips, DSM, RaboBank etc. A number of those companies are members of the Programme Review Board, providing input to the demand driven approach. The second layer of the programme is currently under development for the enterprise architecture function, incorporating input from a number of French multi-nationals such as AXA, Total, and Michelin. The third layer of the programme has not yet been developed as numerous courses already exist in the market for this area.

11.3 Identifying Best Practice and Future Trends in Education

There are many education institutes offering education programmes with ICT content directed at management level practitioners. All the programmes vary in content, structure and delivery mechanism. With this in mind, we endeavoured to identify the best approach, one that could be easily replicated across all education providers.

The methods for ensuring relevance are well-known and understood, and largely practiced by reputable institutes. Nordberg (2008)[52] suggested a model for programme development that is aimed at retaining the best features of peer review to ensure academic purpose of a plan, while providing a clearer business justification for the effort. The model (Figure 49) is particularly aimed at the development of professional courses that aspire to be more than the industrial training that was once the main substance of business education, and still informs many commercial and vocational courses.

[52] Nordberg, D (2008) '*Designing business curricula: building relevance into higher education*' International Journal of Management Education. 7(1) pp 81-86.

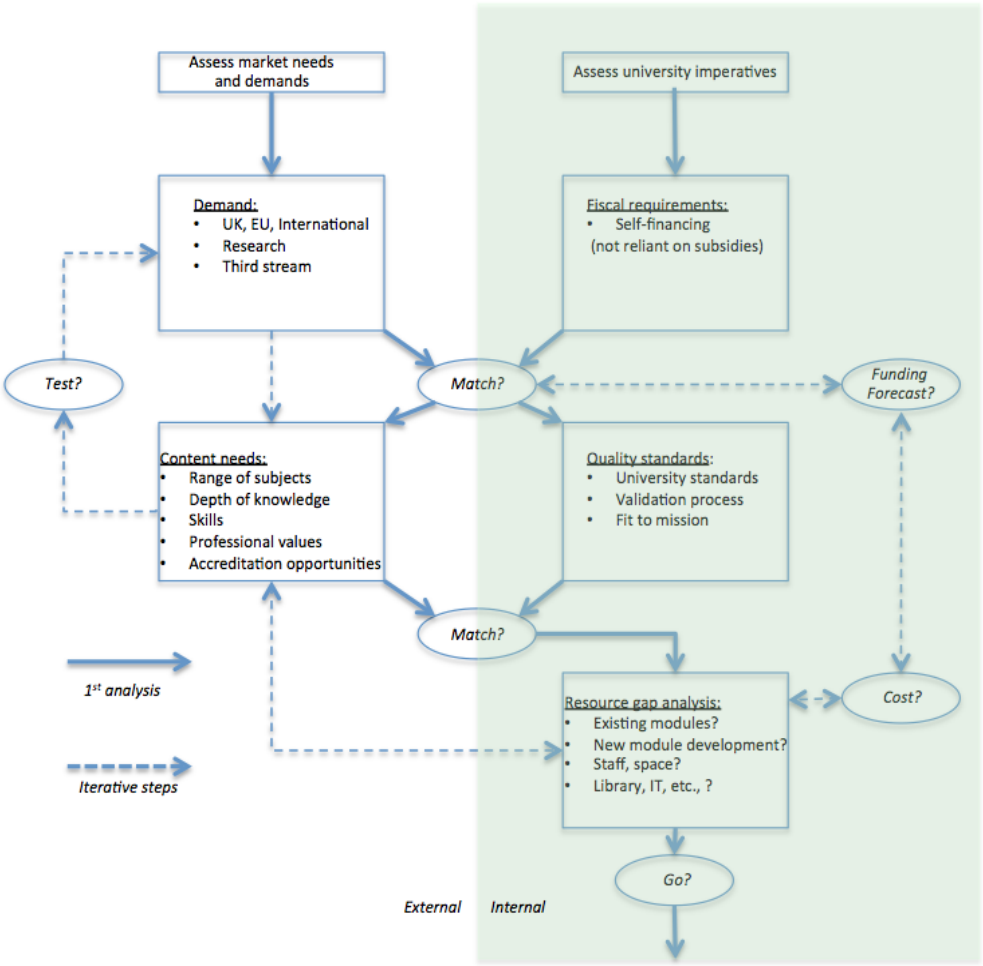


Figure 49 Nordberg's (2008) iterative approach to course development

As Nordberg (2008) points out, the model used for curriculum development draws heavily on thinking from the business world, though set in the context of the purpose of higher education, going beyond the business requirement for any project to demonstrate a positive lifetime net present value. It expands on ideas proposed by Toohey (1999) with more explicit consideration of matching the external requirements, at the levels of both content and values, with the internal requirements of the university's mission and standards, as well as its capabilities.

Having established the feasibility and suitability of the programme, the plan then involves taking the steps needed to make it operational. Figure 50 outlines Nordberg's defined series of steps required internally and externally for launch.

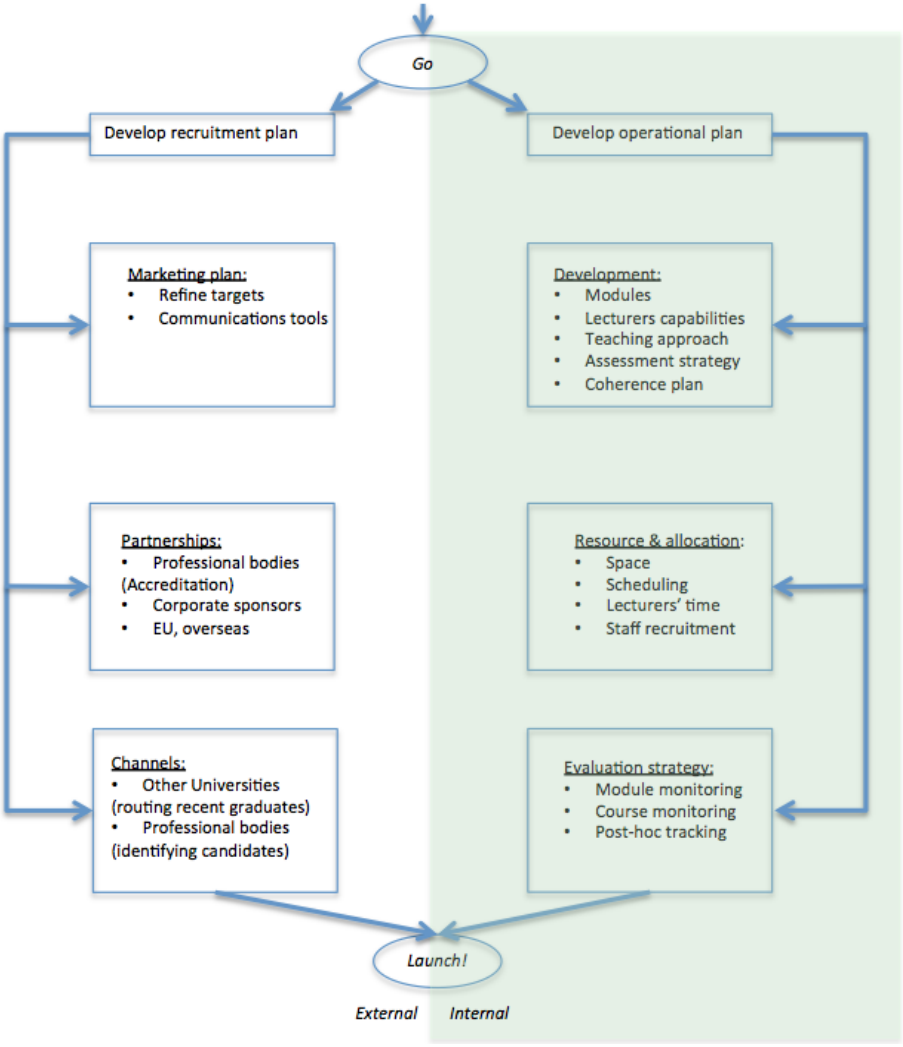


Figure 50 Nordberg (2008) tactical plan

Nordberg's (2008) review of the curricula development process is supported by those education providers seeking to develop and provide academic and industry relevant training. This model supports a demand driven approach to curricula development, and is therefore dependant on the link with industry to ensure the education provider correctly and accurately assesses market needs and demands. It is a vital first stage in defining the needs of the end-user groups; examples of which would be providing education programmes to help CIOs/CxOs understand the impact of the future Internet and ICT-enabled innovation from both an organizational and business perspective. Although these trends are important, any proposed framework should be robust enough to capture and respond to future IT-related trends.

It also demonstrates the dependency education providers have on professional accreditation bodies. In this case, the professional accreditation bodies' act as a representative of various professional groups identifying and expressing the training needs of their respective memberships.

Our proposed education and training framework below effectively supports Nordberg's curricula development and tactical plan. In fact the proposed framework supports any demand driven curricula model.

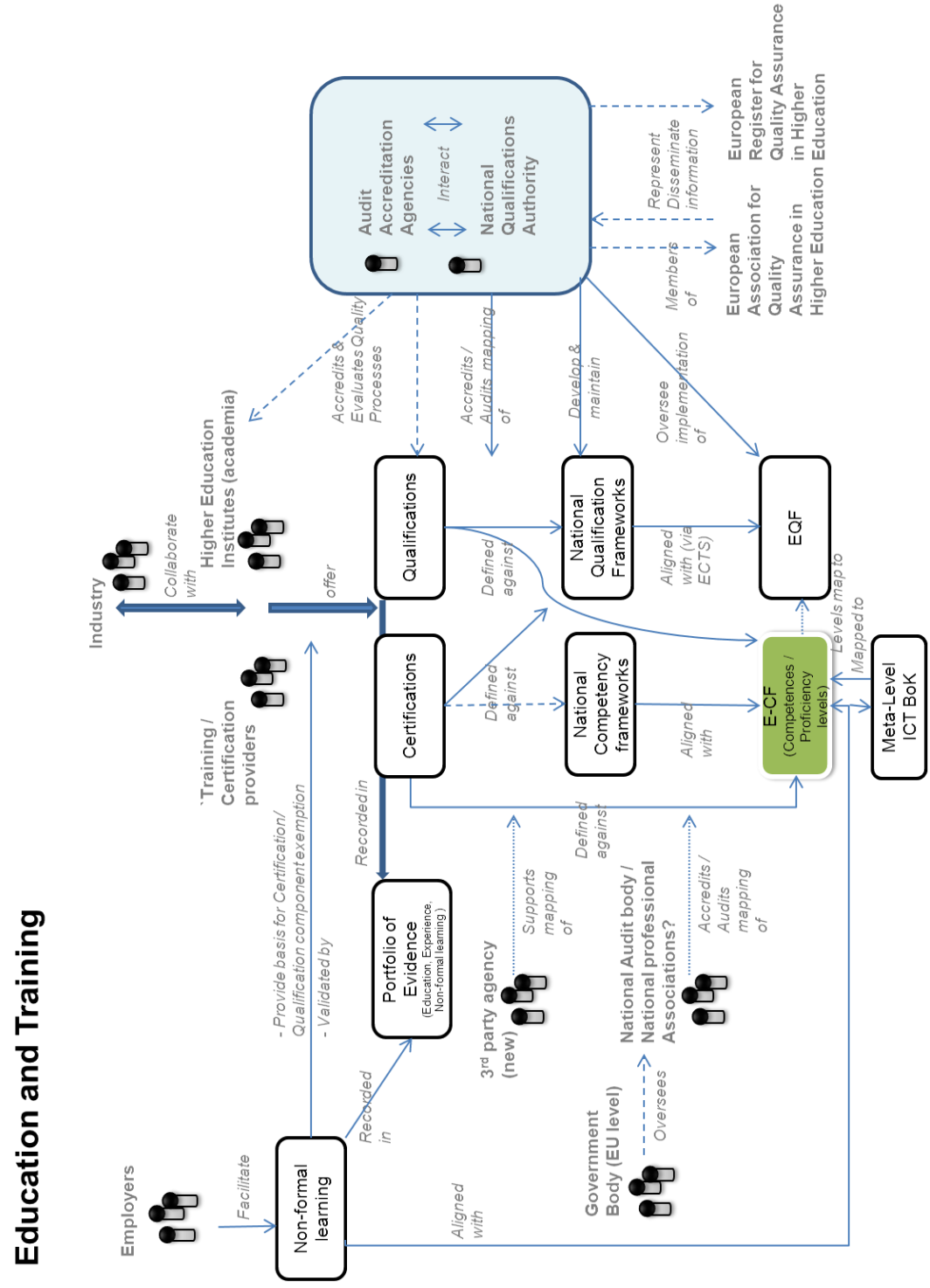


Figure 51 Proposed education and training framework

What becomes obvious is the important role accreditation, and professional network groups play in the development of relevant education and training programmes. Education providers have the capability to develop and deliver programmes that are both level and role specific. What is lacking is an identified and articulated demand for CIO specific training.

11.4 Recommendations for CIO Training

In order for CIO specific education is to be developed and delivered across the EU there are some considerations that need to be addressed. For example, the EU's industry landscape is mainly SME based. Because of this many organizations will be at different stages of development. The impact of this wide-variation in industry and organizational types can be seen in the range of management courses already available. Industry and CIO needs will be impacted by organizational size, competitive environment, culture, national identity, and work practices - differences that are at the very heart of the economic issues besetting the Euro Zone at present. We propose the following recommendations:

- **Identify demand for role-specific training programmes for CIOs and senior ICT managers**: Universities and other third-level education providers' respond to industry lead demand for training. Because of this, course development is demand driven. Therefore in order to establish a role-specific training programme for CIOs and senior ICT managers, the needs and demands of those seeking this type of education must first be defined and articulated. Industry partners and practitioners must identify a reason for education, and how that education can be consumed. This demand for specific CIO/senior ICT manager oriented training needs to articulated and promoted by representative CIO bodies.
- **Encourage industry and CIO representative bodies' collaboration in order to specify CIO training requirements:** This recommendation largely identifies a fundamental requirement in developing a relevant CIO/ICT Managerial level training course. For any framework to add value, the output of the framework will be dependent on the relevant nature of the input. A core aspect of the proposed education and training framework is that as it needs to be demand driven, it is a logical assumption that the quality and relevance of the output will depend on the manner in which the requirements for education and training have been specified. To that end, there is a need for collaboration between CIO representing bodies and industry, in order to capture and articulate the needs of the represented group in terms of education. Certainly the e-CF can help define the competences expected of senior ICT practitioners and managers. An explicit understanding of expected competences can then be used to drive education and training requirements. There are representative bodies forming such as CIOnet, EuroCIO, CIO Academy etc., and existing bodies that would profess to represent senior managers and professionals such as IoD, CIM, IET, BCS etc., but this landscape is still maturing from a CIO perspective. Those bodies that believe they have some insight into the needs of the CIO, and can represent their views need to establish a common mechanism for channelling these views, concerns, and expectations of their CIO user-groups. This would ensure that the programmes developed are responding to the needs of future CIOs. This also has the important effect of ensuring that courses reflect, and provide training to cope with trends in business and technology, such as how to manage the impact of the future Internet and ICT enabled innovation within a business environment.
- **Develop CIO ICT Curricula Development Guidelines:** Based on CIO training requirements, we recommend the development of curricula guidelines for CIO training programmes. Universities and other higher education institutions will then have an important role to play in implementing these guidelines to develop training programmes of relevance that are linked to life-long learning efforts.
- **Tailor the education programme to the respective role of the CIO:** Given the wide range of factors impacting CIO needs, it would be difficult to develop a 'one-size fits all' education programme for CIOs in this space. Instead of focusing on the

specifics of the course at an EU level, establishing CIO networks that consider the unique issues facing SME-based CIOs, and developing the conversation between these networks and local / national education providers will ensure a more relevant education offering is available to CIOs. Further, it is understood that the role of the CIO has demand for a specific skill set. We recommend that training programmes targeted towards CIOs and senior ICT managers should be developed at a level that sits between technology-specific courses, which aim to develop deeper understanding of specific aspects of technology, and MBAs, which seek to improve business and management awareness.

- **Ensure alignment of training programmes with the EQF and e-CF:** Given the competitive nature of the education landscape, it is important to note that each education provider wants their education programmes to be considered unique. Knowledge is their selling point so they want potential students and corporate sponsors to consider their programmes as being different and of considerably more value than other courses. Any ICT training programme developed needs to be aligned against national qualifications frameworks, the EQF and the e-CF in order to enable CIO's and senior ICT managers to interpret its suitability and relevance. This will also enable individual education providers to highlight the unique selling points of their programmes.
- **Acquire external validation of courses by professional bodies**: Because of the variation in training and education available in the market today, students and employers need some way of validating the education programmes in terms of relevance and credibility. This is an area where independent professional bodies have firmly established themselves. We recommend that universities and other third level education providers acquire validation of their programmes by professional bodies as this ensures industry partners understand the value of their educational offerings. This has the knock-on effect of developing a reputation as an academic institute of being cognisant of the needs of industry, which in turn helps develop research partnerships, industry sponsorships, and collaborative executive training programmes.

The education and training framework being proposed will enable the conversation to flow between the key stakeholders in terms of:

- What demand is there for CIO training/ education?
- What Technology and Business trends are shaping the ICT business landscape?
- What are the components of that training and education?
- How can the training / education be delivered and consumed?
- How can the training / education be validated in terms of relevance and credibility to both the individual and the organization?

12 Recommendations

12.1 Translating research into actions

The process of maturing the ICT profession will take many years, reflecting the same path that other professions have taken. This current project, to support the development of a European Framework for ICT Professionalism, has investigated professionalism from many different perspectives in order to construct a framework that addresses the requirements of multiple stakeholders across different EU Member States.

Looking ahead, we require concerted and coordinated initiatives to align our efforts towards a successful goal. To this end, we propose the following Action Points[53]. For each action point, we have identified the high-level responsibilities for each stakeholder. We provide greater insight into a timeline for these action points in the proposed roadmap, outlined in Section 12.2 Roadmap and Appendix F.

12.1.1 Action Point 1. Establish a sustainable operating model for ICT Professionalism

Context/Purpose: The project has identified a number of components aimed at strengthening professionalism and maturing the ICT profession in Europe: e.g. foundational ICT BoK meta-model, career streams, educational and training mapping process, ethics meta-model, etc. In order for these components to be constructed and maintained, each stakeholder must identify a clear role and value proposition: this will drive the creation of a scalable and sustainable operating model for ICT professionalism. The project identified some possible revenue and value streams for stakeholders. These initial proposals have to be refined further, better articulating the roles of key stakeholders. For example: CEN will start work in 2012 on version 3.0 of the European e-Competence Framework and the European Commission has launched a series of initiatives aimed at identifying an operating model for the e-CF and the promotion of ICT professionalism. As part of these initiatives, stakeholders will test and clarify possible roles for their organisation, and what alliances might better serve the ICT community. We propose that these discussions should progressively be extended to the other components of the overall pan-European ICT professionalism framework.

Approach: The European Commission and CEN should act as catalysts helping to bring together the different stakeholders and Member States, so that they identify potential roles for their organisation and related value/benefit streams, as well as potential partnerships required to achieve common goals. Ultimately, each stakeholder must assume well defined

[53] This list is an extended version of the abbreviated lists of Action Points appearing in the Executive Summary and project brochure.

and clear responsibility for a specific part of the overall picture if the model is to be successful.

Stakeholder	Responsibility
European Commission	Facilitate discussion on governance and sustainability and promote components
European Standardisation Committee (CEN)	Assume responsibility for coordinating development of e-CF content Standardization on foundational ICT BoK based on consensus building
European Union Member States	Represent national perspectives and assume responsibility for engaging relevant national bodies (auditing e.g.)
Industry	Self-organisation and promotion and identification of potential value/revenue streams Develop toolsets, value-added services, consultancy services, benchmarking etc. and represent perspectives of employers and practitioners (including via professional associations)
Education and Training Providers	Facilitate mechanisms for improving transparency of educational offerings and confidence in professionalism framework, thereby encouraging adoption within organisations and by practitioners; and identify potential value/revenue streams etc.
Professional Informatics Associations / Computer Societies	Provide input to development of framework representing practitioners; as well as supporting promotion/adoption

12.1.2 Action Point 2: Form/Mobilise stakeholder entities at national and European level

Context/Purpose: The current landscape reflects the disjointed nature of the relationships between stakeholders at a national and European level. While there are pockets of excellence, the level of maturity varies considerably from country to country, and from sector to sector. An important step towards maturing the profession as a whole requires mobilisation and collaboration between the different stakeholder communities. In this way, likeminded organisations with similar goals for ICT professionalism (and specific sub-streams of activity) can pull their respective resources to develop strategies, processes, and tools for ICT professionalism relevant to their specific sector. This is also an important step towards developing coherence and clarity of vision among stakeholder groupings. The

creation of such powerful stakeholder communities will provide significant impetus in achieving success of the other action points listed in this report. Existing initiatives provide useful examples that have delivered important results: e.g. TechAmerica in the U.S. and its ICT competency model. In Europe, Microsoft has undertaken substantial work in the area of mapping certifications to the EQF; sharing the lessons learned and engaging with other stakeholders planning similar activities will help mature the processes in the long-term for everyone.

Approach: While the Commission can act as a catalyst for stakeholders coalescing; ultimately, responsibility for their creation and on-going engagement lies with the individual stakeholder communities. We should also recognise that some relevant industry groupings may already exist, but perhaps they do not possess a specific ICT professionalism work-stream, in which case, such an option might represent a rapid solution.

Stakeholder	Responsibility
European Commission	Invite suitable individuals and organisations to participate in ongoing discussions, to facilitate them identifying possible partnerships with similar stakeholders
European Standardisation Committee (CEN)	Facilitate discussion between relevant individuals and organisations interested in formulating stakeholder partnerships
European Union Member States	Establish/enhance national e-Skills bodies to act as focal point and catalyst for engagement in national and European activity (Acts as focal point for discussion on e-skills; drives vision strategy at a national level; contributes ideas and collateral to European discussions; aligns with EU policies)
Industry	Establish and engage in joint industry bodies focusing on ICT professionalism(Pool resources/knowledge/relationships to prevent duplication of effort and strengthen potential outputs)
Education and Training Providers	Establish and engage in joint education partnerships for e-Skills (e.g. these partnerships could form around specific markets: ICT Certification providers, Tertiary ICT education providers, etc.)
Professional Informatics Associations / Computer Societies	Forge alliances between professional associations at the national and European level and establish joint workgroups on ICT professionalism to prevent disparate initiatives fragmenting the solution unnecessarily

12.1.3 Action Point 3: Development of a foundational ICT body of knowledge meta-model

Context/Purpose: In contrast to other key professions, there is currently no shared ICT body of knowledge (BoK) understood by all ICT professionals. This has fostered the creation of a silo-mentality within ICT whereby practitioners do not always appreciate the impact of their actions on other aspects of the ICT environment or the overarching organisation. Establishing a foundational ICT body of knowledge would strengthen professionalism and facilitate communication and understanding between professionals, thereby reducing risk. This proposal would solely define the base-level of knowledge required of all ICT professionals (experienced professionals use separate domain-specific BoKs as their careers advance). Identifying a suitable structure for such a BoK is critical given the highly dynamic nature of the ICT environment – any attempt to generate detailed content across the whole of ICT would be unsustainable given the range and depth of content required. For this reason, a high-level meta-model approach is proposed (e.g. defining the body of knowledge in terms of a syllabus/bibliography) thereby facilitating the on-going maintenance and relevance of the BoK to practitioners.

Approach: In the first instance, a research project could be undertaken to gather stakeholder requirements and define (using a meta-model) the scope, nature and characteristics of a foundational ICT body of knowledge. The development effort should build upon existing syllabi for ICT education; however, the scope of the ICT body of knowledge would also include non-ICT topics: given the growing demand and importance of the so-called "dual-thinkers, it is vital that ICT professionals also understand non-technical aspects of organizations in order to deliver value successfully. This research project would also aim to develop a detailed approach and roadmap for population of the relevant contact (an activity which would be outside of this initial project).

Stakeholder	Responsibility
European Commission	Facilitate discussion and identification of good practices Support initial research project
European Union Member States	Provide input to BoK definition (particularly national requirements)
Industry	Support identification of industry requirements for Foundational BoK
Education and Training Providers	Provide input on perceived requirements based on perceived market gaps
Research Organisations	Develop meta-model based on detailed stakeholder requirements and define approach to populate content
Professional Informatics	Provide input on practitioner expectations and requirements

Stakeholder	Responsibility
Associations / Computer Societies	

12.1.4 Action Point 4: Incentivise mapping of educational and training offerings to the foundational ICT body of knowledge

Context/Purpose: Given the expectation that all aspiring ICT professionals must possess a solid understanding of a foundational ICT body of knowledge, it is important that education and training providers map their respective offerings to this foundational ICT BoK. This mapping process will facilitate transparency of the various educational and training offerings; thereby supporting practitioners to better understand what they could learn from each provider.

Approach: Without knowing the precise nature of the foundational ICT body of knowledge meta-model, it is difficult to be too prescriptive about how this mapping process could be incentivized. The intention is that education and training courses would be mapped against relevant parts of the foundational ICT body of knowledge (e.g. against the syllabus). In this way, an ICT degree course would hopefully cover all of the required components of the foundational ICT BoK. In contrast, a tailored course for experienced practitioners would only cover certain components. The key benefit is that this would enable practitioners to progress from Associate level to Professional – as such the mapping process would facilitate transparency between courses. This Action Point shares many traits with the e-CF mapping initiative – as such, any lessons learned from the e-CF mapping process should be integrated into the approach accordingly.

Stakeholder	Responsibility
European Commission	Launch initiative to drive ICT BoK mapping initiative
European Standardisation Committee (CEN)	Facilitate development and maintenance of foundational ICT BoK involving multiple stakeholders; and support transition to a technical standard
European Union Member States	Contribute to design of mapping process (including the sharing of best practices where appropriate) and facilitate implementation of the mapping process at a national level and engage relevant national bodies to support mapping process
Industry	Provide input into mapping process to ensure industry demands and expectations (of both employers and practitioners) are reflected in the solution; and encourage and promote adoption of solution (critical mass of adoption enhances benefits for industry)

Stakeholder	Responsibility
Professional Informatics Associations / Computer Societies	Provide input into mapping process to ensure industry demands and expectations (of both employers and practitioners) are reflected in the solution Encourage and promote adoption of solution (the more people use the solution, the stronger it becomes)
Education and Training Providers	Mapping their courses to the foundational ICT BoK and promotion of mapping
National Audit / Accreditation / Qualification Authorities	Contribute to design of mapping process, facilitate improved confidence in mapping process and promote adoption

12.1.5 Action Point 5: Drive broad adoption within organizations and to practitioners

Context/Purpose: Promotion and adoption of the e-CF are critical aspects underpinning a sustainable operating model for ICT professionalism, given the e-CF's pivotal role in the overall ICT professionalism framework by acting as a common reference for e-competences. The potential benefits derived from the e-CF are proportional to the number of employers, educators and practitioners using it. For this reason, a range of efforts along with associated collateral will be required to drive adoption among stakeholders and to raise awareness of its role in the overarching professionalism framework.

Approach: The transition of the e-CF to an official CEN European standard (EN) (for example, resulting from the move of the Workshop on ICT Skills to a Technical Committee) could trigger a substantial benefit in adoption patterns, stemming from the fact that national standards bodies across Europe would thereafter adopt and translate the e-CF – facilitating adoption at a national level for human resources management activities. Another impetus for adoption across the industry could be the specification of e-competences as the basis for ICT service procurement activities. This would drive adoption within service providers, within education providers, and among practitioners. Liaison between CEN and the third parties would facilitate the development of relevant promotional material to stimulate its adoption, and raise awareness on the overarching ICT professionalism framework. It could include for example a User Guide for implementation within organizations, and promotional material for the mapping of qualifications/certifications for active and aspiring ICT practitioners.

Stakeholder	Responsibility
European	Facilitate discussion on e-CF operating model and promote best

Stakeholder	Responsibility
Commission	practices regarding human resources management Encourage partnerships and joint ventures (cost-sharing)
European Standardisation Committee (CEN)	Development and maintenance of e-CF content and its links to other key components of the overarching professionalism framework Transition e-CF to a European Standard (eg via move from a workshop to a Technical Committee)
European Union Member States	Align national competency frameworks against e-CF Encourage local and national adoption for human resources management purposes (where applicable)
Industry	Identify and develop value streams and adopt e-CF for human resources management practices Support development of toolset and services to facilitate adoption of e-CF
Professional Informatics Associations / Computer Societies	Promote and drive adoption to national associations and practitioners
Education and Training Providers	Develop and promote educational offerings tied to e-CF Establish skills to support mapping process

12.1.6 Action Point 6: Develop ICT Professional Career Streams

Context/Purpose: Employers and ICT professionals alike (as well as students) have a desire for defined, visible career streams that would facilitate the planning of an individual's career, and the identification of appropriate development methods to pursue those career plans. At present, no consistency exists in the definition of such career streams within ICT across Europe and their development would be a further step towards maturing the ICT profession.

Approach: A research project could be undertaken with a view to developing a series of ICT career streams. Due to the diverse nature of ICT and the roles that exist within the ICT organization, the development of ICT career streams should be undertaken by a multi-stakeholder workgroup that would collectively develop content and drive consensus. The

multi-stakeholder group responsible should build on the output from the European ICT Professional profiles project facilitated by CEN.

Stakeholder	Responsibility
European Commission	Launch initiative to define ICT career streams(poss. via CEN)
European Standardisation Committee (CEN)	Development of ICT Career Streams Consensus building Standardization on ICT Career Streams
European Union Member States	Share best practices in existing models Adopt and promote agreed career stream approach at national and local levels
Industry	Engage in discussions to ensure career streams reflect industry needs Adopt/promote agreed solutions
Education and Training Providers	Support creation of education paths aligned with career streams
Professional Informatics Associations / Computer Societies	Adopt and promote agreed career stream approach via national association and professional offering

12.1.7 Action Point 7: Investigate synergies with organizational ICT capability gap analysis and improvement frameworks

Context/Purpose: ICT Competence frameworks focus on providing an assessment of an individual practitioner's ICT competences. In contrast, an ICT capability framework assesses an organization's ICT capability, taking into consideration its ICT human capital, its ICT-enabled processes and of its technology. Organisations using ICT capability frameworks can benchmark themselves against other organisations in similar industries or regions. By providing insight into the "bigger picture", organisations are better able to establish a clear roadmap for improving performance over time, helping them to derive increased ICT business value from their human, technical and operational assets.

ICT capability frameworks can be used to identify gaps in organisations which can be bridged, for example, through maturing their processes in a specific ICT capability. This, in

turn, may identify a need to develop improved proficiency in specific practitioners' competences, to be met via targeted employee training, or via recruitment/outsourcing activities. In this way, ICT capability frameworks and ICT competence can complement one another perfectly to help drive increased business value for organisations.

Approach: A research project could be undertaken to investigate the potential synergies, relevance and potential benefits of frameworks supporting organizational ICT capability gap analysis to complement the e-CF and support its adoption in organisations. Such a project could provide important insight into the value of these frameworks in helping to understand an organization's current maturity and degree of ICT professionalism, to identify the development needs of individual ICT practitioners and managers via competence development, and ultimately, to drive enhanced business value within the organization

Stakeholder	Responsibility
European Commission	Launch new research project Investigate potential for standardisation via CEN
European Union Member States	Facilitate research engagement of multiple national partners
Industry	Engage in maturity assessments/ feedback Adopt/promote agreed approach
Researchers	Investigate synergies and interoperability options Validate potential framework outputs

12.1.8 Action Point 8: Map education courses to the e-CF to provide increased transparency

Context/Purpose: The current volume of ICT industry training certifications and tertiary education courses makes it difficult for individuals to select the courses that optimally fit with their competence development requirements. Mapping of education and training courses to the e-CF would improve the transparency, relevance and comparability of these courses in terms of developed e-competences and associated proficiency levels. In doing so, this would support more informed course selection decisions by individuals as part of their continuous professional development initiatives.

Approach: Accelerating adoption by ICT vendors of the e-CF and promoting the value of mapping their certifications to the specific e-CF competences could be further supported through a pan-European research project. Such an initiative has been launched in January 2012 by the European Commission. Driving this mapping process on a European level and incorporating input from the leading ICT industry certification players is an important factor in assuring this mapping process gains momentum. Whilst it is anticipated that in the future the leading vendors may undertake this mapping process themselves, independent third party may also play a role in future mapping activities. In addition, the mapping of higher education courses to the e-CF could be fostered by the provision of a forum for promoting and discussing the issues in mapping higher education qualifications to the e-CF. Such a forum should involve national higher education representatives, for example individuals in the National Qualifications Authorities. This would provide a useful starting point for the development of national practices/policies for mapping HEI qualifications to the e-CF.

Stakeholder	Responsibility
European Commission	Instigate new EU project to drive mapping Facilitate workshops for promotion and discussion
European Standardisation Committee (CEN)	Facilitate design of mapping process via engagement with multiple stakeholders
European Union Member States	Develop national policies/practices to support mapping Engagement via national higher education bodies (inc NQAs)
Industry	Undertake mapping of education and training courses and certifications
Third Parties Agencies	Develop certification mapping offering for companies without in-house expertise

Stakeholder	Responsibility
Education and Training Providers	Undertake mapping of education courses

12.1.9 Action Point 9: Promote confidence in educational mapping to the e-CF through auditing

Context/Purpose: The transparency and consistency of the mapping of education courses to the e-CF are essential to provide useful information to ICT professionals and facilitate mobility within Europe. With the involvement of different parties, such a process needs to be effectively audited in order to ensure quality and to build and maintain confidence in the mapping initiatives.

Approach: Detailed plans on the auditing of the mapping of industry certifications to the e-CF need to be developed, and bodies responsible for the audit process within each country identified. For example, the professional Informatics Associations or national audit bodies will play an important role at national level. To ensure consistency across national borders, relevant mechanisms at EU level would be required to act in a monitoring role to oversee consistency across the EU. The first step in driving this initiative forward involves detailed planning regarding the bodies involved and the audit approach. In addition, the mapping of higher education institutions qualifications against the individual competences of the e-CF needs to be audited. This role may be undertaken by a national level body, for example the national audit/accreditation agencies or the National Qualification Authorities (who already play a role in auditing the mapping of qualifications against the National Qualifications Framework in countries where it exists). Auditing of e-CF mapping by such bodies would promote confidence in the quality assurance processes adopted and the quality standards that national higher education qualifications adhere to. This audit process could leverage from the audit planning process proposed above for vendor mapping auditing.

Stakeholder	Responsibility
European Commission	Support definition of overarching framework for auditing Monitor consistency of mapping across the EU
European Standardisation Committee (CEN)	Facilitate standardisation on auditing approach Investigate requirements for supra-national EU audit body, in conjunction with other stakeholders
European Union Member States	Develop national policies/practices to support mapping

Stakeholder	Responsibility
National Audit / Accreditation / Qualification Authorities	Audit quality of mapping nationally Share best practices
Industry	Provide input on auditing practices
Professional Informatics Associations / Computer Societies	Audit quality of mapping nationally

12.1.10 Action Point 10: Validate Non-formal Education and Informal Education

Context/Purpose : Non-formal and informal learning is a very important aspect of an ICT professional's career development and given the high number of practitioners who have not studied and/or been formally graduated in computer science, the potential impact of non-formal and informal learning within the ICT industry is very significant. Recent studies highlight that while improvements are being witnessed, more concerted efforts on the validation of non-formal and informal learning by higher education institutions (HEIs) across Europe is required.

Approach: Further in-depth investigation into the approaches to validating non-formal and informal learning by HEIs is required, whereby such validation would result in a formal qualification that is mapped against the competences of the e-CF. Such validation may be based on an individual's' submission of non-formal and informal learning experiences and supporting evidence by employers. Such an investigation would require the development of plans to improve the adoption and consistency of validation of non-formal and informal learning by HEIs leading to a complete qualification.

Stakeholder	Responsibility
European Commission	Facilitate workshops on discussion of validation practices and promote alignment of European practices
European Standardisation Committee (CEN)	Facilitate development of coherent validation approach with support of relevant key stakeholders
European Union	Development of national approaches to validation aligned with

Stakeholder	Responsibility
Member States	European framework and sharing of best practices at national level with other Member States
National Audit / Accreditation / Qualification Authorities	Develop/enhance national policies/ practices on non formal and informal education validation
Industry	Provide input into design process to ensure industry requirements are adequately reflected and encourage adoption and provide recognition
Professional Informatics Associations / Computer Societies	Represent practitioner and employer expectations in discussions and facilitate validation process and encourage adoption among organisational members and practitioners
Education and Training Providers	Enhance validation practices and award full qualifications based on non-formal and informal learning

12.1.11 Action Point 11: Align national codes of ethics / conduct for ICT professionals with a European meta-framework of ethical issues

Context/Purpose: Developing a universal code of ethics/conduct for ICT professionals may not be feasible given the cultural, traditional, legal, social and political divergence across national boundaries. Nonetheless, a more consistent approach to ethics should be encouraged at European level to ensure that a common core set of issues are addressed in the ethical codes.

Approach: Professional Informatics Associations need to update their codes of ethics/conduct to ensure they address a common and core set of ethical issues, as outlined in a specified meta-framework of ethical issues. In so doing, an initial step would be to organise a workshop on a European level to discuss an appropriate meta-framework of ethical issues, and to establish deadlines for alignment by national computing associations of their codes to encompass a core set of ethical criteria. Such a meta-framework may constitute, among others, the criteria/guidelines for defining codes of ethics/conduct developed via IFIP initiatives

Stakeholder	Responsibility
European Commission	Facilitate a workshop to agree a meta framework of ethical issues

Stakeholder	Responsibility
European Standardisation Committee (CEN)	Encourage engagement with multiple stakeholders (both European and international) to provide input into meta-framework
European Union Member States	Participate in discussion to establish European meta-framework for ethics, enabling accommodation of national perspectives
Industry	Contribute to discussion on ethics to ensure proposals reflect industry demand and are workable
Professional Informatics Associations / Computer Societies	Develop and maintain a meta ethics framework and promote compliance and alignment with Codes
Global Associations	Engage in dialogue to facilitate alignment with global solution

12.1.12 Action Point 12: Drive adoption of ethics code among ICT professionals

Context/Purpose: Once alignment between national codes of ethics has been established (see Action Point 11), the impact of the code will be negligible unless ICT professionals sign-up to, and adhere to the code. The issue of adherence is a complex question: our engagement with practitioners throughout this project has revealed an almost 50:50 split between those who were in favour of enforcement via for example, a licence to practice; and those opposed to such a scheme. Despite this split on the question of enforcement, there is broad support for the existence and adherence to an ICT code of ethics, given growing organisational and public awareness on the importance of data privacy and information security concerns. This in turn has stimulated an increased emphasis on the ethical behaviour of people responsible for managing and handling our data.

Approach: Consolidated efforts by industry, the European Commission, and Member States, as well as computing associations to promote the importance of signing up to an ICT code of ethics would be needed: for example, mandatory code signup for professionals working in European/National/Local government bodies would drive adoption throughout the industry. We make no specific recommendations as to whether or not the code of ethics should be mandatory neither for all ICT professionals nor whether serious code breaches should result in exclusion from the profession. However, we do recognise that research at a country and European level could be undertaken in the future to ascertain the potential need for policies to address accountability and/or enforcement, and how this could be implemented (if required) in a consistent manner.

Stakeholder	Responsibility
European Commission	Promote adoption of Ethics code Facilitate dialogue on accountability/ enforcement
European Standardisation Committee (CEN)	Investigate potential options for standardisation in the longer term
European Union Member States	Promote adoption and introduce public sector code signup
Industry	Promote adoption of code and engage in discussion on accountability
Professional Informatics Associations / Computer Societies	Promote adoption of Ethics code to all members Maintain register of signatories to Ethics code and develop policies to manage accountability/enforcement Engage in dialogue to facilitate alignment with global solution

12.1.13 Action Point 13: Enhance links to parallel professionalism initiatives outside of Europe

Context/Purpose : The environment in which organisations operate is becoming increasingly international; products, services, tools, technologies, suppliers, customers and projects often have a global dimension as indeed do internal and external projects within organisations. Reflecting this trend, the makeup of organisations themselves is changing with employees often originating from a variety of countries. These patterns are likely to become more prevalent over time. The ICT profession, which in certain regions suffers from identified skills gaps and/or skills shortages, is a profession which could benefit greatly from increased mobility of practitioners. Reflecting the fact that organisations require global solutions, the ICT profession itself will become more global. The initiative to foster a European ICT Professionalism framework is clearly one step along this longer term path, but relationships must also be forged outside of Europe: For example, TechAmerica (United States) and IPA (Japan) have embarked on similar journeys to maturing the ICT profession in their respective countries. By opening such paths of communication, there is the potential for best practices to be shared more widely, an act which in itself supports greater alignment.

Approach: The European Commission should act as a catalyst in identifying potential areas of cooperation and collaboration between itself and global counterparts, which could help

inform related projects (e.g. via sharing of best practices, definition of common framework components such as competence definitions, Foundational ICT BoK components, etc.).

Stakeholder	Responsibility
European Commission	Identify common points of interest in liaison with CEN Encourage sharing of best practices/ development of common components
European Standardisation Committee (CEN)	Facilitate dialogue and engagement with relevant global partners Encourage sharing of practices towards global alignment Investigate options for standardisation on a global basis
European Union Member States	Share best practices and collateral Foster supplementary bilateral relationships Support and promote alignment
Industry	Participation via Professional Associations, Communities of Practice, etc Prioritise components most important to organisations
Professional Informatics Associations / Computer Societies	Include non-European associations and engage in dialogue Share best practices and collateral

12.1.14 Action Point 14: Launch regular global ICT Professionalism workshop

Context/Purpose: The European Commission and CEN workshop play an important role in facilitating discussion between relevant players and for forging consensus on key matters. Discussions have typically tended to occur on a single day, focused on addressing a single strand/objective of work, and participation from outside Europe is typically ad hoc. Two-day, invitation-only workshop for key stakeholders from around the globe could provide a valuable opportunity for understanding the "big picture" of ICT professionalism and for galvanising action on the topic. A small nucleus of industry experts, academics and policy makers could provide the basis for effecting real change in a short period of time.

Approach: This activity is closely tied to Action Point 2 (Mobilise ICT Professionalism stakeholder entities at national and European level) and Action Point 13 (Enhance links to parallel professionalism initiatives outside of Europe). However, some progress towards both of these initiatives in advance of a global workshop; that is to say, the formation of

relevant stakeholder bodies to create relevant stakeholder "voices" should be progressed in order to reduce the number of participants to a manageable level and to have formulated opinions on the shared interests of each stakeholder grouping. Similarly, identifying suitable counterparts in other regions to engage with on specific ICT professionalism themes is an important pre-requisite to moving the dialogue forward at the session. To facilitate discussion among workgroup members in advance of the sessions, usage of an appropriate knowledge sharing environment should be encouraged.

Stakeholder	Responsibility
European Commission	Participate in workgroups (e.g. policy initiatives) Set Objectives/ Scope/ Identify base list of participants / Facilitate organisation of the event
European Standardisation Committee (CEN)	Organise and support activities in workgroups (e.g. standardisation process)
European Union Member States	Participate in workgroups (e.g. policy initiatives)
Education and Training Providers	Participate in workgroups (e.g. Competence mapping, Building practitioner awareness of competence models)
Industry	Participate in workgroups (e.g. development of industry-wide functions, toolsets and protocols; building adoption)
Professional Informatics Associations / Computer Societies	Participate in workgroups (e.g. practitioner engagement, codes of ethics adoption) Foster engagement with non-European associations/societies

12.2 Roadmap

Taking into consideration the various recommendations proposed above, the diagram below puts forward a tentative view of a roadmap of proposed initiatives (both public and private) which could help drive significant improvements in the overall level of ICT professionalism across the EU.

The key facet of the roadmap is recognising the importance of involving the relevant players at appropriate times. Key stakeholders from industry, government and academia must first align efforts and initiatives before raising awareness to practitioners and HR agencies. Notwithstanding, it is essential that the needs of practitioners are represented and embedded in the framework throughout the entire development process.

Further details of the various initiatives contained in the Roadmap are contained in Appendix B.

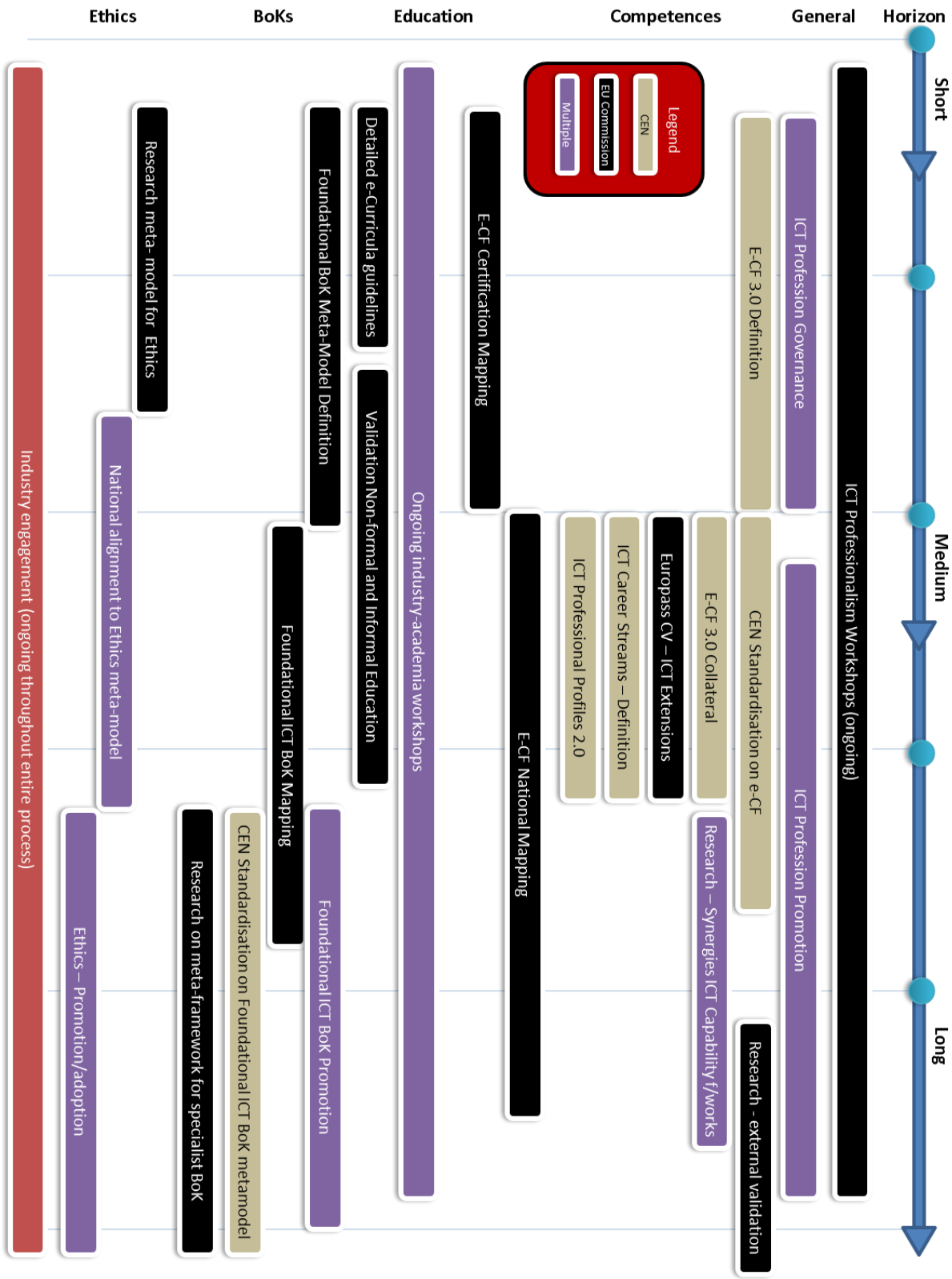


Figure 52 ICT Professionalism Roadmap

Appendix A Sample Questionnaire

A.1 Introduction

Welcome to the e-Skills & ICT Professionalism European Survey commissioned by Directorate General Enterprise and Industry (European Commission)

The Innovation Value Institute (IVI) and the Council of European Professional Informatics Societies (CEPIS) are jointly undertaking this research.

We are asking for your views and opinions on many aspects of ICT Professionalism and CIO Training. This survey is designed to provide further insight and understanding into this area, and complement earlier desktop research work.

All information gathered will be held in confidence and access to original data is only available to the researchers directly involved in this project. Summary data and findings based on the analysis of the survey replies will be published on our website at www.ICTProf.eu.

Personal data will not be used outside this project and will not be communicated or made accessible to any third party.

We kindly thank you in anticipation of your contribution to this project, the EU ICT Professionalism Project Team.

A.2 ICT Professional Definition

ICT Professional

A professional is said to be professionally competent if he/she exhibits all of the following characteristics:

- **Knowledge:** of a common body of knowledge, supplemented by more specific knowledge and skills related to the area(s) of specialism
- **Quality:** commitment measured by adherence to quality standards (internal and/or external)
- **Ethics:** commitment displayed by demonstration of ethical professional practice against an agreed code of Ethics or code of conduct
- **Accountability:** the Professional takes personal responsibility for the quality and effectiveness of his/her work
- **Experience:** practical experience of the exercised competence
- **Earns living:** The ICT Professional obtains income from ICT related activities.

A.3 Participant Information

In this section we ask for information about you and your organisation. This information enhances our ability to analyse the survey results and place those results in context.

Q01. Forename:

Q02. Surname:

Q03. Job Title:

Q04. Email:

Q05. Optionally – Please indicate your gender:

○ **Female** ○ **Male**

Q06. How did you enter the ICT profession?

- ○ Directly from college via ICT related course
- ○ Directly from college following conversion course
- ○ Transferred within a company from another role
- ○ Role evolved over time to encompass a greater ICT component
- ○ Planned via vendor specific or vendor independent certifications or courses
- ○ Self taught with personal career plan
- ○ I do not work in ICT
- ○ Other - Please Specify

Q07. Indicate any formal academic qualifications you have attained:

☐ None	☐ None	☐ None
☐ Diploma/Certificate (EQF 5)	☐ Diploma/Certificate (EQF 5)	☐ Diploma/Certificate (EQF 5)
☐ Diploma/Certificate (EQF 5)	☐ Diploma/Certificate (EQF 5)	☐ Diploma/Certificate (EQF 5)
☐ Bachelor's degree and/or Higher diploma (EQF 6)	☐ Bachelor's degree and/or Higher diploma (EQF 6)	☐ Bachelor's degree and/or Higher diploma (EQF 6)
☐ Master's Degree or/and Postgraduate Diploma (EQF 7)	☐ Master's Degree or/and Postgraduate Diploma (EQF 7)	☐ Master's Degree or/and Postgraduate Diploma (EQF 7)
☐ Doctorate (EQF 8)	☐ Doctorate (EQF 8)	☐ Doctorate (EQF 8)

Check all that apply or none if applicable. The check boxes can be toggled via a left mouse click or the space bar.

Q08. What type of certifications do you hold (e.g. Microsoft MCDBA, PMI, Prince2 etc.)?

ICT technical	ICT management	Other

Q09. How many years have you been working in the ICT industry?

Q10. What is your nationality?

Q11. Please state the country you currently work in (or most recently worked in)?

Q12. Company or Organisation:

Q13. Organisation type:
Please check all that apply.

☐ Private enterprise
☐ Public educator
☐ Private educator
☐ Certification developer
☐ Professional ICT association
☐ Government (EU, Country, Local)
☐ Standards bodies
☐ Other (Please state)

Q14. What is the approximate global size of your organisation?

○ Large enterprise > 250 employees or turnover > €50M or balance sheet > €43M

○ Medium enterprise <= 250 employees, turnover < €50M & balance sheet < €43M

○ Small enterprise < 50 employees, turnover < €10M & balance sheet < €10M

○ Micro enterprise < 10 Employees, turnover < €2M & balance sheet less than €2M

Q15. Which of the following best describes your primary ICT-related activity?

☐ ICT Management
☐ ICT Team Leader (i.e. also working as a practitioner)
☐ ICT Practitioner (non-management)
☐ Management (non-ICT or ICT is a small component)
☐ Trade union (representing ICT workers)
☐ Educator
☐ Researcher
☐ Other – Please specify

Q16. Are you professionally involved in any of the following activities?
Please check all that apply

☐ ICT management training
☐ Bodies of knowledge (including course development and syllabi maintenance)
☐ Standards, certifications and qualifications
☐ Competencies and or competence frameworks
☐ Ethics or codes of conduct including governance structures and processes
☐ None of the above

Q17. Please list any ICT professional associations of which you are a member.

Enter none if appropriate.
Please indicate any offices that you hold in those organisations (e.g. President, Chairman, Honorary Member,…)

A.4 Bodies of Knowledge

Bodies of Knowledge (BOK) can be used as a basis to define standards and certifications in a number of fields. We want to understand if you are using any, and if so, what you use them for, and whether they meet your needs?

Q18. Do you use industry-established ICT Bodies of Knowledge?

Examples: PMBOK, SWEBOK, CIPS BOK, ITIL, COBIT, ACM/IEEE Computer Science Curriculum, CMMI, Prince2, IT Security Essential Body of Knowledge, IT-CMF, etc.

○ Yes ○ No

Q19. If you answered "Yes" to question 18, please indicate how the industry-recognised ICT Bodies of Knowledge are used, and assess their fitness for purpose. (These details should be provided for up to four of the BoKs you use).
BOK uses could include "gap analysis at team and individual levels", "defining standards and certification exams", "branding and compliance", etc.
When assessing the BOK's fitness for purpose, please consider factors such as its relevance, level of detail, cost, access and availability, supported languages or other matters you consider important.

	Name	Uses	Fitness for Purpose
Body of Knowledge			
Body of Knowledge			
Body of Knowledge			
Body of Knowledge			

Q20. Do you develop in-house ICT Bodies of Knowledge?
For example from other sources like university syllabi or derive Bodies of Knowledge from technology roadmaps.

○ Yes ○ No

Q21. If you answered "Yes" to question 20; please indicate how the in-house developed Bodies of Knowledge are used, and assess their fitness for purpose. (These details should be provided for up to four of the BoKs you use).
BOK uses could include "gap analysis at team and individual levels", "defining standards and certification exams", "branding and compliance", etc.
When assessing the BOK's fitness for purpose, please consider factors such as its relevance, level of detail, cost, access and availability, supported languages or other matters you consider important.

	Name	Uses	Fitness for Purpose
Body of Knowledge			
Body of Knowledge			
Body of Knowledge			
Body of Knowledge			

A.5 Certifications, Qualifications and Standards

Formal education qualifications as well as certifications (industry and vendor-neutral) are regarded as one method of advancing career prospects within the ICT profession. This section elicits insights on issues pertaining to their perceived importance, drivers for acquiring them, expected trends, awareness of frameworks, and standards.

Q22. During recruitment, please indicate the levels of importance you attribute to certifications and formal education in terms of assessing competence for stated job grades/roles.

	Certifications	Formal Academic Qualifications
Entry Level	Please select	Please select
Senior / Experienced	Please select	Please select
Managerial	Please select	Please select

Q23. Please indicate the levels of importance you attribute to certifications and formal education qualifications as components of continuing professional development (CPD)?

	Certifications	Formal Academic Qualifications
Entry Level	Please select	Please select
Senior / Experienced	Please select	Please select
Managerial	Please select	Please select

Q24. What factors would motivate you to complete training that leads to certification or a formal education qualification?

- ☐ Financial gain
- ☐ Job Mobility
- ☐ Professional Recognition
- ☐ Career Development
- ☐ Competence Validation
- ☐ Regulatory Requirement
- ☐ Job Requirement
- ☐ Gaining knowledge
- ☐ Other (Please State)

Q25. What factors might deter you from completing further certifications or formal education qualifications?

- ☐ Time availability
- ☐ Lack of recognition from employer
- ☐ Not mandated
- ☐ Lack of suitable courses
- ☐ Accessibility (e.g. location, course format, language…)
- ☐ Cost
- ☐ Course prerequisites
- ☐ Alternate development methods
- ☐ Other (Please State)

Q26. Are you aware of any industry and academic collaborations on certifications and qualifications?

○ Yes ○ No

Q27. If yes, how would you describe future trends? Comment on the value of these collaborations.

Q28. Are you aware of a National Qualifications Framework (NQF) in your country?

○ Yes ○ No

Q29. What is the name of this framework?

Q30. Are you aware of the European Qualifications Framework (EQF)?

○ Yes ○ No

Q31. Are you aware of the European e-Competence Framework (e-CF)?

○ Yes ○ No

Q32. What benefits (if any) do you derive from the use of ICT competence frameworks when comparing certifications and qualifications?

Q33. Do ICT certifications support mobility of workers across national boundaries?

○ Yes ○ No

Please comment

Q34. Do formal academic ICT qualifications support mobility of workers across national boundaries?

○ Yes ○ No

Please comment

Q35. Does your organisation develop certifications and/or academic qualifications?

○ Yes ○ No

Q36. Are the certifications that your organisation develops based on or linked to ISO, national, industry or other recognised standards?

○ Yes ○ No ○ I do not know

Please comment

A.6 Competences

Competences are the skills and knowledge that practitioners have acquired during their career. This section gathers views on the usage of competence frameworks in organisations, as well as their potential benefits and barriers to adoption.

Q37. Are ICT job roles in your organisation defined in terms of required competences?

○ Yes ○ No ○ I do not know

Q38. Please indicate any ICT competence frameworks that you are aware of (even if not used in your organisation)?

- ☐ I am not aware of any ICT competence frameworks
- ☐ e-CF
- ☐ SFIA
- ☐ AITTS/APO
- ☐ CIGREF
- ☐ IT-CMF
- ☐ EUCIP
- ☐ Other (please specify)

Q39. Which of the ICT competence frameworks you have listed in the previous question are in use within your organisation?

- ☐ I am not aware of any ICT competence frameworks
- ☐ e-CF
- ☐ SFIA
- ☐ AITTS/APO
- ☐ CIGREF
- ☐ IT-CMF
- ☐ EUCIP
- ☐ Other (please specify)

Q40. What is the skills focus of the ICT competence framework(s) in use in your organisation?

- ☐ I do not know / Not applicable
- ☐ Mainly technical skills (i.e. technology based skills)
- ☐ A mix of technical and non-technical skills
- ☐ Mainly non-technical skills (i.e. business, managerial, interpersonal skills)

Q41. If you are using an ICT competence framework within your organisation, what are the top two benefits your organisation derives from its usage?

- ☐ Employee mobility
- ☐ Training needs analysis
- ☐ Consistency of processes
- ☐ Recruitment facilitation
- ☐ Workforce capability planning
- ☐ Other (please specify)

Q42. What obstacles prevent your organisation from adopting a national/European ICT competence framework?

- ☐ None
- ☐ Lack of awareness
- ☐ Lack of perceived benefits
- ☐ Cost of implementation
- ☐ No requirement (e.g. current in-houseprocesses cope adequately)
- ☐ Too specific

☐ Too broad in concept
☐ Other (please specify)

Q43. How would mapping ICT certifications to a national / European competence framework benefit your organisation?

Q44. What could encourage education or certification providers to map their qualifications / certifications to a competence framework?

☐ Improved brand recognition among practitioners and employers of competence framework
☐ Legislation
☐ Simpler mapping process
☐ I do not know
☐ Other – Please comment

Q45. What are the main barrier(s) to mapping ICT certifications / qualifications to a National or European-level ICT competence framework?

☐ No clear benefits for education providers
☐ No demand from practitioners
☐ No demand from employers
☐ Process is too complicated
☐ Unaware of process
☐ I do not know
☐ Other – Please comment:

Q46. What are the main benefits of adopting a European-level ICT competence framework (such as the European e-Competence Framework)?

☐ Facilitates employers understanding the capabilities of workers
☐ Supports comparison of certificates and qualifications across borders
☐ Provides more of a roadmap for personal development
☐ Other – Please specify:

Ethics

Adhering to principles of ethical conduct is regarded as a defining aspect of many professions. This section gathers input on Codes of Ethics/Conduct used within the ICT profession, their content, usefulness, compliance requirements, and your opinions on enforcement.

Q47. Do you personally adhere to a professional Code of Ethics/Conduct?

○ Yes ○ No

Q48. Please indicate which Code of Ethics/Conduct you adhere to:

Q49. How useful is this Code of Ethics/Conduct in practice?

☐ Very useful
☐ Useful
☐ Not useful
☐ Restricts business

Please comment:

Q50. Which of the following does your Code of Ethics/Conduct address?

☐ Respect for people/things (e.g. individual interest/the profession/public welfare, the computer society etc.)
☐ Personal/institutional characteristics (e.g. honesty, quality, competence, professional development, integrity, accountability)
☐ Promotion of information privacy and data integrity
☐ Production and flow of information (e.g. to involved parties, the public)
☐ Attitudes towards regulations (e.g. respect for the code, for the law, for professional standards)
☐ Computer specific ethical issues
☐ I do not know
☐ Other (Please specify)

Q51. Are there any important aspects that your Code of Ethics/Code of Conduct does not adequately address?
(e.g. due to technological developments such as the New Internet)?

Q52. For the Code of Ethics to which you adhere, what are the consequences of non-compliance?

Q53. Is there a need for greater enforcement and penalties where professional codes of conduct are breached?

○ Yes ○ No

Please comment

A.7 CIO Training

We are keen to understand your views on the need for CIO training, as well as what content could best prepare CIOs to undertake the role successfully.

Q54. Should CIOs be required to possess a certificate or qualification in ICT management?

○ Yes ○ No

Please comment

Q55. At what level should the role of the CIO be regulated?

☐ It should not be regulated
☐ Self-regulation e.g. via Professional association
☐ National Legislation
☐ EU Directives

Q56. Select the five subjects of most importance to your role as CIO (and add any additional subjects you feel are missing):

☐ Policy and Organisation
☐ Leadership/Management
☐ Process/Change Management
☐ Information Resource Strategy and Planning
☐ IT Performance Assessment: Models and Methods
☐ IT Project / Programme Management
☐ Capital Planning and Investment Control
☐ Acquisition
☐ e-Government
☐ Information Security/Information Assurance
☐ Enterprise Architecture
☐ Technology Management and Assessment
☐ Other - Please specify

Q57. Are Education and Training providers equipping employees with the necessary skills for the role of CIO?

○ Yes ○ No ○ I do not know

Please comment

Q58. Is there a need for CIO training/education providers to be more responsive to the demands of industry?

○ Yes ○ No

Please comment

Q59. What skill gaps (if any) exist between CIO training developed by ICT management academic courses and those demanded by an IT management role?
Enter none if appropriate.

Q60. If you were recruiting a replacement CIO or senior IT manager, what would you expect in terms of educational background?

	Business	IT
Minimum Level	Choose an item	Choose an item
Desired Level	Choose an item	Choose an item

Q61. If recruiting a replacement CIO or senior IT manager, would you expect him/her to be a member of a professional association?

○ Yes ○ No

If yes, please indicate which one or describe your requirement:

Q62. What type of course content could help to promote ICT-enabled innovation in organisations?

A.8 Developing an ICT Profession

We would like your opinions on the concept of an ICT Profession and what the next steps ought to be in developing an ICT profession.

Q63. What trends do you see in your organisation relating to the number of ICT workers employed outside of their country of origin?

○ Large increase

○ Small increase

○ Static

○ Small decrease

○ Large decrease

Q64. What benefits do you see from the promotion of a Europe-wide ICT profession?

Q65. What risks do you see from the promotion of a European-wide ICT profession?

Q66. In your opinion, how should an ICT Professional body be organised?

○ None - no professional body is required

○ National level

- National level with Europe wide recognition
- European level
- European body with Global recognition
- World wide body

Additional comments:

Q67. What do you think should be the essential components of an ICT Professionalism Framework?

A.9 Data Protection Compliance

Q68. Can the project team contact you in the future for follow-up and clarification?

Yes No

Q69. Can the project team retain your details for future related ICT surveys?

Yes No

Thank you

The research team appreciates your time in completing this survey.

The survey answers will be of significant benefit to us on completing this assignment on ICT Professionalism and ICT Manager training.

The interim report will be available on our website in July, 2011. You can email us with feedback on the interim report. The final report will be drafted by October 2011. The project website will keep you informed on the progress and status of this research assignment.

Project website http://ICTProf.eu

Email: info@ICTProf.eu

Appendix B BOK Status

The following table summarizes the current status of a number of BOKs reviewed as part of the desktop research.

B.1 BOK SWOT Analysis

BOK	Strengths	Weaknesses	Opportunities	Threats
PROJECT MANAGEMENT BODY OF KNOWLEDGE (PMBOK®)	Well established with by far the largest number of certified practitioners. It is comprehensive and current and maintained by a well funder institution. It has gained acceptance by both employers and practitioners. It has forged links with many other standards organisations and by way of example the IEEE dropped its project management standard in favour of the PMI's PMBOK.	It was perceived as being US centric until recent years. It now has offices in Brussels, China, South America etc. This cultural bias is being actively addressed.	The PMBOK and associated publications have the potential to have a truly global reach. Its local chapters and mentoring are real winners to promoting the profession. Its research efforts have been beneficial in convincing employers of the merits of project, program and portfolio management. This closes the loop by ensuring that the value of the certified individual is known and appreciated.	The PMI has been successful in a world whose appetite for project managers has not been satisfied. It remains to be seen if it can be as successful when the certifications are not necessarily a means to employment. Software engineering has taken to the agile development methodology and PMBOK needs to adapt. PMI is working on this but did leave it late and is now playing catch up. Prince2 is a serious competitor in the UK but there is no obvious competitor likely to oust the PMI's global dominant position.

BOK	Strengths	Weaknesses	Opportunities	Threats
SOFTWARE ENGINEERING BODY OF KNOWLEDGE (SWEBOK)	This standard has been widely accepted by educators, employers, professionals and is the basis of some international standards.	IEEE CS and ACM need to be more active at maintaining the currency of the SWEBOK. The seven year gap is too long.	The SWEBOK has a clear lead with its current acceptance levels. It has the ability to be a key player in the developer professional world. It should be made available in other languages. It needs revitalisation if it is to have a future.	Currency issues are the biggest threats. However, the SWEBOK is widely used and its dominance in the Indian market along with the V3 refresh should resolve this.
Canada's association of Information Technology Professionals (CIPS BOK) British Computer Society (BCS) IT Diploma Syllabus	International support from academics, educators and practitioners is apparent. The material is well maintained and well respected. Open and easy access is available.	Only English language versions were found. It is practitioner based and weak on management.	BCS can leverage of IFIP to gain wider acceptance and usage.	Globally maintained BOKs may emerge from other initiatives and make the need for a separate UK based BOK partially redundant.

BOK	Strengths	Weaknesses	Opportunities	Threats
Information Technology Infrastructure Library	ITIL has gained worldwide recognition and acceptance. It is supported by a growing number of qualified practitioners and is the preferred approach being used by many large IT consulting companies like IBM, HP and SUN to name a few. ISO 20000 which is loosely based on ITIL has accelerated the need qualified practitioners.	"The focus on people and human change issues is, indeed, one overlooked by ITIL and seriously underestimated by implementers".[54]	ITIL is evolving quickly and its now widespread use will provide a richer set of feedback that should allow it to mature and improve even further quickly.	The standards world is competitive and ITIL publications are expensive for SMEs.
COBIT 4.1	COBIT is supported by a wide range of experienced professionals. It leverages off other standards and bodies of knowledge including legislative frameworks. By way of example, ITIL, ISO 17799, Sarbanes–Oxley Act, art. 41 of the 8th European Company Law Directive etc.	No weaknesses found.	The ISACA seems to be further developed than their European counterparts. Thus, it should be possible for ISACA to forge ahead and establish further its lead in the audit, compliance and governance areas of IT.	There are reviews of audit failings and financial turmoil which may result in a very changed legislative framework. That said ISACA has demonstrated its ability to be adaptive and flexible in the face of change.

[54] http://www.itskeptic.org/node/551 BY Cary King, Minerva Enterprises, Managing Partner, http://www.MinervaE.com

BOK	Strengths	Weaknesses	Opportunities	Threats
ACM/IEEE Computer Science Curriculum	It has worldwide acceptance and is kept current and is freely available.	It has an undergraduate level focus and lacks an associated career progression.	This forms a solid basis on which to build professional career levels at post graduate level.	It lacks business domain expertise and with the blurring of career paths this may become an issue in the future. Specifically, it may need to refocus on the application of computer science to the solution of business problems and the provision of business services.
Capability Maturity Model Integrated (CMMI®)	The CMMI is today widely recognised as a solid indicator of the capabilities of software suppliers. It is still used in software development supplier selection criteria and is mandated in many instances.	The CMMI has a relatively narrow focus when compared with the full remit of today's ICT professionals.	The CMMI is an excellent framework for product and service developers. Its continued US government support ensures that it has a strong future. The SEI could do more to push its use beyond the current uptake.	The product development world is rapidly changing and cycle times are being collapsed. CMMI will need to be responsive and adaptive to changes in the future. Project planning in particular is changing with agile development methodologies.
Prince2	Securely funded and a solid customer base with supporting organisations.	Prince2 has few real weaknesses. Its acceptance globally has not been as widespread as some of its competitors and the publications are expensive.	Prince2 has the potential to grow its market share and it is positioned well in Europe from an EU perspective. It already has many EU languages supported.	Globalisation and the movement of labour will tend towards global standards. Catching up with the PMI will be a push.

BOK	Strengths	Weaknesses	Opportunities	Threats
IT Security Essential Body of Knowledge	It is comprehensive and is financially viable. It's effectively free. It covers knowledge, skills and competency and acts as a guide to educators on the curricula for ICT Security Professionals.	It is available only in English.	The EBK could be used globally.	None
Information Technology Capability Maturity Model (IT-CMF)	The relatively low cost to complete an assessment is a major bonus point. It has speed of execution and is very effective at generating value.	The solution does not attempt to replace the ICT body of knowledge. It has to be used with other management techniques.	The IT-CMF has the potential to form the basis of assessment for CIO's. It is the most holistic of the frameworks and bodies of knowledge looked at. It is now (March 2011) generating accelerated interest though the IT consulting partners and founding members like Ernst & Young and the Boston Consulting Group who are taking IT-CMF to their customers.	It is relatively new and yet to gain significant momentum.

BOK	Strengths	Weaknesses	Opportunities	Threats
TOGAF	There is a lot y more freely and inexpensively available information about TOGAF than about all others. (Sessions, 2007) Well defined process. It's well funded. (GTRA, 2009)	Poor on practice guidelines and artefact quality is dependent on the experience of the implementer. A blended approach of using TOGAF in conjunction with others is sometimes recommended.	TOGAF needs to be made available in other languages. Build on existing library of artefacts. TOGAF should be promoted as a standard for large enterprises initially.	Appears complicated (700+ pages, a lot of quotation from ANSI, ISO, etc.) Tough to sell Competition (Zachman, DoDAF, etc.) Eliminating duplication in hardware and software. (GTRA, 2009)

Table 25: BOK SWOT Analysis

Appendix C Country Profiles

C.1 Austria

COUNTRY	AUSTRIA	POPULATION	8,214,160 (July 2010 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Federal Ministry of Economy, Family and Youth Federal Ministry of Science and Research Federal Ministry for Education, Arts and Culture	http://www.en.bmwfj.gv.at/Seiten/default.aspx http://bmwf.gv.at/home/ http://www.bmukk.gv.at/enfr/min_en/index.xml	Vocational training, economic policy University level education School education and further education
Government Agencies/Bodies			
Professional Bodies/National Computing Associations	Austrian Computer Society OCG (Oesterreichische Computer Gesellschaft OCG)	http://www.ocg.at/	The objective of the Austrian Computer Society (OCG) is the comprehensive and interdisciplinary promotion of information processing, with due regard to its effects on man and society. To achieve this, the OCG undertakes the following: • It serves as the focal point of associations, organisations, and institutions in Austria involved in information processing (institutional members). • It represents Austria in the IFIP (International Federation for Information Processing) and in other associations, e.g. CEPIS (Council of European Professional Informatics Societies) and IMIA (International Medical Informatics Association). • It is an affiliate member of ACM (Association of Computing Machinery) and of the IEEE Computer Society. • It provides services, information and consultation for its members. • It promotes research and development projects, especially those of an interdisciplinary nature. • It has established several Working Groups dealing with specialized aspects in the field of information technology. • It organizes international conferences and congresses and supports its member institutions in organizing such events.

COUNTRY	AUSTRIA	POPULATION	8,214,160 (July 2010 est.)
Type	**Name**	**Website**	**Specifics**
Trade Unions	ÖGB (Österreichischer Gewerkschaftsbund)	www.oegb.at	The Austrian Trade Union Federation and its member unions represent the economic, political, social and cultural interests of all employees against employers, government and political parties. ÖGB has 1.2 million members.
Chambers of Commerce	WKÖ Wirtschaftskammer Österreich UBIT, Fachverband Unternehmensberatung & IT	http://portal.wko.at/wk/startseite.wk www.ubit.at	Austrian Chamber of Commerce IT subgroup of WKÖ (Austrian Chamber of Commerce)
CERTIFICATION			
Certification Bodies	Some examples OCG (Austrian Computer Society) TUV CIS Complete list of accredited certification bodies:	 www.ocg.at www.tuev.at http://at.cis-cert.com/ http://www.en.bmwfj.gv.at/technicalaffairsandsurveying/Accreditation/Seiten/ListsofbodiesaccreditedbytheFederalMinistryofEconomy,FamilyandYouth.aspx	 ICT skills certification, ECDL Technical certification, quality management systems ISMS
Accreditation Bodies	Österreichischer Akkreditierungsrat Fachhochschulrat Federal Ministry of Economy, Family and Youth	www.akkreditierungsrat.at www.fhr.ac.at http://www.en.bmwfj.gv.at/technicalaffairsandsurveying/Accreditation/Seiten/default.aspx	Accreditation of private universities Accreditation of “Fachhochschulen” (Universities of applied sciences) Accreditation for certifying bodies
Qualification Framework	none		

COUNTRY	AUSTRIA	POPULATION	8,214,160 (July 2010 est.)
Type	**Name**	**Website**	**Specifics**
E-COMPETENCIES			
Skills Framework	Bildungsstandards	http://www.bmukk.gv.at/schulen/unterricht/ba/bildungsstandards.xml	Framework for Schools, defining standards for different subjects and ages (e.g. Informatics/IKT for 14 year old pupils) development/ implementation process not finished yet (2011)
Promoted By	BMUKK (Federal Ministry for Education, Arts and Culture)	http://www.bmukk.gv.at/enfr/min_en/index.xml	As above
ETHICS			
Professional Body's Code of Ethics/Conduct	No special code of ethics The law defines the code of conduct		

Note: Professionalism is not a used term in Austria, it is also a discussion if the correct translation to the German language is "Professionalität" or "Professionalismus". "Professionalität" does not fit perfectly. "Professionalismus" is not used. In Austria we do not have a culture of accreditation. Universities and schools are usually owned by state and are not accredited; only "Fachhochschulen", private schools and private universities have to be accredited.
Certifying bodies are accredited by BMWFJ (Federal Ministry of Economy, Family and Youth).

C.2 Belgium

COUNTRY	BELGIUM	POPULATION	10,431,477 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education and Training (Flemish)	http://www.ond.vlaanderen.be/dvo/english/index.htm	Flemish agency for quality assurance (Agentschap voor Kwaliteitszorg in Onderwijs en Vorming, AKOV).
	Ministry of Employment, Labour and Social Dialogue (Federal)	http://www.emploi.belgique.be/home.aspx	Federal Public Service Employment, Labour and Social Dialogue deals with areas as diverse as labor, collective relations, standards of welfare to work, etc as well as offering a variety of information services and documentation to the public.

COUNTRY	BELGIUM	POPULATION	10,431,477 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	Minister for SMEs, Self-Employed, Agriculture and Science Policy (Federal)	http://www.belgium.be/en/	
	Minister of Enterprise and Simplification (Federal)	http://www.belgium.be/en/	
Government Agencies/Bodies			
Professional Bodies/National Computing Associations	Federation of Belgian Informatics Associations (FBVI-FAIB)	http://www.bfia.be/	CEPIS Member Society for Belgium
	Agoria	http://www.agoria.be/	Agoria is Belgium's largest employers' organisation and trade association. The companies represented by Agoria are active in 13 branches of the technology industry. Agoria provides services for its members on international business development and specialized clubs which focus on enhancing business opportunities for its members.
Trade Unions	Confederation of Christian Trade Unions (ACV/CSC)	http://www.acv-csc.be/	The ACV/CSC has 22 regional federation and 16 sectoral unions, with a membership of 1.7 million (almost 16% of the total Belgian population).
	General Confederation of Liberal Trade Unions of Belgium (ACLVB-CGSLB)	http://www.aclvb.be/index.php?st=home&st1=&st2=&st3=&st4=&st5=&taal=en	It was founded before the turn of the 20th century, and represents 230,000 workers. It organizes unions directly, without an occupationally based union structure.
	General Federation of Belgian Labour (ABVV/FGTB)	http://www.abvv.be/	A socialist national trade union federation in Belgium. It was founded in 1898 and took its present name in 1937. It is affiliated with the International Trade Union Confederation and has a membership of almost 1.2 million.
Chambers of Commerce	Unknown		Several chambers for specific countries or regions, no overall chamber details found.
CERTIFICATION			
Certification Bodies	Major vendor certification activity including Microsoft, CISCO, CompTIA		
Accreditation Bodies	NVAO (Nederlands-Vlaamse Accreditatieorganisatie)	www.nvao.net	The quality assurance of higher education qualifications from level five to level eight is followed up through the NVAO (Nederlands-Vlaamse Accreditatieorganisatie). The NVAO is the accreditation organisation of the Netherlands and Flanders for higher education established by an international Treaty.

COUNTRY	BELGIUM	POPULATION	10,431,477 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	Agentschap voor Kwaliteitszorg in Onderwijs en Vorming (AKOV)	http://www.ond.vlaanderen.be/wegwijs/AKOV/	Flemish agency for quality assurance (Agentschap voor Kwaliteitszorg in Onderwijs en Vorming, AKOV).
	As above	As above	The EQF coordination point was designated in February 2010: it is the new Flemish agency for quality assurance (Agentschap voor Kwaliteitszorg in Onderwijs en Vorming, AKOV).
Qualification Framework	Belgium (German)	N/A	Similar to the UK, Belgium is seeing the development and implementation of more than one NQF. The German speaking community has not taken any initiative to develop an NQF.
	Beglium (Flanders)	http://www.ond.vlaanderen.be/	On 30 April 2009 the Flemish Parliament and Government in Belgium adopted an Act on the qualification structure (kwalificatiestructuur) introducing a comprehensive qualification framework. While the Flemish framework is seen as a precondition for referencing to the EQF (8 level structure adopted), it is primarily an instrument for improving the national qualifications system. It is an integrated framework for professional qualifications and educational qualifications at all levels, including educational qualifications of higher education. The 2009 Act defines the Flemish qualification structure (FQS) as 'a systematic classification of recognised qualifications based on a generally adopted qualifications framework (FQF)'.
	Belgium (Wallonia - French)	http://www.febisp.be/view/fr/FeBISP/Reseautage/Mandats/SFMQ_mandat.html	The French speaking communities have also begun NQF development. Suggestions have been made, following a change of government, to build a framework on the principles outlined in Flemish qualifications framework (see above). A national coordination point for the EQF referencing will be established from September 2010. This NCP is under the responsibility of the Service francophone des metiers et des qualifications (SFMQ).
E-COMPETENCIES			
Skills Framework	SFIA	http://www.sfia.org.uk	
Promoted By	SMME	http://www.smme.com	SMME is an accredited training provider of IT management and control frameworks in the US, Europe and the Middle East. It focuses on IT process frameworks which organisations use to develop world-class IT services.

COUNTRY	BELGIUM	POPULATION	10,431,477 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
ETHICS			
Professional Body's Code of Ethics/Conduct	Unknown		

C.3 Bulgaria

COUNTRY	BULGARIA	POPULATION	7,093,635
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education, Youth and Science	http://www.mon.bg/en/top_menu/vocational_education/	Provides links regarding general, vocational and higher education. Also provides links to documents related to EQF/NQF -- for national qualification framework.

COUNTRY	BULGARIA	POPULATION	7,093,635
Type	**Name**	**Website**	**Specifics**
	Ministry of Transport, Information Technology and Communications	http://www.mtitc.government.bg	The Minister of Transport, Information Technology and Communications implements the state policy in the field of transport, information technology, communications and e-governance. Three directorates are working in the field of ICT: Information Technology (IT) Directorate: Communications Directorate; and E-Governance Directorate. These directorates develop the policy, strategies, programmes and plans in the field of information technologies, communications and e-governance. The IT Directorate is responsible for pursuing the policy in information society development in coordination with other line ministries. It coordinates and monitors the development and implementation of programmes and projects in the IT area, particularly the ICT theme in FP7, the PSP Programme in CIP, the National Broadband Strategy and related projects. The Communications Directorate is responsible for pursuing the policy, as well as harmonizing the legal framework in electronic communications and postal services with the acqus communitaire, and for managing of the radio frequency spectrum. The e-Governance Directorate is responsible for developing and implementing the e-governance policy in coordination with the line ministries. It coordinates the implementation of the National e-Governance Strategy and implements a series of e-governance projects funded by the Administrative Capacity Operational Programme. The Ministry works in close cooperation with the ICT sector which is represented by the branch organizations in the Consultancy Board on the issues of electronic communications, postal services, information society and e governance.
Government Agencies/Bodies			

COUNTRY	BULGARIA	POPULATION	7,093,635
Type	**Name**	**Website**	**Specifics**
Professional Bodies/National Computing Associations	Union of Automation and Informatics (UAI)	http://www.sai.infotel.bg sai@infotel.bg	UAI's objectives are: 1. To join the efforts of its members to take an active part in decision making and activities related to progress in economics, scientific studies and their applications in the country, in the name of national prosperity and universal human values. 2. To represent and defend the creative professional interests and the public prestige of its members before state, social and business institutions in the country and abroad. 3. To create conditions for its members to increase constantly their knowledge, qualifications and professional skills. 4. To represent the community of specialists of automation and informatics in similar international and foreign organizations and to assist in making and developing active contacts in international scientific life. UAI is the national representative to and member of CEPIS.
	Bulgarian Academy of Sciences (BAS)	http://www.bas.bg/cgi-bin/e-cms/vis/vis.pl?p=0200	The leading national research center of excellence with several institutes and research units in the informatics field. (Not exactly a "professional society" as many understand the term but certainly a leading player in informatics related activities).

COUNTRY	BULGARIA	POPULATION	7,093,635
Type	**Name**	**Website**	**Specifics**
Trade Unions	Federation of Scientific and Technical Unions of Bulgaria (FNTS)	http://www.fnts.bg/en/about_us_en.php info@fnts-bg.org	The Federation of scientific and technical unions in Bulgaria /FNTS/, or the Federation, is a non-profit, non-government, non-political, creative-professional association and is a part of the civil society.
	Statutes including aims and scope	http://www.fnts.bg/en/doc_en/statute.pdf	
	Union of Scientists in Bulgaria	http://www.usb-bg.org/English/english.htm	The main aim is to assist the advancement of science and higher education in the country, to promote their prestige and contribution to the prosperity of the Republic of Bulgaria. The USB participates as an independent partner and consultant to the Law- and Decision-makers in the elaboration and implementation of the national strategy for the development of science and higher education. The USB voices and protects the rights and interests of its members and assists their innovative and professional activities.
	Confederation of Independent Trade Unions in Bulgaria	http://www.knsb-bg.org/	
	Confederation of Labour "Podkrepa"	http://www.podkrepa.org/content/	
Chambers of Commerce	Bulgarian Chamber of Commerce and Industry (BCCI)	http://www.bcci.bg/	Preserve the stability of the Bulgarian economy, improve the business conditions and the attractiveness of the economic environment in the Republic of Bulgaria; Curtail the consequences of the world economic and financial crisis for Bulgaria and ensure a speedy economic recovery in its aftermath; Secure the stability of the country's energy system; Improve trilateral cooperation, inclusive of achieving a better balance in the relations between workers/employees and employers, and shared rights and responsibilities for the firm's economic results; Preserve the BCCI's capacity, and optimize and enhance the efficiency, types and quality of the BCCI's services and its role in upholding the business circles' interests.
	Bulgarian Industrial Association	http://www.bia-bg.com/	

COUNTRY	BULGARIA	POPULATION	7,093,635
Type	**Name**	**Website**	**Specifics**
CERTIFICATION			
Certification Bodies	Ministry of Education Youth and Science Bureau Veritas Certification Bulgaria	 http://certification.bureauveritas.bg	 They certify organizations in: ISO 9001, ISO 14001, ISO 22000 (HACCP), OHSAS 18001, ISO 27001, ISO 16949, TL 9000, EMAS, BRC / IFS, TAPA, SA 8000. They also have global and network accreditations. They qualify auditors, classify organizations by industrial codes, define the time for audit, etc.
Accreditation Bodies	VET Accreditation	http://www.mon.bg/opencms/export/sites/mon/en/top_menu/vocational_education/presentation_VET-system_BG.pdf	
Qualification Framework	In progress		Working towards EQF
E-COMPETENCIES			
Skills Framework	None		
Promoted By	N/A		
ETHICS			
Professional Body's Code of Ethics/Conduct	Union of Scientists in Bulgaria	http://www.usb-bg.org/English/english.htm	This body has an Ethics Committee

C.4 Cyprus

COUNTRY	CYPRUS	POPULATION	1,102,677 (July 2010 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Department of IT Services	http://www.mof.gov.cy/mof/dits/dits.nsf/index_en/index_en?OpenDocument	Government body responsible for the promotion and application of Information Technology and e-Government in the Public Sector.
Government Agencies/Bodies	Department of Electronic Communications	http://www.mcw.gov.cy/mcw/dec/dec.nsf/dmlindex_gr/dmlindex_gr?OpenDocument	The Department of Electronic Communications (DEC) (formerly Directorate of Telecommunications) of the Ministry of Communications and Works was established in 2003 and it has responsibilities in Radio-communications, Electronic Signatures, Information Society and Space issues
Government Agencies/Bodies	Commissioner of Telecommunications and Postal Regulations	www.ocecpr.org.cy	In the framework of harmonizing the Cyprus law with the European acquis communautaire for the deregulation of the sectors of electronic communications and postal services, Cyprus since 2002 has introduced through the establishment of the Office of the Commissioner of Electronic Communications and Postal Services the regulation of the above named sectors
Professional Bodies/National Computing Associations	Cyprus Computer Society (CCS)	http://www.ccs.org.cy	The Cyprus Computer Society (CCS) was established in 1984 and today it numbers more than 1000 members. CCS is the national member society of CEPIS. As a not-for-profit organization, the CCS is seeking to improve and promote high standards amongst informatics professionals, in recognition of the impact that informatics has on employment, business, society as well as on the quality of life of the citizen. The CCS plays a key role in linking Academia with the Profession through the promotion of key elements of Informatics, in particular in the areas of digital literacy, professional skills, professionalism, education, training and research.
Professional Bodies/National Computing Associations	Cyprus Scientific Technical Chamber	www.etek.org.cy	The Cyprus Scientific and Technical Chamber (ETEK) is the statutory Technical Advisor to the State and is the umbrella organisation for all Cypriot Engineers.

COUNTRY	CYPRUS	POPULATION	1,102,677 (July 2010 est.)
Type	**Name**	**Website**	**Specifics**
IT Companies Association	Cyprus IT Enterprises Association	www.citea.net	Involved in closely observing the rapid changes of IT in the global arena with the purpose of introducing and adopting them to the Cyprus market.
Trade Unions	There are no contacts as they are not active in the field.		
Chambers of Commerce	Cyprus Chamber of Commerce and Industry	http://www.ccci.org.cy/	The Cyprus Chamber of Commerce and Industry is a private corporate body functioning under special law and is financially independent, free of any influence by the state. The Chamber is funded by its members' subscription fees and through income generated from a number of services it provides.
Employers Federation	Cyprus Employers Federation	www.oeb.org.cy	The Cyprus Employers and Industrialists Federation (OEB) OEB is a pan-cyprian independent organisation comprising of more than 55 of the main professional/sectoral associations as well as hundreds of companies from the Manufacturing, Services, Commercial, Construction and Agricultural Sectors. In total, OEB has more than 4,500 Member/ Enterprises.
CERTIFICATION			
Certification Bodies	KYSATS: Cyprus Council for the Recognition of Higher Education Qualifications	www.kysats.ac.cy	KY.S.A.T.S. (Council for the Recognition of Higher Education Qualifications) is the Competent Authority for the recognition of Titles (or Degrees) which were awarded from institutions of Higher Education recognized in the country they operate. It serves the role of the National Academic Recognition Information Centre (NARIC) for Cyprus
Accreditation Bodies			
Qualification Framework	Human Resources Development Authority	www.hrdauth.org.cy	HRDA's mission is to create conditions for the planned and systematic training and development of human resources of Cyprus, at all levels and in all sectors, to meet the needs of the economy within the social and economic policies.

COUNTRY	CYPRUS	POPULATION	1,102,677 (July 2010 est.)
Type	**Name**	**Website**	**Specifics**
E-COMPETENCIES			
Skills Framework	ECDL	www.ecdl.com.cy	The ECDL - EUROPEAN COMPUTER DRIVING LICENCE - is an internationally-recognized standard of competence, a widely acceptable certificate that asserts that the holder has the knowledge and skills needed to use the most common computer applications efficiently and productively in the workplace and at home.
Promoted By	Cyprus Computer Society (CCS)	www.ccs.org.cy	See above.
ETHICS			
Professional Body's Code of Ethics/Conduct			

C.5 Czech Republic

COUNTRY	CZECH REPUBLIC	POPULATION	10,190,213 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Industry and Trade of the Czech Republic	http://www.mpo.cz/en/e-comm-and-post/	The Ministry of Industry and Trade is a central body of the state administration involved in: the national industry policy, trade policy, foreign economic policy, integrated raw material policy, use of mineral resources, energy, gas and heat production, mining, crude oil, natural gas, solid fuels, nuclear materials, ores and non-ore treatment and conversion, metallurgy, machinery, electrical engineering and electronics, chemical industry, crude oil processing, rubber and plastic materials industry, glass and ceramics industry, textile and clothing industry, leather and print industry, paper, cellulose and wood-working industry, building materials production, building industry production, medical production, waste, domestic trade and the protection of consumers' interests, foreign trade and supporting exports, small and medium-sized companies' issues with the exception of regional business support and trading issues, technical standardization, metrology and state quality control, industrial research, engineering and technology development, electronic communication and postal services.
	Ministry of Education, Youths and Sports of the Czech Republic	http://www.msmt.cz/index.php?lang=2	The Ministry of Education, Youths and Sports is a central authority of the state administration for pre-school facilities, school facilities, elementary schools, secondary schools and universities, for science policy, research and development including international cooperation in this sphere, for science degrees, for the state policy related to children, youths, sports, tourism and sport representation.
	Ministry of Labour and Social Affairs	http://www.mpsv.cz/en/	The Ministry of Labour and Social Affairs is a authority of the state administration for social and labour relations, safety of labour, employment and retraining, collective bargaining, wages and other remuneration for work, pension security, health insurance, sickness benefits, social care, working conditions of women and youths, legal protection in maternity, family and children care, care for citizens with special aid requirements and other wage and social policies.

COUNTRY	CZECH REPUBLIC	POPULATION	10,190,213 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Government Agencies/Bodies	Government Council for Information Society	http://www.vlada.cz/en/ppov/rvis/government-council-for-information-society-74186/	The Government Council for Information Society is an expert advisory body of the government in the field of the information society which is to carry out the coordination role instead of the dissolved Ministry of Informatics and to provide the government with a knowledge basis as an aid for its decisions in the strategy issues of the area of information society development so that the coordination of departmental and nation-wide projects would be improved.
Professional Bodies/National Computing Associations	The Czech Society for Cybernetics and Informatics (CSKI)	http://www.cski.cz/main.php?id=02.01.01.00	The Czech Society for Cybernetics and Informatics (CSKI) was founded in 1966 as the Czechoslovak Society for Cybernetics. It has currently about 300 members and it is the largest society focused on informatics in the Czech Republic. The society objectives centre on support and promotion of cybernetics, informatics and related fields, advancing the professional standing of its members, providing services to its members, and support of conferences, seminars and other activities. The CSKI is the Czech member of CEPIS.
	Association For Information Technologies And Telecommunications – ICT Unie O.S.	http://www.ictu.cz/index.php?id=1165	ICT UNIE is a professional association of enterprises operating in the information and electronic communication technologies sector and other businesses and educational subjects, with the objective of increasing the importance of the introduction and the use of modern technologies in society, including the creation of the optimal conditions for the development of public telecommunication networks in the Czech Republic, as a necessary precondition for the creation of an information company. The activities of the Association are related to the objectives of the Association for Information Society (SPIS) and the Association of Operators of Public Telecommunication Networks (APVTS).
Trade Unions	Czech-Moravian Confederation of Trade Unions	http://www.cmkos.cz/homepage	The Czech-Moravian Confederation of Trade Unions is a voluntary, open, independent, democratic confederation of trade unions protecting wage, working and living conditions and rights of employees. It is an important social partner in tripartite negotiations in the framework of the Council of Economic and Social Agreement of the Czech Republic. It works in the regions of the Czech Republic through Regional Councils of Trade Unions (RROS) and Regional Offices for Legal Assistance (RPP).

COUNTRY	CZECH REPUBLIC	POPULATION	10,190,213 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Chambers of Commerce	Economic Chamber of the Czech Republic	http://www.komoracz.eu/	The Czech Chamber of Commerce (CCC) is an entity representing the entrepreneurial public and became an integral part of the economic life in the Czech Republic. It protects the interests of its members – small, medium and large enterprises associated in a network of regional chambers and trade associations.
CERTIFICATION			
Certification Bodies	UNMZ - Czech Office for Standards, Metrology and Testing	http://www.unmz.cz/office/en	The Czech Office for Standards, Metrology and Testing was established by the Czech National Council Act No. 20/1993 on the Organisation of the State Administration in the Field of Standards, Metrology and Testing as the state administration body responsible for such activities. The Office is a budgetary organisation subordinated to the Ministry of Industry and Trade. The Office's mission is to perform tasks set out in Czech legislation on technical standardisation, metrology and testing and tasks related to the harmonisation of Czech technical regulations and standards with the technical regulations of the European Community. Since 2009, the Office has been ensuring development and publication of Czech standards.
Accreditation Bodies	The Czech Accreditation Institute	http://www.cia.cz/default.aspx?id=45	The Czech Accreditation Institute, Public Service Company, National Accreditation Body, was established by the Government of the Czech Republic. It provides services to state and private organizations in all fields of accreditation in conformity with valid legal regulations. The principle of a uniform European accreditation system, formed by national accreditation bodies working in conformity with uniform rules and performing accreditation according to defined internationally recognized standards, is based on the EC position as defined in the Global Conception of Testing and Certification.
Qualification Framework	Under development		The development and implementation of the National Qualifications Framework (NQF 2) in the Czech Republic is to be carried out during the years 2009-2015. The Ministry of Education, Youth and Sports works together with the National Institute of Technical and Vocational Education on the project, which is co-financed by the European Social Fund and from the Czech Republic state budget. The project will be carried out during the years 2009-2015.

COUNTRY	CZECH REPUBLIC	POPULATION	10,190,213 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
E-COMPETENCIES			
Skills Framework	There is no developed national ICT Skills Framework.		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	Unknown.		

C.6 Denmark

COUNTRY	DENMARK	POPULATION	5,313,577 (1999, Royal Danish Ministry of Foreign Affairs)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	The Ministry of Science, Technology and Innovation	http://en.vtu.dk/	The Ministry of Science, Technology and Innovation is responsible for the following areas: Research, Information technology (IT), Innovation, Telecommunications, University educations and Internationalisation of education and training in Denmark.
	Ministry of Education	http://www.eng.uvm.dk/	The Department has the overall responsibility for managing the various domains of the Ministry of Education and to ensure the best possible foundation for carrying out the Government's education policy.
	Ministry of Employment	http://uk.bm.dk/	The Ministry of Employment has the overall responsibility for measures in relation to all groups of unemployed persons, i.e. both unemployed persons on social assistance as well as unemployed persons receiving unemployment benefits.

COUNTRY	DENMARK	POPULATION	5,313,577 (1999, Royal Danish Ministry of Foreign Affairs)
Type	**Name**	**Website**	**Specifics**
Government Agencies/Bodies	National IT and Telecom Agency	http://en.itst.dk/	The National IT and Telecom Agency's strategy for itst.dk is to offer users information, knowledge and tools about e-government, public communication, IT and telecommunications as well as legislation, statistics and international cooperation within the field of IT and telecommunications.
	Danish Agency for Science, Technology and Innovation (DASTI)	http://en.fi.dk/	The Danish Agency for Science, Technology and Innovation serves and oversees a wide range of independent Councils, commissions and committees which support and advise on research and innovation.
	Danish Agency for International Education (formerly known as CIRIUS)	http://en.iu.dk/	The Danish Agency for International Education is a government agency within the Danish Ministry of Science, Technology and Innovation responsible for supporting the internationalisation of education and training in Denmark. The Agency is also the central institution in Denmark where persons with foreign qualifications can get these assessed and recognised. In addition, the Agency is an information centre concerning internationalisation of all the educational sectors.
Professional Bodies/National Computing Associations	DANSK IT	http://www.dansk-it.dk/	With more than 6,000 members DANSK IT is a leading interest organisation for IT professionals in Denmark. The core activities evolve around member networks, conferences, courses, certification programmes and IT political advice to the DK Government and its agencies. Founded in 1958 DANSK IT is among the first IT societies in the world and is a member of CEPIS.
Trade Unions	LO – The Danish Confederation of Trade Unions	http://www.lo.dk/English%20version/About%20LO.aspx	The Danish Confederation of Trade Unions is the largest national trade union confederation in Denmark and is recognised as the most representative workers' organisation in both the private and the public sector. LO's main objective is to handle employee interests vis-à-vis employers and authorities. Through its cooperation with associations, cartels and other trade union organisations, LO seeks to influence the government and the political parties when it comes to drafting and implementing legislation, especially in relation to labour market policies.
	The Danish Society of Engineers, IDA	http://ida.dk/sites/english/Sider/IDA.aspx	The Danish Society of Engineers, IDA is a professional body and trade union for technical and scientific professionals as well as students. IDA has more than 83.000 members, and represents the interests of employees, managers, the self-employed and pensioners within the fields of pay and employment, the labour market, industrial policy, skills, careers and training, the working environment, technology and research.

COUNTRY	DENMARK	POPULATION	5,313,577 (1999, Royal Danish Ministry of Foreign Affairs)
Type	**Name**	**Website**	**Specifics**
	PROSA	http://www.prosa.dk/in-english/	With 13,000 members working professionally with IT, PROSA stands out as the leading interest group and labour association for organised IT Professionals in Denmark. PROSA is a democratic and professional association, with no ties to political parties. At the same time it has a strong political engagement in questions related to the implications of IT for the wider society - eg. privacy issues, digital rights etc.
	SAM-DATA	https://www.sam-data.dk/info/info.asp?id=259&m=5&sprog=uk	SAM-DATA is a trade union for the IT profession. SAM-DATA strives to improve the conditions in the labour market for IT specialists. SAM-DATA offers supplementary training, IT-related events, union experts and legal advice. SAM-DATA constantly strives to improve the conditions for IT specialists.
	Dansk Metal	http://www.danskmetal.dk/Om%20Dansk%20Metal/Hvad%20er%20Metal/English.aspx	The Danish Metalworkers' Union ("Dansk Metal") works professionally to safeguard the rights and interests of its members. Dansk Metal is a politically independent, democratic association, in which the members make the decisions. Dansk Metal has 136,000 members in the manufacturing, building and construction, IT and telecommunications and service industries, in enterprises throughout Denmark.
Chambers of Commerce	The Danish Chamber of Commerce	http://www.danskerhverv.dk/OmDanskErhverv/Profil/Danish-Chamber-Commerce/Sider/Danish-Chamber-Commerce.aspx	The Danish Chamber of Commerce is the network for Trade, IT, Industry and Service in Denmark.
	Danish IT Industry Association ITB	http://www.itb.dk/site.aspx?p=51	With more than 500 IT-member companies The Danish IT Industry Association (ITB) is the largest and leading independent representative for the IT-business community in Denmark.
	DI ITEK	http://itek.di.dk/special/bundmenu/Pages/English.aspx	DI ITEK is the Danish ICT and electronics federation for IT, Telecommunications, Electronics and Communication enterprises. The 300 members of DI ITEK all have their ties within the IT, Telecommunications, Electronics and Communication business.
	TI – Telecommunications Industry Association in Denmark	http://www.teleindustrien.dk/	TI is a professional association, working to improve the conditions for the Danish telecommunications operators.

COUNTRY	DENMARK	POPULATION	5,313,577 (1999, Royal Danish Ministry of Foreign Affairs)
Type	**Name**	**Website**	**Specifics**
CERTIFICATION			
Certification Bodies	DANSK IT	http://www.dansk-it.dk/	DANSK-IT has undertaken the role of a certifying and accrediting body for IT qualifications – one of many activities aimed at promoting the knowledge and use of Information and Communication Technology into the Danish market. Being an independent interest organisation for nearly 6,000 IT professionals it is also a way for them to gather the community around the development and documentation of qualifications for IT professionals. DANSK IT provides the following Certifications: ITIL V3, ITIL®, ISTQB Software Tester, Lean it-processer, and It-arkitektur.
Accreditation Bodies	DANSK IT	http://www.dansk-it.dk/	DANSK-IT has the role of a certifying and accrediting body for IT qualifications – one of many activities aimed at promoting the knowledge and use of Information and Communication Technology into the Danish market. Being an independent interest organisation for nearly 6,000 IT professionals it is also a way for them to gather the community around the development and documentation of qualifications for IT-professionals.
Qualification Framework	Danish Qualification Framework	http://en.iu.dk/transparency/qualifications-frameworks/about-the-qualifications-framework	Denmark has had a national QF since 2003, and this framework has been widely implemented and used by institutions of higher education in the country. However, in order to be in line with the overarching European framework, a revision of the country's existing framework was necessary - a process that started in 2006. The Danish Qualifications Framework for Lifelong Learning is a comprehensive, systematic overview, divided by levels, of qualifications that can be acquired within the Danish education system – from primary and lower secondary to university level and within the area of adult and continuing education and training. The Qualifications Framework has eight levels. Degrees and certificates are placed at one of these eight levels on the basis of learning outcomes.
E-COMPETENCIES			
Skills Framework	There is no developed national skills framework		
Promoted By			

COUNTRY	DENMARK	POPULATION	5,313,577 (1999, Royal Danish Ministry of Foreign Affairs)
Type	**Name**	**Website**	**Specifics**
ETHICS			
Professional Body's Code of Ethics/Conduct			

C.7 Estonia

COUNTRY	ESTONIA	POPULATION	1,282,963
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education and Research	http://www.hm.ee/	The main tasks of the Ministry of Education and Research are to guarantee the expedient and effective development of education, research, youth and language policies and the high level and competitiveness of research and development activities.
	Ministry of Economic Affairs and Communications	http://www.mkm.ee/	Ministry of Economic Affairs and Communications, the aim is to create conditions for growth and competitiveness of the Estonian economy, balanced and sustainable economic development through the development, implementation and evaluation of outcomes.
Government Agencies/Bodies	Estonian Informatics Centre A new name is:Estonian Information System's Authority	http://www.ria.ee/	Established by the Estonian government to solve the main IT problems common for several state organisations and to arrange the work of the state's information systems. The Estonian Informatics Centre is an implementing body in general coordination of state information policy and public sector IT development (Subdivision of the Ministry of Economic Affairs and Communications).
	The National Examinations and Qualifications centre (REKK)	http://www.ekk.edu.ee/	The Examination Centre is a governmental body administered by the Ministry of Education and Research. Its main objective is to implement the national education and language policy in the field of primary, basic and secondary education as well as in vocational and adult education.
	Estonian Qualifications Authority (Kutsekoda)	http://www.kutsekoda.ee/	The Estonian Qualifications Authority's main aim is to develop and administer the professional qualifications system.

COUNTRY	ESTONIA	POPULATION	1,282,963
Type	**Name**	**Website**	**Specifics**
	Estonian Information Technology Foundation (EITF)	http://www.eitsa.ee/?url=eitf	Estonian Information Technology Foundation is a non-profit organisation founded by the Estonian Republic, Tartu University, Tallinn Technical University, Eesti Telekom and the Association of Estonian Information Technology and Telecommunications Companies. EITF's aims are to assist in preparation of the highly qualified IT specialists and to support information and communication technology-related development in Estonia. For these purposes the Foundation established and manages the Estonian IT College and adminsters the National Support Program for ICT in Higher Education "Tiger University."
	Tiger Leap Foundation	http://www.tiigrihype.ee/?setlang=eng	Established by the Estonian Government and private companies to, collect national and international intellectual and material resources, and give focus to the updating process of the Estonian educational system, and establish basement to the open learning environment.
Professional Bodies/National Computing Associations	Technical Education Development Foundation	http://www.tehnikaharidus.ee/	Technical Education Development Foundation (2008). An initiative led by a private entity - a foundation whose goals are to promote lifelong learning in Estonia with a focus on IT and other technical education issues and raising the level of knowledge of other countries.
	Estonian Information Technology Society (EITS)	http://www.eits.ee	Former IT Society in Estonia. No longer in operation.
	Estonian Association of Information Technology and Telecommunications (ITL)	http://www.itl.ee/	Voluntary organisation, whose primary objective is to unite the Estonian information technology and telecommunications companies, to promote their co-operation in Estonia's development towards information society, to represent and protect the interests of its member companies and to express their common positions.
Trade Unions	Estonian Trade Union Confederation (EAKL)	http://www.eakl.ee/	The (EAKL) comprises of 19 branch unions that represent state and municipal government officials, education workers, health care workers, transport workers (including road, railway, sea and air transport), industrial workers and people employed in the service sector.
	Estonian Association of Information Technology and Telecommunications (ITL)	http://www.itl.ee/	See professional bodies (above)
	Estonian Employees´ Unions´ Confederation (TALO)	http://www.talo.ee/	TALO is a central union composed of trade unions and the associations of these working throughout Estonia.TALO has been established in order to represent and defend the employees´ work, profession and income-related as well as economic, social, educational and society-related interests and relevant rights through co-operation.

COUNTRY	ESTONIA	POPULATION	1,282,963
Type	**Name**	**Website**	**Specifics**
Chambers of Commerce	Estonian Chamber of Commerce and Industry (ECCI)	http://www.koda.ee/	The Estonian Chamber of Commerce and Industry (ECCI) is the oldest and largest Estonian representative organization of entrepreneurs and was founded to represent and protect common interests of Estonian merchants, manufacturers, bankers and ship-owners in the year 1925.Today, the ECCI with almost 3,200 members is the largest business representation organization in the country.
CERTIFICATION			
Certification Bodies	National Examinations and Qualifications Centre (REKK)	http://www.ekk.edu.ee/	The Examination Centre is a governmental body administered by the Ministry of Education and Research. Its main objective is to implement the national education and language policy in the field of primary, basic and secondary education as well as in vocational and adult education.
	The Estonian Higher Education Quality Agency (EKKA)	http://ekka.archimedes.ee/	The mission of the Estonian Higher Education Quality Agency (EKKA) is to foster the quality of Estonian higher education, and to promote and disseminate the best quality assurance practices. Upon making assessment decisions, EKKA is independent and sovereign.
Accreditation Bodies	Estonian Qualification Authority (QA) (Kutsekoda)	http://www.kutsekoda.ee/et/index	The main institution involved in the implementation of the NQF however, other ministries, institutions (National Examination and Qualification Centre, employers, agencies, etc.) are involved.
	BCS Koolitus AS	http://www.bcs.ee/koolitus	Official accreditation body. Awards ICT Professional Qualifications in Estonia
Qualification Framework	Estonian Qualification Authority (QA) (Kutsekoda)	http://www.kutsekoda.ee/et/index	See Government Agencies
E-COMPETENCIES			
Skills Framework	"Estonian Information Society Strategy 2013"	http://www.riso.ee/en/information-policy/policy-document/Estonian_Information_Society_Strategy_2013	Estonian Information Society Strategy 2013, approved by the Order of the Government of the Republic Nr 667 (of 30 November 2006), is a sectoral development plan, setting out the general framework, objectives and respective action fields for the broad employment of ICT in the development of knowledge-based economy and society in Estonia in 2007-2013.
Promoted By	Ministry of Economic Affairs and Communications	http://www.mkm.ee/	See Government Departments (above).
Skills Framework	EUCIP	www.eucip.org	

COUNTRY	ESTONIA	POPULATION	1,282,963
Type	**Name**	**Website**	**Specifics**
Promoted By	Technical Education Development Foundation	http://www.tehnikaharidus.ee/	See Professional Bodies (above)
	BCS Koolitus AS	http://www.bcs.ee/koolitus	Awards Professional Qualifications (IT Specialist I, IT Specialist II)
	ECDL Estonia	http://www.ecdl.ee	ECDL Estonia is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Estonia
ETHICS			
Professional Body's Code of Ethics/Conduct	Estonian Information Technology Society (EITS)	http://eits.ee/index.php?section=ws_eits_est&ws_id=9	Former EITS had one.
	Estonian Association of Information Technology and Telecommunications (ITL)	http://itl.ee/?op=body&id=24	ITL has Code of Ethics for ICT companies

C.8 France

COUNTRY	FRANCE	POPULATION	65,312,249
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministère de de l'Economie des Finances et de l'Industrie	http://www.industrie.gouv.fr/, http://www.minefe.gouv.fr/ministere_finances/besson/eric-besson.php	In charge of French economic and industrial policy, including a specific department promoting digital economy
		http://www.telecom.gouv.fr	Governmental initiative to promote the ICT

COUNTRY	FRANCE	POPULATION	65,312,249
Type	**Name**	**Website**	**Specifics**
		http://www.gouvernement.fr/gouvernement/societe-de-l-information/liste	All governmental initiatives about the Information Society
	Ministère de l'Enseignement Supérieur et de la Recherche	http://www.enseignementsup-recherche.gouv.fr/	In charge of upper education (Universities) and Research
Government Agencies/Bodies	INRIA	http://www.inria.fr/	Research agency specialising in IT
	National Academy of Technologies of France	http://www.academie-technologies.fr/en.html	Public consultancy body aiming to advise political authorities as well opinion leaders. Linked to Ministère de l'Enseignement Supérieur et de la Recherche
	CGIET	http://www.cgiet.org/	The high council for Industry, energy and technology: provide Public Authorities with elements to assess, prefigure or shape up public policies relative to information and communication technologies, informatics, audiovisual, technologies, space and postal services.
Professional Bodies/National Computing Associations	MEDEF	www.medef.com	No specific interest
	Syntec numérique	http://www.syntec-numerique.fr/?TabID=1	Professional body of SSO's, SW editors and Engineering and innovation consulting companies. It brings together over 1,000 businesses totaling over 380,000 professionals
	CIGREF	http://cigref.typepad.fr/cigref_english/CIGREF_En_December_2008.pdf	An association of companies founded in 1970, CIGREF brings together 128 French companies and organisations from all sectors. To this end, CIGREF has three aims: 1) To bring together major companies using information systems, 2) To support CIOs and help them develop in the exercise of their profession, 3) To develop a long-term vision of the impact of information systems and technologies on the enterprise, the economy, and

COUNTRY	FRANCE	POPULATION	65,312,249
Type	**Name**	**Website**	**Specifics**
			society.
	AFDEL	http://www.afdel.fr/	Another professional body of SW editors totaling 230 companies
	Alliance TICS	http://www.alliance-tics.org/	Alliance TICS Professional Union brings together stakeholders from industries of information technology, communications and related services (ICT).
	MUNCI	http://munci.org/	Founded in 2003, MUNCI is the professional association which gathers all physical members of any IT branch (Information technology, Web, Telecom and other ICT), of any status (employee, freelancer, unemployed) and of any employer (software based services, software editors, outsourcing and consulting enterprises, others…). In synergy with SPECIS, union partner in the branch – Syntec-CICF - itself affiliated with the UNSA (fourth union confederation in France), MUNCI frequently intervenes in the media, with institutions and public authorities to defend the interests of these professions.
Trade Unions	CICF	http://www.cicf.fr/cicf-syndicats/cicf-informatique	Professional body of VSME (< 50 employees) acting as SSO's, SW editors or consulting. 150 companies
Chambers of Commerce	CCI	http://www.cci.fr	Chamber of Commerce and Industry
CERTIFICATION			
Certification Bodies	AFPA	http://www.afpa.fr	National association for professional training
	FAFIEC	http://www.fafiec.fr	The FAFIEC, OPCA Branch of computer science, engineering, consulting…, is to inform and advise businesses, especially SMEs and small businesses, in their efforts to continuing vocational training.
	PCIE (ECDL)	http://www.pcie.tm.fr	European Computer Driving Licence

COUNTRY	FRANCE	POPULATION	65,312,249
Type	**Name**	**Website**	**Specifics**
Accreditation Bodies	AFNOR	http://www.afnor.org/en	National and international operator charted to deliver performance and sustainable development solutions for business and civil society: Standardization, Publishing, Certification, and Training.
	Commission des Titres d'Ingénieurs	http://www.cti-commission.fr/	Accreditation of engineering schools (Grandes Ecoles d'ingénieurs)
	AERES	http://www.aeres-evaluation.com/	Evaluation of institutions, research units, doctoral schools and programmes & degrees
	RNCP	http://www.rncp.cncp.gouv.fr/	National inventory of professional certifications
	Ministère de l'éducation nationale	http://www.education.gouv.fr	Ministry of National Education
Qualification Framework	CNCP	http://www.rncp.cncp.gouv.fr/grand-public/qualificationsFramework	Professional certification authority for both initial and vocational education
E-COMPETENCIES			
Skills Framework	e-CF	http://ecompetences.eu	Common European framework for ICT Professionals in all industry sectors
	CIGREF	http://www.cigref.fr	French IT Job profile framework in user companies (2011 – Information Systems roles in large companies : HR Nomenclature – CIGREF)
	Portail des métiers de l'Internet	http://www.metiers.internet.gouv.fr	National inventory of the professions of the Internet
	ROME	http://www2.pole-emploi.fr/espacecandidat/romeligne/RliIndex.do	Operational Directory of Trades and Jobs
Promoted By	Pasc@line and CIGREF	http://www.cigref.fr	

COUNTRY	FRANCE	POPULATION	65,312,249
Type	**Name**	**Website**	**Specifics**
		http://www.assopascaline.fr	
ETHICS			
Professional Body's Code of Ethics/Conduct	TIC ETHIC ADEME Cercle Ethique des Affaires CNIL	http://www.ticethic.com http://www2.ademe.fr http://www.cercle-ethique.net/ http://www.cnil.fr/english	TIC ETHIC is accompanying implementation strategies respecting the sustainable development (ethics). French Environment and Energy Management Agency Association for Business Ethics CNIL is an independent administrative authority protecting privacy and personal data.

C.9 Finland

COUNTRY	FINLAND	POPULATION	5,259,250 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	The Ministry of Transport and Communications	http://www.lvm.fi/web/en/home	The Ministry of Transport and Communications is responsible for two broad sectors: transport policy and communications policy. In the communications sector, the Ministry takes care of issues relating to communications networks, information security and data protection, information society policy, the mass media, and postal services.
	The Ministry of Education and Culture	http://www.minedu.fi/OPM/Ministerioe_ja_hallinnonala/?lang=en	Within the Government, the Ministry of Education and Culture is responsible for developing education, science, cultural, sport and youth policies, and international cooperation in these fields. The Ministry develops conditions for education, know-how, lifelong learning, creativity and citizens' social participation and well-being.

COUNTRY	FINLAND	POPULATION	5,259,250 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	Ministry of Employment and the Economy	http://www.tem.fi/index.phtml?l=en&s=2072	The Ministry of Employment and the Economy (MEE) is responsible for the operating environment underpinning entrepreneurship and innovation activities, securing the functioning of the labour market and workers' employability, as well as for regional development within the global economy. The sphere of authority of the Ministry of Employment and the Economy includes: industrial policy and innovation and technology policy, internationalization and technical safety of enterprises, amongst others.
Government Agencies/Bodies	Finnish National Board of Education	http://www.oph.fi/english/about_us	Finnish National Board of Education is the agency responsible for the development of education in Finland. Its administrative sector encompasses pre-school and basic education, upper secondary education, basic vocational training, adult education, and liberal adult education, including folk high schools and adult education centres. It also produces services for polytechnics and universities.
	Public Sector ICT	http://www.vm.fi/vm/en/16_ict/index.jsp	This operational unit is responsible for the overall development of public administration information management, e-Government and corporate data, for information management governance in central government and for the coordination of joint development projects. Public sector ICT promotes information management cooperation between central and local government, formulates joint functional and technical solutions and methods and is in charge of overall development of information security in public administration as well as data security governance in central government.
	Kuntien Tiera Oy	http://www.tiera.fi/yritys	Kuntien TIERA Ltd develops and streamlines ICT services of the municipal sector in cooperation with municipalities and other public and commercial actors.
	CSC — IT Center for Science Ltd	http://www.csc.fi/english/csc	CSC — IT Center for Science Ltd is administered by the Ministry of Education, Science and Culture. CSC is a non-profit company providing IT support and resources for academia, research institutes and companies: modeling, computing and information services.
	Tekes - the Finnish Funding Agency for Technology and Innovation	http://www.tekes.fi/en/community/Home/351/Home/473	Tekes works with the top innovative companies and research units in Finland. Every year, Tekes finances some 1,500 business research and development projects, and almost 600 public research projects at universities, research institutes and polytechnics.
	Sitra – the Finnish Innovation Fund	http://www.sitra.fi/en/About+Sitra/sitra.htm	Sitra, the Finnish Innovation Fund has the duty to promote stable and balanced development in Finland, the growth of its economy and its international competitiveness and co-operation. Sitra's responsibilities are stipulated in law.

COUNTRY	FINLAND	POPULATION	5,259,250 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Professional Bodies/National Computing Associations	The Finnish Information Processing Association, FIPA,	http://www.ttlry.fi/in_english/	The Finnish Information Processing Association, FIPA, (Tietotekniikan Liitto ry) is an independent association of Finnish ICT professionals and companies that provide ICT products and services or use them. FIPA has currently about 16 000 professionals and more than 500 companies as members. They are organised as 27 individual FIPA member associations. FIPA is the national member of CEPIS.
	Tieto- ja viestintäteollisuuden tutkimus TIVIT Oy	http://www.tivit.fi/en/company	TIVIT is committed to ensuring even more rapid development of Finnish ICT know-how. The aim is both to increase the speed with which new innovations reach the market and also to increase the know-how and promote the growth of both companies and research communities.
	The Federation of Finnish Technology Industries	http://www.teknologiateollisuus.fi/en/	The mission of the Federation of Finnish Technology Industries is to ensure that the Finnish technology industry has the preconditions for success in the global marketplace.
	The Finnish Software Entrepreneurs Association	http://www.ohjelmistoyrittajat.fi/in-english	The Finnish Software Entrepreneurs Association is a non-aligned association for innovative, professional, growth-driven and entrepreneurial software business executives. Association drives the success of software business as an industry and supports individual software companies in their road to success.
	TIEKE Finnish Information Society Development Centre	http://www.tieke.fi/in_english/about_tieke/	TIEKE Finnish Information Society Development Centre has a key networking role as a neutral and non-profit organisation in promoting the efforts of its members, within the public and private sectors alike, with an ultimate goal to create viable tools and expertise for use in the information society.
	Finnish Federation for Communications and Teleinformatics, FiCom	http://www.ficom.fi/inbrief/index.html	Finnish Federation for Communications and Teleinformatics, FiCom is a co-operation organisation for the ICT industry in Finland and looks after its interests.
	Culminatum Innovation Oy Ltd	http://www.culminatum.fi/en/sivu.php?id=3	Culminatum Innovation Oy Ltd is a development company owned by the Uusimaa Regional Council, the cities of Helsinki, Espoo and Vantaa, and the universities, polytechnics, research institutes and the business community of the Helsinki region.
	Electronic Frontier Finland – EFFI ry	http://www.effi.org/index.en.html	Electronic Frontier Finland ry (EFFI) was founded in 2001 to defend active users and citizens of the Finnish society in the electronic frontier. EFFI influences legislative proposals concerning e.g. personal privacy, freedom of speech and user rights in copyright law. EFFI also works in close cooperation with organizations sharing the same goals and values in Europe, the United States and elsewhere. EFFI is a founding member of the European Digital Rights (EDRi).

COUNTRY	FINLAND	POPULATION	5,259,250 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	COSS	http://www.coss.fi/en/about	COSS (the Finnish Centre for Open Source Solutions), founded in 2003, is a national development agency for the open source business ecosystem in Finland and the number one gateway to Finnish open source. COSS promotes the development and adoption of managed and sustainable open source solutions in various industries and public sector.
Trade Unions	The Central Organisation of Finnish Trade Unions - SAK	http://www.sak.fi/english/whatsnew.jsp?location1=1&lang=en	The Central Organisation of Finnish Trade Unions – SAK is the oldest employee confederation in Finland. Nowadays SAK represents the interests of more than one million members in 21 affiliated trade unions.
	The Finnish Confederation of Professionals STTK	http://www.sttk.fi/en-GB/	The Finnish Confederation of Professionals STTK is one of the three trade union confederations in Finland. STTK was founded in 1946.
	Akava - Confederation of Unions for Professional and Managerial Staff in Finland	http://www.akava.fi/en/	Akava, The Confederation of Unions for Professional and Managerial Staff in Finland, is a trade union confederation for those with university, professional or other high-level education.
Chambers of Commerce	Finland Central Chamber of Commerce	http://www.keskuskauppakamari.fi/site_eng/About-us	Finland Chamber of Commerce together with the regional Chambers helps businesses succeed in Finland and in international markets.
CERTIFICATION			
Certification Bodies	The Finnish Standards Association, SFS	http://www.sfs.fi/en/	The Finnish Standards Association SFS is an independent, non-profit organization co-operating with trade federations and industry, research institutes, labour market organizations, consumer organizations, and governmental and local authorities. Members of SFS include professional, commercial and industrial organizations, and the state of Finland represented by the ministries.
Accreditation Bodies	Finnish Software Testing Board FiSTB	http://www.fistb.fi/	FiSTB represents ISTQB in Finland.
	Finnish Software Measurement Association FiSMA	http://www.fisma.fi/in-english/	Finnish Software Measurement Association FiSMA is an independent registered association focusing on better management through improving the quality and measurability of software and systems engineering. FiSMA's membership is intended for all companies, research units, universities and other institutes interested in software measurement.
	FINAS (Finnish Accreditation Service)	http://www.mikes.fi/frameset.aspx?url=finas.aspx%3fcategoryID=2&langID=uk	FINAS (Finnish Accreditation Service) is according to the law (921/2005) a national accreditation body responsible for organising the accreditation activities according to international criteria. FINAS offers accreditation services for testing and calibration laboratories, inspection bodies, certification bodies, providers of proficiency testing, GHG and EMAs verifiers.

COUNTRY	FINLAND	POPULATION	5,259,250 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Qualification Framework	The National Framework for qualifications and other learning in Finland	http://www.oph.fi/mobility/qualifications_frameworks	A committee appointed by the Ministry of Education has completed its proposal for a National Framework for qualifications and other learning. According to the proposal, the National Framework consists of eight levels, similar to the EQF. The Framework describes the competence required by Finnish qualifications in terms of knowledge, skills and competences based on the EQF level descriptions, while further specifying the EQF level descriptions from a national perspective.
E-COMPETENCIES			
Skills Framework	IT Service Management Forum Finland	http://www.itsmf.fi/	itSMF Finland is part of itSMF international. itSMF is a forum for IT Service Management professionals and decision-makers worldwide.
	The Association of Finnish eLearning Centre	http://www.eoppimiskeskus.fi/en	The Association of Finnish eLearning Centre is an independent national association that promotes sharing of knowledge, best practices and quality in eLearning. The Centre distributes information and acts as a contact surface for partner finding, such as experts and service providers, in the Finnish eLearning market.
ETHICS			
Professional Body's Code of Ethics/Conduct	Code of Ethics for FIPA is currently being updated in line with the Working Group SIG9.2.2: IFIP Framework on Ethics of Computing	This code can be found In Finnish at http://www.ttlry.fi For translation, please contact Kai Kimppa, kai.kimppa@it.utu.fi http://www.info.fundp.ac.be/~jbl/IFIP/cadresIFIP.html	In late 1993 the Finnish information processing association (FIPA) ethics group was established. Its main purpose was to create a code of ethics for the association. This was accomplished in 1995. After getting the first code of ethics ready, the members of the ethics group devoted their attention to teaching about IT and ethics in various educational institutes ranging from FIPA member groups to universities. This is one of the main reasons universities in Finland teach IT and ethics as part of their curriculum in departments of information technology. Members also wrote articles to professional magazines. The code also went under a revision and the new code was ready in 2002. There are no sanction procedures to enforce the current code, nor was there one for the previous code.

C.10 Germany

COUNTRY	GERMANY	POPULATION	81,802,000 (Germany Federal Statistics Office – Dec 2009)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Federal Ministry of Economics and Technology	www.bmwi.bund.de	Specific objective for the Ministry in promoting new technologies and innovation to maintain economic competitiveness.
	Federal Ministry of Education and Research	www.bmbf.de	The promotion of education, science and research by the Federal Ministry of Education and Research represents an important contribution to securing the country's prosperity.
	Federal Ministry for Labour and Social Affairs	www.bmas.de	One of the areas the ministry is responsible for is creating a strong framework for more jobs by focusing on the maintenance & fostering of well-trained and highly-motivated workers in the workforce to enable/ maintain competitive advantage for Germany.
Government Agencies/Bodies	BIBB	www.bibb.de	Federal Institute for Vocational Education and Training
	Federal Employment Agency	www.arbeitsagentur.de	Agency is the operational unit of the Federal Ministry for Labour and Social Affairs. Offers some services on the labour and training market for unemployed citizens.
Professional Bodies/National Computing Associations	GesellschaftfürInformatik e.V. (GI) (Society for Computer Science)	www.gi.de	Motivates & develops the scientific discipline and promotes the impact of informatics on the economy, business and society. GI is a member of CEPIS.
	InformationstechnischeGesellschaftimVerband der ElektrotechnikElektronikInformationstechnik (VDE) (Association for Electrical, Electronic & Information Technologies)	http://www.vde.com/	VDE, the Association for Electrical, Electronic & Information Technologies is one of the largest technical and scientific associations in Europe with more than 34,000 members. VDE is a member of CEPIS.
	BITKOM	www.bitkom.org	Federal Association for Information Technology, Telecommunications and New Media. Industry Society. Counterpart of GI and VDE
	Professional Association for IT Consultants (Certified)	http://www.bvsi.de/	An Organization for Professionals in Computer Science which is targeted at Freelancers in particular. This is one of many organizations of this nature.

COUNTRY	GERMANY	POPULATION	81,802,000 (Germany Federal Statistics Office – Dec 2009)
Type	**Name**	**Website**	**Specifics**
Trade Unions	Ver.di GEW IGM	www.verdi.de www.gew.de www.igmetall.de	United Services Union For School and Education workers as well as the admin force in academia. IG Metall – includes workers in the information technology area.
Chambers of Commerce	German Chambers of Commerce.	www.ahk.de	AHK in partnership with BMWI develops German business interests abroad
CERTIFICATION			
Certification bodies: Privately owned and governmental accredited	CERT-IT	www.cert-it.com/en/home/	Certification Authority for ICT Sector (permit grated by DAkks and by Federal Employment Agency 2010). Products ITIL, Certified Tester, IT Specialists ISO 17024 (= AITTS), QM Specialists ISO 17024, QM Sytems ISO 9001:2008, AZWV Accreditation
Non-gov'l accredited	DEKRA, TUEV, among others DLGI	www.dekra.de www.dlgi.de	Develops Solutions for Vocational Education and Future training (wrt Management Training QM and PM) ECDL, ClickITSafe, You start IT, IT Tech
Accreditation Bodies	DAkkS	w.dakks.de/ueber_die_dakks	German Accreditation Service (GmbH) includes certification for Management Systems and People
Qualification Framework	GQF – German Qualifications Framework (often referred to as DQR)	http://www.deutscherqualifikationsrahmen.de	German Qualification Framework including Lifelong Learning. Based on the EQF.
E-COMPETENCIES			
Skills Framework	AITTS	www.aitts.de	Advanced IT Training System. With this certification according to ISO 17024, you have expertise in one of the 14 IT Specialists profiles, not only in theory but in practice based on real projects.
Promoted By	GesellschaftfürInformatik e.V. (GI) / German Informatics Society (GI)	www.gi.de	Analyses, motivates & develops the scientific discipline and promotes the impact of informatics on government, economy, business and society.
ETHICS			
Professional Body's Code of Ethics/Conduct	GI Ethical Guidelines	www.gi.de/wir-ueber-uns/unsere-grundsaetze/ethische-leitlinien.html	

C.11 Greece

COUNTRY	GREECE	POPULATION	10,760,136 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Infrastructure, Transport and Networks	http://www.yme.gr/index.php?getwhat=1&oid=531&id=&tid=531	The Ministry of Infrastructure, Transport and Networks plans and implements national policy for the development of transport, mass-transit, telecom and postal services; promotes the Information Society; and contributes to the country's economic development.
	Ministry of Development	http://www.ypan.gr/structure_uk_c.htm	The General Secretariat for Research and Technology of the Ministry of Development supports the research activities of both the scientific research institutes and its productive industry; promotes the transfer and dissemination of advanced technologies throughout the country's productive sector; contributes to the reinforcement of the country's research manpower; promotes cooperation with other countries and international organisations on research and technology issues; establishes new institutes and technological centres in support of sectors of high priority for the development of the Greek economy; supervises and provides support for 21 of the country's best-known research and technological centres; supports the dissemination of research and technology information throughout the country and internationally; and encourages activities aimed at raising awareness of the general public about research and technology issues.
	Ministry of Education, Lifelong Learning and Religious Affairs	http://www.minedu.gov.gr/	Formerly the Ministry for National Education and Religious Affairs, it is responsible for Education, Lifelong Learning policies and Religious Affairs.
	Ministry of Employment and Social Security	http://www.ypakp.gr/	Responsible for Employment Policy, Industrial Relations, Social Security, Social Protection, and Health and Safety at Work.
Government Agencies/Bodies	The Federation of Hellenic Information Technology & Communications Enterprises (SEPE)	http://www.sepe.gr/en/AboutSEPE	A non-profit organisation, established in 1995. Over 400 companies are currently members of SEPE and collectively they hold more than 95% of the country's turnover in the Information Technology and Telecommunication Industry. The main objectives of SEPE are to promote Information and Communications Technologies (ICT) in Greece and to enlarge ICT Industry's market. SEPE also represents the interests of the Greek ICT Enterprises vis-à-vis the Greek Government, the European Commission and other bodies of influence.

COUNTRY	GREECE	POPULATION	10,760,136 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	Department of Information Technology and Communications of the Technical Chamber Greece (e-TEE)	http://www.e-tee.gr/index.php?option=com_content&view=frontpage&Itemid=1	Created in order to effectively promote the institutional role of the Technical Chamber Greece (TEE) as adviser to the Greek State in the area of ICT. The Objective of e-TEE is to contribute decisively in the formulation of effective policies in the area of ICT, in the development and use of ICT induced added-value, as well as in the promotion of the profession of the ICT scientists in Greek society.
	The Research Academic Computer Technology Institute (RA-CTI)	http://www.cti.gr/index.php?option=com_frontpage&Itemid=273	Founded as the "Computer Technology Institute" in 1985, since 1992 it is supervised by the Ministry of Education and Religious Affairs, and constitutes an independent institution at the financial, administrative and scientific level. The objectives of RA-CTI are: To conduct basic and applied research in hardware and software technology, networks and the socio-economic impacts of the Information Society; To design and develop products and services; To support all forms of education and training with respect to Information and Communication Technologies; To develop technology and to transfer know-how.
Professional Bodies/National Computing Associations	Hellenic Professionals Informatics Society (HePIS)	http://www.hepis.gr/	HePIS is the network that brings together all categories of professionals in the ICT market in Greece. It promotes their professional interests and develops their professional recognition. HEPIS aims to promote a culture of the professional and scientific interests of its members through the creation of a framework for a permanent and constructive dialogue, as well as the interest representation and the support of professionals and scientists active in the ICT sector in Greece. HePIS is the only member of CEPIS in Greece.
	Greek Computer Society (EPY)	http://www.epy.gr/	GCS fosters the establishment and observation of evaluation criteria for ICT Professionals. It promotes the facilitation of development and learning of interested parties through publication of articles, magazines, books and other published forms, the organisation and operation of a digital library, the organisation of lectures, seminars, congresses and other scientific activity. It seeks to contribute to the general knowledge of the public with regard to its familiarization with the terminology, the operation and the offered possibilities of ICT. It seeks to and will contribute to a use of ICT geared towards the benefit of society at large. GCS is the Greek member of IFIP.
	Union of Engineers of Information Technology and Communications of Greece ([EMiPEE])	http://www.computer-engineers.gr/index.php	The Union of Engineers of Information Technology and Communications of Greece exists in order to create the conditions for the promotion of Information technology, developing forces of Computer specialists and satisfying their labour and scientific needs. It represents computer specialists in all fields of their interests.

COUNTRY	GREECE	POPULATION	10,760,136 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Trade Unions	The General Confederation of Greek Workers (GSEE)	http://www.gsee.gr/	The General Confederation of Greek Workers (GSEE) is the highest, tertiary trade union body in Greece. GSEE is made up of 83 worker unions and 74 departmental secondary confederations. Its prime purpose is defending the interests of all workers in Greece, in the private sector.
	The Civil Servants' Confederation (ADEDY)	http://www.adedy.gr/adedy/site/home/ws.csp?loc=en_US	The Civil Servants' Confederation (ADEDY) is a trade union center in Greece. It is affiliated with the European Trade Union Confederation.
	The All-Workers Militant Front (PAME)	http://www.pamehellas.gr/main.php?lang=2	The All-Workers Militant Front is a coordination center within the Greek trade union movement, founded on the initiative of Communist Party of Greece trade-unionists in April 1999. According to its website, the trade unions that are affiliated in PAME have 415,000 members in total as of 2005. PAME is internationally affiliated with the World Federation of Trade Unions.
Chambers of Commerce	The Athens Chamber of Commerce and Industry (ACCI)	http://www.acci.gr/acci/Home/tabid/28/language/en-US/Default.aspx	ACCI's mission is to assist the Government in the fields of commerce, industry, services and general development policy. Its Department of Information & Communication Technologies is responsible for: 1. Covering ACCI's computer ICT needs in terms of analysis, design, planning, documentation standards and application development. 2. Software, hardware and network maintenance and technical support. 3. Maintenance and operation of ACCI's internet node, EBR network and linkage with external Data Banks to provide information to ACCI's members, aiming at fostering entrepreneurship. 4. Reviewing European and National programmes related to new Information and Communications Technologies to consider possible participation.
	The Union of Hellenic Chambers of Commerce and Industry (UHC)	http://www.uhc.gr/newsite/english/index.php?menu=main_menu&page=home	UHCC members are all 59 Chambers covering the entire country. The Union represents the Chambers at home and abroad and expresses their positions and a component of their views. The UHCC represents our country's entire business world: namely 880 thousand Hellenic enterprises.
CERTIFICATION			
Certification Bodies	PEOPLECERT	http://www.peoplecert.org/en/Pages/peoplecert.aspx	With more than 3,000,000 certificates issued to date, PEOPLECERT Group offers independent, globally recognized certifications that evaluate competence, know-how and expertise. PEOPLECERT operates worldwide, with 142 employees and 1,000 associates, through 8,850 global examination locations, including the extensive network of Pearson VUE. With internationally recognized brands such as ITIL®, IASSC Lean Six Sigma, ECDL, City & Guilds, CEEL and a wide portfolio of market driven PEOPLECERT certifications based on specific industry requirements and globally recognized ISO standards.

COUNTRY	GREECE	POPULATION	10,760,136 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	Info test	http://www.infotest.gr/	Infotest is active in Greece since 2003 and has exclusivity in the provision of Certiport certifications.It provides the following certifications: Microsoft Certified Application Specialist, Microsoft Office Specialist, IC3, Adobe Certified Associate, CompTIA, Infotest Certified Basic User, Infotest Certified CAD Specialist, Infotest Certified Joomla Specialist and @kids.
	I-Skills S.A.	http://www.i-skills.gr/index.php?lang=en	The company I-Skills (Society Anonyme for the Certification of Skills S.A. – I-Skills S.A.) was established in 2007, aiming at providing a thorough range of certification services in the field of education and vocational training for individuals and companies in Greece and neighboring countries. I-Skills S.A. provides the following Certifications: I-SKILLS Cad 2 Basic; I-SKILLS Network ; I-SKILLS Multimedia Content Authoring; I-SKILLS Project Manager; I-SKILLS ERP FI User; I-SKILLS Web Developer; I-SKILLS DB Admin - SQL Server;I-SKILLS Web Designer; I-SKILLS Network Admin; I-SKILLS System Security
	ICT Europe	http://www.icteurope.gr/index.php	International Computer Technology is a Skills Certification programme for the use and knowledge of Computer and Information Technology at introductory, basic and specialized levels. It has a presence in Greece, in Cyprus and in Albania, since 2004 and provides the following Certifications:.ict Intermediate; ict Foundation; ict Master In Office; ict Advanced; and ict Professional Training
	Aristotle Certification Training & Assessment	http://www.acta.edu.gr/en/acta/index.php	The ACTA Spin off Aristotle University of Thessaloniki, having acquired know-how in certifying computer knowledge offers reliable computer certifications, adopting and implementing reliable and fair examination procedures in accordance with the requirements of International Standards ELOT EN ISO / IEC 17024. ACTA provides the following certifications: CTNP, CWNP, CCITEE, CompTIA Strata IT Fundamentals, Certified Computer Programmer (CCP), Certified Java Programmer (CJP), Certified Data Base Designer (CDBD), Certified Information Security Professional (CISP), CELM, Infotest Certified Joomla Specialist, Certified E-commerce Consultant (CEC), and Certified Project Manager in Information Technology (CPMIT).
	Vellum	http://www.vellum.org.gr	Vellum Educational Services provides solutions to bridge the gap between educational programmes and assessment procedures in Greece, Cyprus and the Balkans. The company has been a Cambridge associate partner since 2003. It provides a series of certifications based on the International Diploma in IT skills Standard programme.
Government Accreditation Bodies	The National Accreditation Centre for Continuing Vocational Training (EKEPIS)	http://www.ekepis.gr/main/Aboutus/tabid/124/Default.aspx	EKEPIS is a statutory body supervised by the Ministry of Education, Lifelong Learning and Religious Affairs with administrative and financial autonomy. The Centre's mission is to develop and implement the National Accreditation System for Continuing Vocational Training.

COUNTRY	GREECE	POPULATION	10,760,136 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	The Hellenic Accreditation System S.A. (ESYD)	http://www.esyd.gr/portal/p/esyd/en/index.jsp	The Hellenic Accreditation System S.A., under the distinctive title ''ESYD'', was established in 2002 and succeeded the Hellenic Accreditation Council. ESYD is a private liability company operating in favour of the public interest with the responsibility of the management of the accreditation system in Greece.
	EOPP	http://www.eopp.gov.gr/index.php/home/eopp-who-we-are	EOPP is an autonomous legal entity, supervised by the Ministry of Education, Lifelong Learning and Religious Affairs. It has administrative and economic independence. It implements the targets of the National Vocational Education and Training System and has the overall responsibility for the Vocational Training Institutes which have been operating in Greece since 1992. It recognizes and qualifies the professions which correspond to vocational education and training. In addition, EOPP regulates the professional rights of the diploma holders of secondary vocational education and post-secondary vocational training and provides degree equivalences up to the level of secondary vocational education and post-secondary vocational training to foreigners who come to work in Greece.
Qualification Framework	The Hellenic Qualifications Framework	http://www.nqf.gov.gr/	The National Qualifications Framework uses 8 levels of reporting, that are based on learning outcomes describing what the individual knows, comprehends and is capable of doing after the completion of the training process.
E-COMPETENCIES			
Skills Framework	There is no developed national ICT Skills Framework.		
Promoted By			
ETHICS			
			Ongoing efforts involving various Bodies seek to create and apply a Code of Ethics/ Professional Conduct for the Greek scientists in the ICT sector. The Code has been in development for some time but has not been produced yet.

C.12 Hungary

COUNTRY	HUNGARY	POPULATION	9 972 000
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of National Resources – State Secretary for Education	http://www.kormany.hu/hu/nemzeti-eroforras-miniszterium/oktatasert-felelos-allamtitkarsag	
	Ministry of National Development – State Secretary for Info-communication	http://www.kormany.hu/hu/nemzeti-fejlesztesi-miniszterium/infokommunikacioert-felelos-allamtitkarsag	
	Ministry for National Economy – State Secretary for Employment Policy	http://www.kormany.hu/hu/nemzetgazdasagi-miniszterium/foglalkoztataspolitikaert-elelos-allamtitkarsag	
	Educational Authority	http://www.oh.gov.hu/	Within the Ministry of National Resources
	Hungarian Institute for Educational Research and Development	http://www.ofi.hu/	Within the Ministry of National Resources
	Educatio Nonprofit Kft.	http://www.educatio.hu	Within the Ministry of National Development
Government Agencies/Bodies	Government IT Development Agency	http://www.kifu.gov.hu/index.php?lang=eng	Within the Ministry of National Development
	National Innovation Agency	http://www.nih.gov.hu/english	Within the Ministry for National Economy
Professional Bodies/National Computing Associations	NJSZT	http://njszt.hu/en	John von Neumann Computer Society (Hungary) is the Hungarian CEPIS member.
	IVSZ	http://ivsz.hu/	Hungarian Association of IT Companies

COUNTRY	HUNGARY	POPULATION	9 972 000
Type	**Name**	**Website**	**Specifics**
Trade Unions			No relevant ICT related Trade Union activity.
Chambers of Commerce	MKIK AmCham Hungary	http://www.mkik.hu/index.php http://www.amcham.hu	Hungarian Chamber of Commerce and Industry American Chamber of Commerce in Hungary
CERTIFICATION			
Certification Bodies	National Institute of Vocational Education Hungarian Institute for Educational Research and Development	https://www.nive.hu/english_version/index.php http://www.ofi.hu/appendix-090617-1/description-of-hungarian	Within the Ministry for National Economy Hungary uses the ISCED Levels to certify all education. (International Standard Classification of Education – maintained by UNESCO)
Accreditation Bodies	Hungarian Accreditation Committee	http://www.mab.hu/english/index.html	Independent body responsible for oversight on quality of Higher Education in Hungary
Qualification Framework	National Qualifications Framework	www.oh.gov.hu http://www.ofi.hu/kiadvanyaink/orszagos-kepesitesi	National training framework system
	National Qualifications Register	www.oh.gov.hu/letolt/nemzet/naric/okj_angol.pdf http://www.nive.hu/english/okj/insteuction.doc	List of Qualifications register
E-COMPETENCIES			
Skills Framework	There is no developed national ICT Skills Framework.		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	NJSZT	http://njszt.hu/neumann/dokumentumok/njszt-etikai-kodex	John von Neumann Computer Society (Hungary)

C.13 Ireland

COUNTRY	IRELAND	POPULATION	4, 470, 700 (CSO April, 2010 estimate)
Type	**Name**	**Website and Contact Details**	**Specifics**
GENERAL			
Government Departments	Department of the Taoiseach	http://www.taoiseach.gov.ie/	Supports Government operations, and leadership, co-ordination and strategic direction of government policy.
	Department of Education and Skills	http://www.education.ie/	Works to provide high-quality education. Promotes equity, inclusion and lifelong learning. Enhances capacity for service delivery, policy formulation, research and evaluation.
	Department of Enterprise, Trade and Innovation	http://www.deti.ie/	Mission is to drive Ireland's competitiveness and productivity.
	Department of Communications, Energy and Natural Resources	http://www.dcenr.gov.ie/	Objectives regarding telecommunications include contributing to macro-economic growth by promoting investment in infrastructures, developing R&D reputation in ICT etc.
Government Agencies/Bodies	FAS	http://www.fas.ie/	Ireland's national training and employment authority. It enhances skills and competencies, provides tailored training and employment programmes.
	Forfas	http://www.forfas.ie/	Ireland's policy advisory board for enterprise, trade, science, technology and innovation. Provides independent research and support; ensures coherence of policies; and evaluates enterprise policy interventions.
	Expert Group on Future Skills Needs (EGFSN)	http://www.skillsireland.ie/	Advises the Irish Government on current and future skill needs and other labour market issues.
Professional Bodies/National Computing Associations	The Irish Computer Society (ICS)	http://www.ics.ie/	Founded in 1967, the ICS is the national body for ICT Professionals in Ireland. It is a member of CEPIS and IFIP.
Trade Unions	Irish Congress of Trade Unions (ICTU)	http://www.ictu.ie/	Mission is to achieve economic development, social cohesion and justice through organising workers in unions and engaging with Government, employers, and other groups.
Chambers of Commerce	Chambers Ireland	http://www.chambers.ie/	Ireland's largest business organisation, with 60 member chambers representing over 13,000 businesses.
CERTIFICATION			
Certification Bodies	ICS Skills	http://www.ics-skills.ie/	ICS Skills, established in 1997, is the not-for-profit skills division of the ICS. To date, more than 17% of the Irish working population has undertaken an ICS Skills certification.

COUNTRY	IRELAND	POPULATION	4, 470, 700 (CSO April, 2010 estimate)
Type	**Name**	**Website and Contact Details**	**Specifics**
	National Standards Authority of Ireland	http://www.nsai.ie	NSAI is Ireland's official standards body. It is the national certification authority for CE Marking and provides a certification service to enable business demonstrate that Irish goods and services conform to applicable standards.
Accreditation Bodies	Irish National Accreditation Board (INAB)	http://www.inab.ie/	The national body responsible for accrediting laboratories, certification bodies and inspection bodies in Ireland, in accordance with ISO and European standards.
	Higher Education and Training Awards Council (HETAC)	http://www.hetac.ie/	The qualifications awarding body for third level institutions outside of the university sector. It awards qualifications, sets standards, accredits programmes, and provides quality assurance.
	Further Education and Training Awards Council (FETAC)	http://www.fetac.ie/	The statutory awarding body for further education and training. It provides recognition for learning in education/ training centres, the workplace and community.
Qualification Framework	National Qualification Framework (NQF) referenced to EQF	http://www.nqai.ie/	Irelands NQF launched in 2003, has 10 levels, and now includes the majority of national awards. Ireland was the first EU Member State to reference its NQF to the EQF.
E-COMPETENCIES			
Skills Framework	SFIA as part of SkillsCert programme	http://www.ics.ie/index.php/skills-certification.html http://www.sfia.org.uk/	Skills Cert is an accreditation framework for IT job skills. Skills Cert uses SFIA in profiling an individual's competency on a range of ICT skills. This assessment is validated internally and certification is awarded following external validation.
Promoted By	ICS Skills	http://www.ics-skills.ie/	-
ETHICS			
Professional Body's Code of Ethics/Conduct	ICS Professional Code of Conduct	http://www.ics.ie/index.php/code-of-professional-conduct.html	All ICS members subscribe to a code of conduct which has principles in five specific areas.

C.14 Italy

COUNTRY	ITALY	POPULATION	60,605,05 (Nov 2010 estimated)
	Name	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry for Education, University and Research	www.istruzione.it	Includes the portfolios of Education, University and Research.
	Ministry for Labor & Social Policy	www.lavoro.gov.it	Involved in the NQF initiative (involved with ISFOL).
	Ministry for Economic Development	www.sviluppoeconomico.gov.it/	Includes responsibility for policies for the development of technological innovation, and the area of telecommunications.
Government Agencies/Bodies	DigitPA	www.digitpa.gov.it/	National Agency for Informatics in Public Administration.
	CNEL	www.cnel.it	Consiglio Nazionale dell'Economia e del lavoro – CNEL is a "constitutional" body, under the auspices of the President of the Republic. CNEL is an independent (from Government) body whose mission is to influence and monitor Governmental actions. It has been active in the fields of Standardisation, e-Competences and e-Certificates.
	ISFOL	www.isfol.it/	Institute for the development of Vocational training (for Workers)
	CLICLavoro	www.cliclavoro.gov.it	New portal for the ministry of labor and social policies (Services and work exchange)
Professional Bodies/National Computing Associations	AICA	www.aicanet.it/	Italian association for Informatics & Automatic Computing (promotes the EDCL and EUCIP ICT Certification programs). Member of CEPIS.
	AIPSI	www.aipsi.org/	Italian association for Security professionals and Italian Chapter of ISSA (Information Systems Security Association).
	FIDA	www.fidainform.org/	National Federations of Information Management Professional Association. (various regional CTI or CLUB IT are included)
	ANIPA	www.anipa.it/	National Association of Public Administration (includes job profile definitions and continuous education for people in the IT Industry.)

COUNTRY	ITALY	POPULATION	60,605,05 (Nov 2010 estimated)
	Name	**Website**	**Specifics**
Trade Unions	CISL CGIL UIL	www.cisl.it www.cgil.it www.uil.it	Confederation of Trade Unions in Italy Italian General Confederation of Labor Italian Workers Union
Chambers of Commerce	Italian Chambers of Commerce.	www.chamberofcommerce.it	Portal for Chambers of Commerce, Industry, Agriculture and Crafts.
CERTIFICATION			
Certification Bodies	AICA CEPAS EXIN	www.aicanet.it/ www.cepas.it/ www.exin-exams.com/	Italian association for Informatics & Automatic Computing. (Support and involvement with EUCIP and EDCL). Member of CEPIS. Certification of Professional Training (in the area of ISO/IEC 17024 – Internal and Quality auditing) International Organization involved in distributing Exams to the IT professional (ISO Certified – focus on ITIL, Prince2, ITSM and Information Security)
Accreditation Bodies	ISFOL UNI	www.isfol.it/ www.uni.com/	Institute for the development of Vocational training Italian Organization for Standardization (includes technological innovation)
Qualification Framework	QTI (Italian Qualifications Framework)	http://www.quadrodeititoli.it	Framework for Qualifications for European Higher Education Area.
E-COMPETENCIES			
Skills Framework	EeCF	http://www.ecompetences.eu/	The European e-competencies framework (NOTE: Italy is working to converge with EeCF and EUCIP).
Promoted By	AICA	www.aicanet.it/	Italian Association for Informatics & Automatic Computing
Promoted by	FCD	www.forumcompetenzedigitali.org	Forum Competenze Digitali
ETHICS			
Professional Body's Code of Ethics/Conduct	ANIPA	http://www.anipa.it/index.php?option=com_content&view=article&id=16&Itemid=28	Code of Ethics for National Association Public Administration & people who are engaged in IT Industry.

C.15 Latvia

COUNTRY	LATVIA	POPULATION	2,217,969 (July 2010 Estimate)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education and Science Ministry for Economics Ministry of Welfare	izm.izm.gov.lv www.em.gov.lv www.lm.gov.lv/	Includes portfolios of Education, Sciences, Sport and state languages. Included in portfolio is the medium to long-term vision of the Labour market. Includes the area of Labour Affairs.
Government Agencies/Bodies	AIC AIKNC LIAA NVA	www.aic.lv/ www.aiknc.lv www.liaa.lv www.nva.gov.lv	Academic Information Centre (NCP for EQF) Higher Education Quality Evaluation Centre (referred to HEQEC in English) Latvian Investment and development agency (supports and administers ICT education programmes for SMEs) State employment agency, administers ICT programmes for unemployed and underemployed
Professional Bodies/National Computing Associations	LIKTA LDTA LETERA	www.likta.lv/ www.itnet.lv/ www.letera.lv	Latvian Information Technology and Telecommunications Association. Member of CEPIS. (Promotes ECDL). Association of Computer Technologies of Latvia (Both are Members of ITTE ALLIANCE – includes LIA (Latvian Internet Association). Latvian Electrical Engineering and Electronics association
Trade Unions	LBAS LIZDA LDDK	www.lbas.lv/ www.lizda.lv/ www.lddk.lv	Free Trade Union Confederation of Latvia (LBAS) – incorporates 21 different braches & trade unions Latvian Trade Union of Education and Science Employees (unites over 34,000 members, active about 20 years) Employers Confederation of Latvia: Supports definition of e-competences framework and activities initiated by Employers. Social partners to government of Latvia to define employers' needs for education. (LIKTA is a member of LDDK)
Chambers of Commerce	LCCI	www.chamber.lv	Latvia Chamber of Commerce and Industry.

COUNTRY	LATVIA	POPULATION	2,217,969 (July 2010 Estimate)
Type	**Name**	**Website**	**Specifics**
CERTIFICATION			
Certification Bodies	AIKNC (HEQEC in English)	www.aiknc.lv	Higher Education Quality Evaluation Centre (referred to HEQEC in English)
Accreditation Bodies	VIAA (SEDA in English)	www.viaa.gov.lv	State Education Development Agency – Implement National Policy in relation to EU programmes & policy
Qualification Framework	AIC	www.aic.lv/	Academic Information Centre (NCP for EQF)
E-COMPETENCIES			
Skills Framework	AIC	www.aic.lv/	Academic Information Centre (NCP for EQF)
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	LIKTA	www.likta.lv/	Latvian Information Technology and Telecommunications Association. Not published on external website. It is published in the Intranet for members however.

C.16 Lithuania

COUNTRY	LITHUANIA	POPULATION	3,221,200 (June 2011)
Type	**Name**	**Website and Contact Details**	**Specifics**
GENERAL			
Government Departments	Ministry of Education and Science	http://www.smm.lt/en/index.htm	Objectives include implementing the national system of formal and non-formal education, creation of conditions for lifelong learning, and implementation of state policy, administration of education and science, modernisation of national system of research and studies.

COUNTRY	LITHUANIA	POPULATION	3,221,200 (June 2011)
Type	**Name**	**Website and Contact Details**	**Specifics**
	Ministry of Economy	http://www.ukmin.lt/en/About/	Responsible for development of the country's long term strategy for economic growth, enhanced competitiveness and promoting employment and human capital investment.
	Ministry of Social Security and Labour	http://www.socmin.lt/index.php?-973177706	The key objectives of the Ministry of Social Security and Labour are to implement the national policies on employment relations, remuneration and social partnership, occupational safety and health, labour market and employment, development of human resources and vocational training, etc.
	Science Council of Lithuania	http://www.lmt.lt/	Competitive research funding (distributing funds to researchers), evaluation of research activities in Lithuania, development of scientific resources in Lithuania
Government Agencies/Bodies	Administrative Office of Social Care Institutions	http://www.sgiat.lt	State-owned institution under the Ministry of Social Security and Labour. It aims to administer 38 governmental social care enterprises, training and certification of social workers, etc.
	Lithuanian Labour Exchange	http://www.ldb.lt/en/Information/About/Pages/open_for_everyone.aspx	It offers vocational training, public works, works financed from the Employment Fund, starting of one's own business, job clubs, etc.
	Agency for Science, Innovation and Technology (MITA)	http://www.mita.lt/en/istaigos-veiklos-informacija/about-mita/	The main activity is the coordination of national (high-tech, industrial biotechnology) and international programmes (FP7, EUREKA, EUROSTARS, CIP) of research, technological development and innovation and other financial schemes. MITA also promotes business and science cooperation, commercialization of research and protection of intellectual property rights.
Professional Bodies/National Computing Associations	Lithuanian Computer Society (LIKS)	http://www.liks.lt/en/modules/tinycontent/?id=1	A voluntary and independently acting social association of computer and software users, specialists and amateurs in informatics and computer science. Since 1998 LIKS is a member of CEPIS. Since 2001, LIKS is a member of IFIP.
	Infobalt Association	http://www.infobalt.lt	Infobalt Association unites Lithuanian IT and Telecommunication companies, represents and defends their interests in Lithuania and abroad, and pursues creation of conditions for the growth of the ICT industry.
Trade Unions	Lithuanian Trade Union Confederation	http://www.lpsk.lt/en/	Largest Trade Union centre in Lithuania; comprises twenty-six branches. Set up in May 2002. It is a member of International Trade Union Confederation, European Trade Union Confederation and cooperates with the International Labour Organization.
Chambers of Commerce	Association of Lithuanian Chambers of Commerce	http://www.tradepartner.eu/commerce/lithuania	Co-ordinates activities of the Chambers in formulating strategy for development of the Chamber system; formulates the overall strategy for international economic co-operation; represents Chambers with foreign entities, in trade fairs, conferences etc

COUNTRY	LITHUANIA	POPULATION	3,221,200 (June 2011)
Type	**Name**	**Website and Contact Details**	**Specifics**
	Lithuanian Business Employers Confederation	http://www.svv.lt/index.php?language=eng	The largest SME business representation organisation in Lithuania with over 1800 enterprises. It works to create an environment conducive to business development, promoting job creation and initiatives for business investment.
CERTIFICATION			
Certification Bodies	Lithuanian Standards Board LST Sert	http://www.lsd.lt/en/	Public certification organisation (LST Sert) established by order of the Lithuanian Standards Board. LST Sert certify e.g. quality management, environmental protection management, information security management systems.
Accreditation Bodies	Lithuanian National Accreditation Bureau	http://www.nab.lt/en/?pid=12	Responsible for accrediting testing, calibration laboratories, certification bodies for products, personnel, quality and environmental management systems, among other areas
	Centre for Quality Assessment in Higher Education	http://www.skvc.lt/en/?id=0	Independent public agency established in 1995. Implements the external quality assurance policy in research and higher education in Lithuania. Founded by the Ministry of Education and Science as an expert institution.
Qualification Framework	National Qualifications Framework (NQF)		Currently being prepared; work commenced in 2006 on its development by the Labour Market Training Authority of Lithuania. Framework has 8 levels.
E-COMPETENCIES			
Skills Framework	There is no developed national ICT Skills Framework.		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	LIKS	http://www.liks.lt/en/modules/tinycontent/?id=1	States one of LIKS goals as raising professional ethics of LIKS members There is no link to the Code of Ethics provided on English version of the website.

C.17 Luxembourg

COUNTRY	LUXEMBOURG	POPULATION	503,302 (July 2011 est. - CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education and Training	http://www.men.public.lu/	The Ministry of Education and Training's mission is essential in planning and administration of all courses offered in Luxembourg, apart from higher education, - it is the responsibility of the Ministry of Culture, Higher Education and Research.
	Ministry of Higher Education and Research	http://www.mcesr.public.lu/	Ministry of Higher Education and Research has responsibility for higher education and universities, student life, recognition and approval of academic qualifications as well as international cooperation.
	Ministry of Economy and Foreign Trade	http://www.eco.public.lu/	Responsibilities include general economic policy, company policy, technology and innovation, promotion of foreign trade, quality policy (accreditation, certification, standardization), intellectual property.
	Ministry of Labour and Employment	http://www.mte.public.lu/	Responsible for the policy areas of employment and the field of labour law and industrial relations.
Government Agencies/Bodies	ILNAS	http://www.ilnas.public.lu/fr/ilnas/index.html	The Luxembourg Institute of Standardisation – the Accreditation, the Safety and Quality of products and services is a government department under the supervision of the minister in charge of Economics.
	CTE (Centre for Educational Technology)	http://www.cte.lu/	Centre for Educational Technology is a service of the Ministry of Education. Its activities extend to the entire public education in Luxembourg and to all information technology and communication.
	The Employment Administration (ADEM)	http://www.adem.public.lu/	Agency to promote the optimal use of potential work, to recruit workers abroad, to implement legislation on the prevention of unemployment, reduction of unemployment and the granting of full unemployment benefit, to organize and provide career guidance for young adults, to intervene in terms of conversion and reuse of the workforce, to provide training, rehabilitation and professional integration of disabled persons, and to provide direction, training, placement, rehabilitation and outplacement for workers with reduced work capacity.
Professional Bodies/National Computing Associations	Association Luxembourgoise des Ingenieurs (ALI)	http://www.ali.lu/	Association of Engineers, Luxembourg (CEPIS Member)

COUNTRY	LUXEMBOURG	POPULATION	503,302 (July 2011 est. - CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
	Professional Association of Information Security - Association des Professionnels de la Société de l'Information (APSI)	www.apsi.lu	The Association for Professionals in the Information Society (APSI) is a non-profit business association of professionals working in the field of information. The SIPA aims to promote the creation of public and private initiatives in the areas of information society in the Grand Duchy of Luxembourg.
Trade Unions	OGBL	http://www.ogbl.lu/html_fr/qui_sommes_nous/presentation.html	Trade Union Multi-professional Confederation with more than 60,000 members.
	LCGB	http://lcgb.lu/	Trade Union with 40,000 members.
	CGFP	http://www.cgfp.lu/	Trade union representing civil service workers. Comprising of some sixty professional federations and associations of public service, CGFP includes a total of more than 28,000 members, making it the only public service union and a major player in the trade union scene in Luxembourg.
	ALEBA	http://www.aleba.lu/#	Trade Union for Employees in the Banking and Financial Services sector with more than 12,000 members
	FNCTTFEL	http://www.landesverband.lu/	Trade Union Confederation representing Railway employees, Civil Servants, Public and private sector employees in the Transport sector in Luxembourg.
	SYPROLUX	http://www.fcpt-syprolux.lu/fcpt_syprolux/fcpt_mission.htm	Trade Union of Transport and Freight sectors.
Chambers of Commerce/ Professional Employer Chambers	Chambre des Métiers (Guild Chamber of Luxembourg)	http://www.chambre-des-metiers.lu/pls/CDM/GetRub?lng=FR&rub=0&n=2	The Guild Chamber of Luxembourg is a professional body whose main objective is the interest representation of the Luxembourg craft industry.
	Chambre de Commerce (Chamber of Commerce)	http://www.cc.lu/	Today the Chamber of Commerce has more than 50,000 citizens, occupying 75% of total employment, representing 80% of GDP.
	Agricultural Professional Chamber	http://pro.ovh.net/~produitd/	The Objective of the Agricultural Chamber in Luxembourg is the interest representation for Farmers, Wine-makers and Horticulturists.
Professional Employee Chambers	Chambre des Salariés (Chamber of Employees)	http://www.csl.lu/	The Chamber of Employees has more than 400.000 members. All the employees and pensioners, with the exception of civil servants and employees in the public sector, are obligatorily affiliated with the Chamber of Employees, independent of their nationality or their place of residence.
	Chambre des Fonctionnaires et des Employés Publics (Chamber of Civil Servants and Employees in the public sector)	http://www.chfep.lu/	Professional Chambers are public bodies with their main objective being interest representation for their members. The Chamber of Civil Servants and Employees in the public sector was created in 1964 and has fewer than 40.000 members.

COUNTRY	LUXEMBOURG	POPULATION	503,302 (July 2011 est. - CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
CERTIFICATION			
Certification Bodies	Chambre des Salariés (Chamber of Employees)	http://www.csl.lu/	See above for details – ECDL Certification, CISCO Training and Certification, Pearson VUE Certification accredited Centre
Accreditation Bodies	Ministry of Higher Education and Research	http://www.mcesr.public.lu/	Ministry of Higher Education and Research has responsibility for higher education and universities, student life, recognition and approval of academic qualifications as well as international cooperation.
Qualification Framework	NQF coordination by the Ministry of Education		Outline of a comprehensive NQF was presented to the Council of Ministers in early 2009. Work has continued on this basis, resulting in the agreement (March/April 2010) of a set of descriptors covering all levels and types of education and training. There is an on-going discussion at Ministerial level for the adoption of the Framework. Luxembourg is expected to reference to the EQF in mid 2011, following the adoption of the NQF.
E-COMPETENCIES			
Skills Framework	No Skills Framework		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	Unknown.		

C.18 Malta

COUNTRY	MALTA	POPULATION	408,333 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry for Infrastructure, Transport and Communications (MITC)	www.mitc.gov.mt	The Ministry addresses the following areas: New Generation Networks; International connectivity; Training in ICT; Public Services online; ICT Industry; ICT for more modern services provided by Government; Malta Information Technology Agency; the National Information Society Advisory Council and the Smart Island Strategy.
	Ministry of Education, Employment and the Family (MEEF)	www.meef.gov.mt	The Ministry is responsible for Education, Childcare and Early Education, Compulsory Education, Higher Education, University, Malta College for Arts Science and Technology, Institute for Tourism Studies, Lifelong Learning, Examinations, Employment and Training, Public Broadcasting Services, Libraries, National Archives, Social Policy, Family Policy, Child Policy, Social Security, Solidarity Services, Social Housing, Equality, Youth, and Sport and Sport Complexes.
Government Agencies/Bodies	Malta Information Technology Agency (MITA)	www.mita.gov.mt	The Malta Information Technology Agency (MITA) is the central driver of Government's Information and Communications Technology (ICT) policy, programmes and initiatives in Malta. MITA's role is to deliver and implement the assigned programmes as set out in the National ICT Strategy – The Smart Island Strategy 2008 - 2010, and as directed by the Minister for Infrastructure, Transport and Communications. MITA manages the implementation of IT programmes in Government to enhance public service delivery and provides the infrastructure needed to execute ICT services to Government. MITA is also responsible to propagate further use of ICT in society and economy and to promote and deliver programmes to enhance ICT education and the use of ICT as a learning tool.
	Employment and Training Corporation	www.etc.gov.mt	The Employment and Training Corporation is Malta's Public Employment Service. The Corporation was set up 1990 to: - Provide and maintain an employment service - Find suitable employment and to assist employers to find suitable employees - Provide training service to clients seeking new jobs and to clients already on the job but wanting to improve their knowledge and skills

COUNTRY	MALTA	POPULATION	408,333 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Professional Bodies/National Computing Associations	Computer Society of Malta	http://www.csm.org.mt	The Computer Society of Malta was founded in 1992, as the national organisation representing Information & Communication Technology professionals in Malta. The Society offers a number of services aimed at promoting the ICT profession and raising the standard of ICT practitioners in Malta. CSM is the Maltese member of CEPIS.
	British Computer Society Malta Section	www.bcs.org.mt	The BCS Malta Section is one of many International sections of the BCS. It was established in Malta in 1997 with the aim of promoting the ideals of the BCS in Malta, facilitating local membership, organising professional activities, and fostering the development of professional standards in the IT industry. The Malta section have been influential in the local scene ,and has been active in organizing events, addressed by high-profile persons, for the interest of members and the local IT community in general. The Malta section, in essence, extends to Malta the role the BCS plays internationally, under its guidance and influence.
Trade Unions	General Workers' Union (GWU)	www.gwu.org.mt	The GWU was founded in 1943 and has been politically identified with the Labour Party (Malta) as the major left-wing trade union in Malta. The two were statutorily fused and continue to share many common objectives. The GWU is the largest trade union movement in Malta and organised in a confederation format of 8 Sections each to an extent autonomous in conducting industrial relations. The 8 Sections of the Union covering most sectors of the economy are: Government and Public Entities; Professional Finance and Services; Chemicals and Energy; Manufacturing; Hospitality and Foods; Maritime and Aviation; Metal and Construction, Technology Electronics and Communications.
	Union Haddiema Maghqudin	www.uhm.org.mt	The Union Haddiema Maghqudin (UHM) was founded on 29th September 1966, under the name of the Malta Government Clerical Union (MGCU) with membership restricted to clerical employees in the Public Service. Salvino Spiteri and Maurice Agius respectively were the Union's first President and Secretary General. The main objectives of UHM are: - to unite workers into one strong homogeneous body; - to enhance the dignity of the worker and to improve his conditions of work as well as his economic and social standing; - to gain proper representation on bodies where its presence would further the interests of its members; - to achieve and maintain unity of purpose and action among members; - to foster trade unionism among all workers and at all levels; - to educate workers in those matters that affect them; and - to ascertain a good standard of living for pensioners and those who retire from work.

COUNTRY	MALTA	POPULATION	408,333 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	The Confederation of Malta Trade Unions (CMTU)	www.cmtu.org.mt	The Confederation of Malta Trade Unions (CMTU) has a membership of 30,000. The CMTU has no political party affiliations, and its constitution, while placing certain obligations on the affiliates of the Confederation, leaves the individual organisations free to act as they deem best in the interests of their members. The objectives of the Confederation are to promote the interests of its affiliates and to further the ideals of a democratic trade union movement as well as to improve generally the economic and social conditions of workers.
Chambers of Commerce	The Malta Chamber of Commerce, Enterprise and Industry	www.maltachamber.org.mt	The Malta Chamber of Commerce, Enterprise and Industry shall seek: "To vigorously influence the formation of policy at national and European level towards the development of an enterprise culture, the creation of favourable economic conditions to the advantage of Members and the interests of the wider community."
CERTIFICATION			
Certification Bodies			There is not a single national certification body in Malta, but there is a large variety of accredited training providers that enable candidates to obtain professional ICT certifications.
	ECDL Malta	www.ecdl.com.mt	ECDL Malta manages the ECDL certification programmes on behalf of the Computer Society of Malta (CSM) and accredits local test centres to run ECDL examinations and certifications.
Accreditation Bodies	National Accreditation Board Malta	www.nabmalta.org.mt	The National Accreditation Board - Malta (NAB - MALTA) is operated as a Board under the responsibility of the Parliamentary Secretary for Consumers, Fair Competition, Local Councils and Public Dialogue which falls under the responsibility of the Office of the Prime Minister. NAB-MALTA was established as the single nationally recognized accreditation body in Malta with the authority to give accreditation. In particular, the functions of NAB-MALTA include the following (amongst others): - to accredit certification bodies providing certification of products, - to accredit certification bodies providing certification of management systems such as ISO9001, ISO14001, ISO27001 etc (ISO17021) and personnel;

COUNTRY	MALTA	POPULATION	408,333 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	Malta Qualifications Council (MQC)	www.mqc.gov.mt	The Council steers and approves the development of the National Qualifications Framework with the accompanying Standards, Learning Pathways and Quality Assurance procedures. The Council aims to: (a) establish and maintain a qualifications framework for the development, accreditation and award of professional and vocational qualifications, other than degrees, based on standards of knowledge, skills, competences and attitudes to be acquired by learners; (b) promote and facilitate lifelong learning access, transfer and progression; (c) foster the recognition abroad of professional and vocational certificates awarded in Malta.
Qualification Framework	Malta Qualifications Framework	www.mqc.gov.mt/malta-qualifications-framework?l=1	The Malta's Qualifications Framework (NQF) gives a national identity in Malta's educational world as well as provides international recognition within the European Union/Community and beyond. Malta's Qualifications Framework takes the existing qualifications currently being issued by local education and training institutions and superimposes them on eight different levels.
	National Commission for Higher Education	www.nche.gov.mt	The National Commission for Higher Education was established by virtue of the Education Act (ACT No. XIII of 2006). The NCHE is responsible for: - Promoting structured dialogue between all Further and Higher education institutions; - Supporting all stakeholders with research, data and information about the sector; - Maintaining a register of authorised and accredited institutions and programmes available in Malta; - Developing a National Strategy for Further and Higher education; - Preparing key performance indicators and benchmarking the sector against international developments.
E-COMPETENCIES			
Skills Framework	Skills Framework in development		A local Skills Framework is currently in development and will be mapped to the European e-CF.
Promoted By	e-Skills Alliance Malta	www.mita.gov.mt/Page.aspx?pageid=197	E-Skills Alliance Malta was set up in October 2010 through a multi-stakeholder partnership led by MITA together with other public sector actors, business representative bodies and the private ICT sector. E-Skills Alliance Malta is mainly concerned with ensuring that business gets exactly the skills it needs. Its work and corresponding results are guided by one simple principle - identifying and pursuing the creation of practical and relevant ICT skills. And not just random skills but targeted skills – namely those needed to attract investment and jobs with the best prospects.

COUNTRY	MALTA	POPULATION	408,333 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
ETHICS			
Professional Body's Code of Ethics/Conduct	Computer Society of Malta Code of Conduct	http://www.csm.org.mt/category/content/about-us	The Code of Conduct of the Computer Society of Malta is based on the guidelines issued by CEPIS and covers the following four principal areas: 1. Protection of Public Interest and Legal Compliance; 2. Responsibility to Employers and Clients; 3. Professional Dignity and Promotion of Professional Aims; 4. Competence, Ethics and Impartiality.

C.19 Netherlands

COUNTRY	NETHERLANDS	POPULATION	16,647,000 (estimate 2011)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry for Education, Culture and Science Ministry for Economic Affairs, Agriculture and Innovation Ministry for Social Affairs and Employment	www.minocw.nl/ www.minlnv.nl/portal/page?_pageid=116,1640354&_dad=portal&_schema=PORTAL www.szw.nl/	
Government Agencies/Bodies	WRR AWT WTR	www.wrr.nl/ www.awt.nl/?id=16 www.surfsites.nl/wtr/	Advises government about future developments – bridge between academia and policy The Advisory Council for Science and Technology Policy - advises the Dutch government on policy in the areas of scientific research, technological development and innovation. The Scientific Technical Council (WTR) is an independent advisory body of SURF

COUNTRY	NETHERLANDS	POPULATION	16,647,000 (estimate 2011)
Type	**Name**	**Website**	**Specifics**
Professional Bodies/National Computing Associations	Nederlands Genootschap voor Informatica (NGI)	www.ngi.nl	Dutch professional association for ICT, NGI is a member of CEPIS.
	Vereniging van Register Informatica (VRI)	www.vri.net/	VRI is an Association of Registered Information Scientists. VRI is a member of CEPIS.
	SNIR	www.snir.nl/	Dutch Foundation for registered informatics – monitors qualifications and professionalism of ICT members.
	SURF	www.surf.nl	A cooperative organization in which universities and research institutes work together on groundbreaking ICT innovations.
	NGN	www.ngn.nl/	IT professionals, mostly managers of computer networks.
	GIA	http://www.gia.nl/	Society for Information Architects
	ISOC	http://isoc.nl/organisatie/	Internet Society Netherlands is the national chapter of the multi-national operating Internet Society.
	CIO platform	www.cio-platform.nl/	Independent association of CIOs and IT directors of private and public organizations in the Netherlands.
Trade Unions	CNV	www.cnv.nl/	National Federation of Christian Trade Unions
	FNV	www.fnv.nl	Federation Dutch Labor Movement
	MHP	www.vakcentralemhp.nl/home.asp	Federation of Managerial and Professional Staff Unions
Chambers of Commerce	Dutch Chambers of Commerce	www.kvk.nl	
CERTIFICATION			
Certification Bodies	EXIN	www.exin-exams.com/NL/en/home/	EXIN International – Distribute Exams for IT Professionals
	ECDL	www.ecdl.com/	The internationally recognized European Computer Driving Licence, which indicates the level of knowledge in computer skills.

COUNTRY	NETHERLANDS	POPULATION	16,647,000 (estimate 2011)
Type	**Name**	**Website**	**Specifics**
Accreditation Bodies	NVAO Hobéon Groep	www.nvao.com/ www.hobeon.nl	Organization that independently ensures the quality of higher education in Flanders and the Netherlands. Officially recognized Assessing Agency.
Qualification Framework	NVAO	www.nvao.com/	As above.
E-COMPETENCIES			
Skills Framework	NVAO	www.nvao.com/	As above.
Promoted By	Ngi, Dutch computer society	http://www.ngi.nl	
ETHICS			
Professional Body's Code of Ethics/Conduct	Dutch professional association for ICT Vereniging van Register Informatica (VRI) NOREA	http://www.ngi.nl http://www.vri.net/ http://www.norea.nl/	Dutch professional association for ICT, NGI is a member of CEPIS VRI is an Association of Registered Information Scientists. VRI is a member of CEPIS. Professional association for IT-auditors in the Netherlands

C.20 Poland

COUNTRY	POLAND	POPULATION	38, 116,000 (2007 official Census)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of National Education Ministry of Science and Higher Education Ministry of Infrastructure	www.men.gov.pl/ www.nauka.gov.pl/home www.en.mi.gov.pl/	Education portfolio. Science & Higher education portfolio – Research is also included in the portfolio. Part of governmental administration which includes communications portfolio.
Government Agencies/Bodies	IBE (Educational Research Institute)	www.ibe.edu.pl	Conducts both general and applied educational research, drafts expert opinions for the purpose of educational policy and practice, and fulfills advisory functions – on behalf of the Ministry of National Education.

COUNTRY	POLAND	POPULATION	38, 116,000 (2007 official Census)
Type	**Name**	**Website**	**Specifics**
Professional Bodies/National Computing Associations	Polish Academy of Sciences	www.pan.pl	State scientific institution - Structured into 7 Sub divisions including Technical services.
	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl	Supports scientific and technological activities. Is the national CEPIS member.
Trade Unions	NSZZ	www.solidarnosc.org.pl/en/	NSZZ Solidarność
	OPZZ	www.opzz.org.pl	All-Poland Alliance of Trade Unions
	FZZ	www.fzz.home.pl	Forum of Trade Unions
Chambers of Commerce	Polish Chamber of Information Technology & Telecommunications	www.piit.og.pl	Operates under the Chambers of Commerce Law
	Poland Import/Export Chambers of Commerce	www.chamberofcommerce.pl	Polish Import/Export chamber of commerce.
CERTIFICATION			
Certification Bodies	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl	Supports & Certifies ECDL in Poland
Accreditation Bodies	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl	Supports ECDL drive for Poland
Qualification Framework	Polish National Qualification Framework (PNQF)	www.krk.org.pl/en/About_project	Developing an expert model of Polish National Qualifications Framework (PNQF) for lifelong learning and its implementation. (Carried out by Ministry for National Education).
E-COMPETENCIES			
Skills Framework	Polish National Qualifications Framework (PNQF)	www.krk.org.pl/en/About_project	Developing an expert model of Polish National Qualification Framework (PNQF) for lifelong learning and its implementation. (Carried out by Ministry for National Education).
Promoted By	Ministry of National Education	www.men.gov.pl/	Education Ministry
ETHICS			
Professional Body's Code of Ethics/Conduct	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl	Document accepted by PIPS/PTI Board for local professionals.

C.21 Portugal

COUNTRY	PORTUGAL	POPULATION	10, 648, 688 (2010 estimate)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Economy and Labour	www.min-economia.pt www.moptc.pt	Following recent restructuring of the Ministries structures, the Ministry for Economy, Innovation and Development was merged with the Ministry for Public Works, Transport and Communications resulting in the Ministry of Economy and Labour. Until recently, the Ministry of Public Works, Transport and Communications, implemented national policy regarding to public works, transport and communications.
	Ministry of Education and Higher Education	www.min-edu.pt www.mctes.pt	Following recent restructuring of the Ministries structures, the Ministry of Education was merged with the Ministry of Science, Technology and Higher education, in charge of Science and Technology, Information Society and Higher Education resulting in the Ministry of Education and Higher Education.
	Ministry for Social Solidarity	www.mtss.gov.pt	Following recent restructuring of the Ministries structures, the Ministry for Labour and Social Solidarity became the Ministry for Social Solidarity. Previous competences included the definition, orientation and practice of the politics of labour and employment, professional training.
Government Agencies/Bodies	Center for training and Technological Innovation	www.inovinter.pt	Promotes the activity of Professional training.
	Institute of Employment and Vocational Training (IEFP)	www.iefp.pt/Paginas/Home.aspx	The national employment service promotes the creation and quality of employment through the implementation of active employment policies and training.
Professional Bodies/National Computing Associations	Ordem dos Engenheiros (OE)	www.ordemengenheiros.pt/pt/	Includes Informatics & Computer Engineers courses accredited by OE.
	Association of Computer Professionals	www.apdsi.pt	Professional association in the area of information technologies and communication technologies and associated knowledge areas, with cultural, scientific, technical and vocational education. PROFIN is the national CEPIS member.
	Portuguese Association for Information Societies	www.profin.pt/	Main aim is to promote and develop the Information Society and Knowledge in Portugal.

COUNTRY	PORTUGAL	POPULATION	10, 648, 688 (2010 estimate)
Type	**Name**	**Website**	**Specifics**
Trade Unions	CGTP-IN UGT	www.cgtp.pt www.ugt.pt	Confederation of Portuguese Workers General Workers Union.
Chambers of Commerce	Portuguese Chamber of Commerce	www.port-chambers.com	Lisbon Trade Association / Portuguese Chamber of Commerce
CERTIFICATION			
Certification Bodies	DGES (General Directorate of Higher Education)	www.dges.mctes.pt/DGES/en	Direction comes from MCES (Higher education policy)
Accreditation Bodies	A3ES (Agency for Assessment and Accreditation of Higher Education)	www.a3es.pt/en/activity-plan#Mission	Promotes improvement of performance of HE Institutions in Portugal (including to substantiate accreditations).
Qualification Framework	National Qualification Agency FHEQ (included in MCTES Ministry) DGES (General Directorate of Higher Education)	www.en.anq.gov.pt/ www.mctes.pt www.dges.mctes.pt/DGES/en	Coordinates the implementation of policies regarding vocational education and training, ensures the development and management of the System of Recognition, Validation and Certification of Competences. Framework for Higher Education Qualification in Portugal General Directorate of Higher Education
E-COMPETENCIES			
Skills Framework	National Qualification Agency	www.en.anq.gov.pt/	Coordinates the implementation of policies regarding vocational education and training, ensures the development and management of the System of Recognition, Validation and Certification of Competences.
Promoted By	Portuguese Association for Information Society	www.apdsi.pt	Main aim is to promote and develop the Information Society and Knowledge in Portugal.
Promoted By the Government	National technological Plan	http://www.planotecnologico.pt/	Governmental National program for the development and control of ICT Skills in the general population
ETHICS			
Professional Body's Code of Ethics/Conduct	Portuguese Association for Information Society	http://www.apdsi.pt/	Mission & Values of APDSI.

C.22 Romanian

COUNTRY	ROMANIA	POPULATION	21,904,551 (CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education	http://www.edu.ro	Ministry of Education, Youth and Sports, with consultation of other interested ministries and institutions, design and implement the global strategy based on education, setting out the objectives of the education system as a whole, and educational objectives of education levels and profiles (Art. 12 (1) Education Law 84/1995 with subsequent amendments).
	Special Telecommunication Service	http://www.stsnet.ro/	The Special Telecommunications Service is the central specialized structure, with legal status, which organizes and coordinates the activities in the special telecommunications field for the Romanian public authorities and other users as provided for by the law. The institution has a military organization and is part of the national defence system.
	Ministry of Communications and Information Society (MCIS)	http://www.mcsi.ro	The mission of the Ministry of Communications and Information Society (MCIS) is to create sustainable premises transition to the Information Society in Romania. In this respect, it envisages a unified vision for developing a coherent and integrated national system for online public services dedicated citizens and businesses.
	IT&C Commission Chamber of Deputies (Lower House)	http://www.cdep.ro/	The chamber is a parliamentary commission whose objective is to launch legislative initiatives in the field of technology of information and communications, advance specific technologies in the field, and bring them into line with international regulations, respective standards, and intellectual property
Government Agencies/Bodies	National Authority for Communications (ANCOM)	http://www.anrcti.ro/	The ANC was established in September 2008 by Government emergency ordinance (no. 106/200) through the reorganisation of both the National Regulatory Authority for Communications and Information Technology (ANRCTI – which was dissolved) and the National Institute of Research and Development in Informatics (ICI). ANCOM is the institution that sets the rules in the Romanian communications market and watches the enforcement of these rules

COUNTRY	ROMANIA	POPULATION	21,904,551 (CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
	Agency for Information Society Services (ASSI)	http://www.cnmsi.ro/	The Agency for Information Society Services (ASSI) was established in April 2007, according to the Government Emergency Decision No. 25/2007 on the implementation of some reorganising measures of the Government. The agency is subordinated to the Ministry of Communications and Information Technology and overtakes the attributions of the former General Inspectorate for Communications and Information Technology (IGCTI) in the area of eGovernment. The organization is in charge of running IT systems for the central governmental bodies offering electronic services to the public
Professional Bodies/National Computing Associations	AsociatiaPentruTehnologiaInformatiei si Comunicatii (ATIC)	http://www.atic.org.ro/	CEPIS Member society for Romania. Association for Information Technology and Communications of Romania (ATIC) organizes and promotes the exchange of information, collaboration and cooperation among member states.
	Aries (Romanian Association for Electronic and Software Industry)	http://www.aries.ro/	Aries is the association of electronics and software companies of Romania and aims at promoting and protecting the Romanian IT and electronic business environment, as well as the professional and commercial interests of its members.
	Employers' Association of the Software Industry and Services (ANIS)	http://www.anis.ro/	The Employers Association of the Software and Services Industry – ANIS upholds the interests of Romanian software producers and service providers.
Trade Unions	NTUC "Cartel ALFA" C.N.S.C.A. - Confederatia Nationala Sindicala Cartel Alfa	http://www.cartel-alfa.ro/	National Trade Union Confederation "Cartel ALFA" was founded in 1990 with the purpose of establishing a real and authentic representation of the Romanian workers.
	C.N.S.L.R. - Confederatia Nationala a Sindicatelor Libere din Romania - Fratia;	www.cnslr-fratia.ro	NBS was founded in 1993 members – 40 trade federations 42 district branches
	B.N.S. - Blocul National Sindical;	www.bns.ro	NBS was founded in November 1991 members – 39 trade federations 36 district branches
Chambers of Commerce	Chamber of Commerce and Industry of Romania (CCIR)	http://www.ccir.ro/	Chamber of Commerce and Industry of Romania (CCIR) is the most powerful business association in Romania, bringing together its entire network among the 42 county chambers of commerce and industry, bilateral chambers of commerce and professional associations.
CERTIFICATION			
Certification Bodies	Microsoft	http://www.microsoft.com/ro/ro/	Provides training and certification in Microsoft technology on three levels: for users, for developers and for IT professionals
	CISCO	http://www.infoacademy.net/	Provides training and certification in Networking, Security, VoIP, Wireless LAN's, Linux Unix, Java

COUNTRY	ROMANIA	POPULATION	21,904,551 (CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
	Oracle	http://www.oracle.com/ro/index.html and http://education.oracle.com/pls/web_prod-plq-dad/db_pages.getpage?page_id=39&p_org_id=54&lang=RO	Database, Java and middleware, Applications, Server and Storage Systems and Partner Certifications
	IBM	http://www-304.ibm.com/jct03001c/services/learning/ites.wss/ro/ro?pageType=page&c=a0005268	Provides training and certification in: - Software (Clarity, Cognos, DB2, Information Management, Java, Object Oriented, C, Lotus, Rational, Telelogic, Tivoli, WebSphere) - Hardware (Storage and Storage Networking, System i and OS/400, System p, VMware) - Business and professional (Project Management, Project Management Certification)
	IT Academy	http://www.itacademy.ro/	Provides training and certification in MSP, Prince2 and ITIL Foundation V3
	ECDL Romania	http://www.ecdl.org.ro/	Association for Information Technology and Communications of Romania (ATIC Romania) a member of the Council of European Professional Informatics Societies (CEPIS), was awarded the ECDL License for Romania. The administration and the practice of these rights are done exclusively through ECDL ROMANIA SA, the only entity authorized by ECDL Foundation and ATIC to promote and develop the ECDL concept in Romania.
Accreditation Bodies	Romanian National Authority of Qualifications	http://www.cnfpa.ro/ http://www.acpart.ro/	Body made up of the National Adult Training Board and the National Agency for Qualifications in Higher Education and Partnership with Economic and Social. Currently reorganising the National Adult Training Board and creating the National Qualifications' Authority by reunion of NATB and Agency for Qualifications in Higher Education (Education Law 2011, Government Ordinance 74 and 132/2010, Government Decisions 885/2010, 1368/2011)
	National Council for Adult Training	http://www.cnfpa.ro/	National Council for Adult Training - nationally coordinate and control the following activities: - approval of training providers by authorizing county commissions and Bucharest; - the development of occupational standards; - evaluation and certification of professional competences acquired by adults through continuous training.

COUNTRY	ROMANIA	POPULATION	21,904,551 (CIA World Factbook)
Type	**Name**	**Website**	**Specifics**
	National Agency for Higher Education Qualifications and Partnership with the Social and Economic Environment	http://docis.acpart.ro/index.php?page=acpart	ACPART is the national authority for establishing and periodic updating of the national qualifications framework in higher education, a specialized body with a legal personality, within the Ministry of Education, Research and Innovation. Established by Government Decision no. 1357
Qualification Framework	As above	http://www.cnfpa.ro/ http://www.acpart.ro/	As above – In development
E-COMPETENCIES			
Skills Framework	European e-Competence Framework		ATIC are actively supporting e-CF in Romania.
Promoted By	Romanian National Authority of Qualifications	http://www.cnfpa.ro/ http://www.acpart.ro/	Going forward, the Romanian National Authority of Qualifications looks like being the most likely agency to promote any framework of this nature.
ETHICS			
Professional Body's Code of Ethics/Conduct	AsociatiaPentruTehnologiaInformatiei si Comunicatii (ATIC)	http://www.atic.org.ro/	Reference to compliance with code of ethics and professional conduct in the organization statutes.

C.23 Slovakia

COUNTRY	SLOVAKIA	POPULATION	5,429,763 (30 June 2010)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Finance	www.informatizacia.sk	Central governmental body responsible for Information Society development (strategic documents) and e-Government
	Ministry for Education, Science, Research and Sport	www.minedu.sk	Education, science and research portfolios
	Ministry for Labor, Family & Social Affairs.	www.employment.gov.sk	Involved in the coordination of the employment strategy and labor market policy

COUNTRY	SLOVAKIA	POPULATION	5,429,763 (30 June 2010)
Type	**Name**	**Website**	**Specifics**
Government Agencies/Bodies	Governmental Plenipotentiary for Information Society Development National Labor Office K.A.B.A. Slovakia	www.informatizacia.gov.sk www.employment.gov.sk www.kabask.sk	Coordination of projects supporting Information Society development and e-Government activities Implements policies regarding employment and training for the unemployed. Part of the Ministry of Labor portfolio K.A.B.A. Slovakia - adult education and career counseling, and employment programs for the unemployed.
Professional Bodies/National Computing Associations	Slovak Society for Computer Science	www.informatika.sk	Represents the ICT community, and is a member of CEPIS and IFIP
Trade Unions	Confederation of Slovakian Trade Unions	www.kozsr.sk/	Umbrella Organization for majority of the Slovakian Trade unions.
Chambers of Commerce	SCCI	web.scci.sk/	Slovak Chambers of Commerce and Industry
CERTIFICATION			
Certification Bodies	Slovak Society for Computer Science Leading ICT companies	www.informatika.sk	Certification body for the ECDL programme Specialized vendor-oriented certificates (Microsoft, Oracle, Cisco, etc.)
Accreditation Bodies	Accreditation Commission in Ministry for Education	www.minedu.sk	Accreditation Commission - Counselling body of the Government of the Slovak Republic – in the Ministry for Education, Science, Research and Sport. Concerns accreditation of educational programs and courses.
Qualification Framework	Slovak National Agency of Lifelong Learning Programme	www.saaic.sk	Ministry for Education – Life Long Learning Department is the NCP for EQF (WIP)
E-COMPETENCIES			
Skills Framework	There is no developed national skills framework		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	Slovak Society for Computer Science	www.informatika.sk	Represents the ICT community at CEPIS and IFIP

C.24 Slovenia

COUNTRY	SLOVENIA	POPULATION	1,964,03 (2002 Census) (2,048,951 - 2010 Estimate)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education and Sport	www.mss.gov.si/en/	
	Ministry for Higher education, Science and Technology	www.mvzt.gov.si/	
	Ministry for Public Administration	www.mju.gov.si/en	Includes e-government initiative
Government Agencies/Bodies	Slovenian Institute for Vocational Education and Training	www.cpi.si	
	Slovenian Institute for Adult Education	www.siae.acs.si	National institution for development, research and counseling in the field of adult education
	CEAE	www.mss.gov.si	Council of Experts of the Republic of Slovenia for Adult Education – Part of Ministry for Education and Sport
	National Education Institute	www.zrss.si/	Involved in External assessment of Students – maturity exams mainly
	National Examination Center	http://www.ric.si/	
Professional Bodies/National Computing Associations	Slovenian Society Informatika	www.drustvo-informatika.si	Slovenian Computer Society is the national CEPIS member.
Trade Unions	Association of Free Trade Unions of Slovenia	www.sindikat-zsss.si	
	Confederation of Trade Unions of Slovenia PERGAM	www.sindikat-pergam.si	
	Confederation of New Trade Unions of Slovenia "Independence	www.knssneodvisnost.si	

COUNTRY	SLOVENIA	POPULATION	1,964,03 (2002 Census) (2,048,951 - 2010 Estimate)
Type	**Name**	**Website**	**Specifics**
Chambers of Commerce	Chamber of Commerce and Industry of Slovenia Chamber of Craft and Small Business in Slovenia	www.eng.gzs.si/slo/ www.ozs.si/eng/prispevek.asp?IDpm=19	NOTE: Co-founder of Slovenian Institute for Vocational Education and Training NOTE: Co-founder of Slovenian Institute for Vocational Education and Training
CERTIFICATION			
Certification Bodies	National Examination Center	http://www.ric.si/	Some involvement in certification of exams.
Accreditation Bodies	Slovenian Accreditation Body	http://www.sa.gov.si	Included in its scope are certification bodies and management systems
Qualification Framework	There is no National Qualifications Framework		
E-COMPETENCIES			
Skills Framework	There is no developed national ICT Skills Framework.		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	Slovenian Society Informatika	www.drustvo-informatika.si/drustvo/statut/	Slovenian Computer Society Code of Ethics

C.25 Spain

COUNTRY	SPAIN	POPULATION	43,030,109 (2010 Estimate)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Education	www.educacion.gob.es	Education Portfolio.
	Ministry of Science and Innovation	www.micinn.es	Includes Research & Development policies as well as innovation area.
	Ministry for Industry, Tourism and Trade	http://www.mityc.es	Responsible for government policy in many areas including industrial development and innovation, telecommunications and the Information Society.
	Ministry for Regional Policy and Public Administration	www.mpt.gob.es	The 3rd Vice President - Includes all initiatives and agencies relating to the e-Government initiative
Government Agencies/Bodies	E-Government Portal	www.administracionelectronica.gob.es	E-Government Initiative for Spain
	Institute of Education Technology	www.ite.educacion.es/	Unit of Ministry of Education – responsible for integration of ICT into Vocational and general education system.
	IFIIE	www.educacion.gob.es/cide/index.htm	Unit of Ministry of Education – involved in Research and Educational Innovation
	Red.es	www.red.es	Entity within Ministry for Industry, Tourism and Trade responsible for driving Information Society in Spain
	INTECO	www.inteco.es	INTECO is an entity within Ministry for Industry, Tourism and Trade working as development centre of public interest, aimed at adding value to the industry, by disseminating knowledge of ICT sector in Spain, according to the European guidelines.
Professional Bodies/National Computing Associations	ATI	www.ati.es	Association for Information Technology (founding member of CEPIS)

COUNTRY	SPAIN	POPULATION	43,030,109 (2010 Estimate)
Type	**Name**	**Website**	**Specifics**
Trade Unions and associations	AMETIC	www.aetic.es	Trade associations of the main companies for the electronics, telecommunications and Information technology industries (including digital content area).
	UGT	www.ugt.es	General Union of Workers Trade Union
	CCOO	www.ccoo.es	Workers commission Trade Union
	COMFIA	www.comfia.net/	Branch of CCOO trade union specifically oriented to activities in financial services, ICT sector, administrative services, etc. (founder of EUCIP Spain Foundation along with ATI and e-logos)
Chambers of Commerce	High Council of Chambers of Spain	www.camaras.org/	Incorporates Chambers of Commerce, Industry and Navigation, High Council Chambers and Regional Chambers of Commerce.
CERTIFICATION			
Certification Bodies	EDCL Spain	www.edcl.es	EDCL Spain
	EUCIP Spain	www.eucip.es	EUCIP Spain Estimated 1000 types of certifications, with huge variation in the levels of impact depending on many factors including the region.
Accreditation Bodies	ENAC	www.enac.es/	Official National Accreditation Board responsible for accreditation of organisms which evaluate conformance in any sector
	AENOR	www.aenor.es	Private non-profit association for standardization and certification (Spanish member of ISO) As Spain has 17 regions with regulation autonomy for certain activities (e.g. education, training for unemployed people, etc.), there are specific entities created by regional authorities which are working in the topics covered by the study. These vary from region to region.

COUNTRY	SPAIN	POPULATION	43,030,109 (2010 Estimate)
Type	**Name**	**Website**	**Specifics**
Qualification Framework	INCUAL	www.educacion.gob.es/educa/incual/ice_incual_ing.html	National Institute of Qualifications - Supports council for Vocational training to achieve the objectives of the NQF.
	CGFP	www.educacion.gob.es/educa/incual/ice_consejoGeneral_ing.html	General Council for vocational education and training
	SNCFP	www.educacion.gob.es/educa/incual/ice_ncfp_ing.html	National System for Qualification and vocational education and training
	CNCP	www.educacion.gob.es/educa/incual/ice_catalogoWeb_ing.html	National Catalogue of Professional Qualification
E-COMPETENCIES			
Skills Framework	INCUAL	www.educacion.gob.es/educa/incual/ice_incual_ing.html	National Institute of Qualifications - Supports council for Vocational training to achieve the objectives of the NQF.
Promoted By	ATI	www.ati.es/	Association for Information Technology.
ETHICS			
Professional Body's Code of Ethics/Conduct	ATI	http://www.ati.es/spip.php?rubrique332	Member Rules for ATI

C.26 Sweden

COUNTRY	SWEDEN	POPULATION	9,088,728 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	Ministry of Enterprise, Energy	http://www.sweden.gov.s	The Ministry of Enterprise, Energy and Communications is responsible for

COUNTRY	SWEDEN	POPULATION	9,088,728 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
	and Communications	e/sb/d/2067	handling government business in the following areas: Electronic communications – Issues concerning electronic communications; ICT Policy – Infrastructure and responsibility for coordination on issues relating to the use of information technology.
	Ministry of Education and Research	http://www.sweden.gov.se/sb/d/2063/a/21953	The Ministry of Education and Research addresses the following areas: The pre-school system; School-age childcare; The pre-school class; Compulsory school and other compulsory types of school; Upper secondary school; Study financing; Universities and other higher education institutions; Research; Formal and liberal adult education; Gender equality; Policy for civil society; and Youth policy.
	Ministry of Employment	http://www.sweden.gov.se/sb/d/8281	Labour market policy; Working life policy; Integration policy; Discrimination; Human rights at national level; Swedish citizenship; and National minorities.
Government Agencies/Bodies	Swedish Governmental Agency for Innovations Systems (Verket för innovationssystem, VINNOVA)	http://www.vinnova.se/en/	VINNOVA, Swedish Governmental Agency for Innovation Systems, integrates research and development in technology, transport and working life. VINNOVA´s mission is to promote sustainable growth by financing RTD and developing effective innovation systems.
	National Post and Telecom Agency (Post- och telestyrelsen, PTS)	http://www.pts.se/en-gb/	The National Post and Telecom Agency, PTS, is the authority that monitors the electronic communications and post sectors. The term electronic communication includes the telecommunications, IT and radio sectors.
	Högskoleverket (Swedish National Agency for Higher Education)	http://www.hsv.se/aboutus.4.28afa2dc11bdcdc557480001978.html	Högskoleverket (Swedish National Agency for Higher Education) was established in 1995. It reviews the quality of higher education, ensures HEIs comply with relevant legislation and regulations, monitors trends and developments in higher education, provides information about higher education, and recognises qualifications from abroad.
Professional Bodies/National Computing Associations	Dataföreningen i Sverige (The Swedish Computer Society)	http://www.dfs.se/	Dataföreningen I Sverige (The Swedish Computer Society) is the independent body for ICT (Information and Communications Technology) professionals in Sweden. The association holds 20 000 members with local representation in all parts of the country, and is the Swedish member of CEPIS. As well as providing an extensive events programme for their members, they work with the government, the industry and the community on issues such as enhancing digital literacy.

COUNTRY	SWEDEN	POPULATION	9,088,728 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
Trade Unions	Landsorganisationen I Sverige LO - The Swedish Trade Union Confederation	http://www.lo.se/home/lo/home.nsf/unidview/E2A56001E93D5F3EC1256E760040952D	LO is the central organisation for 14 affiliates which organise workers within both the private and the public sectors. The 14 affiliates together have about 1,700,000 members of whom about 770,000 are women. The 14 affiliates of LO have independent status, and LO is primarily an organisation for co-ordination, research, signing labour market insurance schemes and creating public opinion at central and regional levels. Contacts with the Social Democratic Party are frequent and LO has a representative on the party's executive committee elected by the Party Congress.
	Saco - The Swedish Confederation of Professional Associations	http://www.saco.se/templates/LandingPage.aspx?id=36&epslanguage=EN	Saco is a trade union confederation of 23 affiliated associations which together have over 600,000 members. Members are university graduates or professionals with a college degree. The members include employees, students, researchers, self-employed people and retired professionals. Members include economists, lawyers, physiotherapists, graduate engineers, doctors, teachers and members of many other professions.
	TCO (The Swedish Confederation for Professional Employees)	http://www.tco.se/Templates/Page2___2319.aspx	TCO (The Swedish Confederation for Professional Employees) comprises 15 affiliated trade unions. The 1.2 million members of these unions are professional and qualified employees who share a major responsibility for important functions in society, although in a wide variety of occupations. They work in all parts of the labour market, for example in the schools, healthcare, trade, the media, the police, industry, IT and telecom. Over 60 percent of the members are women. Approximately half of the members work in the private sector and half in the public sector.
Chambers of Commerce	The Swedish Chambers	http://www.swedishchambers.se/home-2/about-us-1.aspx	The Swedish Chambers offer contacts, knowledge and capacity to exporters from developing countries within the Trade Promotion Programme. The programme is carried out in cooperation with Sida (Swedish International Development Cooperation Agency). It focuses on business contacts, market information, training and extended contacts in order to promote exports from developing countries.
CERTIFICATION			
Certification Bodies	DF Certifiering AB	http://www.dfcertifiering.se/	DF Certifiering AB (DFC) is a wholly owned subsidiary to Dataföreningen I Sverige, the Swedish Computer Society with 20,000 IT professionals as members in Sweden. DFC's role is to give accreditation to training providers and certify IT. DFC also provides products in the field of Information Security and self assessing tests for e-Citizens.
Accreditation Bodies	DF Certifiering AB	http://www.dfcertifiering	As above

COUNTRY	SWEDEN	POPULATION	9,088,728 (July 2011 est.)
Type	**Name**	**Website**	**Specifics**
		.se/	
Qualification Framework	NQF to be developed	http://www.hsv.se/highereducationinsweden/nationalqualificationsframework.4.5dc5cfca11dd92979c480001476.html	In Sweden, the Swedish National Agency for Higher Vocational Education has been tasked with developing a proposal for a Swedish framework for qualifications (National Qualifications Framework, NQF). The agency has submitted its proposal to the Government. The decision to adopt a national framework is expected to be taken in 2011. Swedish qualifications will be set at the most appropriate level in the national framework, and this will in turn be linked to the European reference framework, EQF. The Swedish National Agency for Higher Vocational Education is the national coordinating point for the European reference framework for lifelong learning, the European Qualification Framework (EQF).
E-COMPETENCIES			
Skills Framework	There is no developed national skills framework		
Promoted By			
ETHICS			
Professional Body's Code of Ethics/Conduct	SUNET	http://basun.sunet.se/html_docs/info_sunet/rules.html	Acceptable Use of Policy of the Swedish University Computer Network (SUNET) and Ethical Rules for SUNET

C.27 United Kingdom

COUNTRY	UNITED KINGDOM	POPULATION	62,008,048 (Estimate 2010)
Type	**Name**	**Website**	**Specifics**
GENERAL			
Government Departments	BIS (Department of Business, Innovation and Skills)	www.bis.gov.uk/	Specifically promotes innovation, enterprise and sciences.
	DfE (Department of Education)	www.education.gov.uk	Department of Education.
	Cabinet Office	www.cabinetoffice.gov.uk	Includes CIO Council – CIO's form Public Sector & professional group of Government IT Profession based on SFIA. Also includes Cabinet Office Minister responsibility for Information Security
	CESG	www.cesg.gov.uk	Provides advice and assistance on the security of communications and electronic data
	DMCS (department for Media, Culture and Sport)	www.culture.gov.uk	Includes responsibility for broadband, freedom of information and broadcasting
Government Agencies/Bodies	QCDA	www.qcda.gov.uk	Qualifications and Curriculum Development Agency. (NOTE : Due to close autumn 2011 – Government Reforms)
	Skills Funding Agency	www.skillsfundingagency.bis.gov.uk/	Agency of BIS, fund and regulate adult further education and skills training in England (Formerly LSC)
	YPLA	www.ypla.gov.uk/	Young People Learning Agency (formerly LSC). Sponsored by Department of Education.
	e-skills UK	www.e-skills.com	Licensed by Government as voice of employers on skills and business competitiveness. (Member of SFIA)

COUNTRY	UNITED KINGDOM	POPULATION	62,008,048 (Estimate 2010)
Type	**Name**	**Website**	**Specifics**
Professional Bodies/National Computing Associations	BCS (Chartered Institute for IT) IET IMIS IT SMF UK Intellect	www.bcs.org/ www.theiet.org/ www.imis.org.uk/ www.itsmf.co.uk www.intellectuk.org	Formerly British Computer Society. Promotes wider social and economic progress through the advancement of information technology science and practice. BCS is the national member of CEPIS. Institution of Engineering and Technology (Formerly IEE, Member of SFIA) Institute for Management of Information Systems (Member of SFIA) IT Services Management Forum for UK. (Member of SFIA) Trade Association for IT Sector
Trade Unions	TUC STUC	www.tuc.org.uk www.stuc.org.uk/	Trade Union Congress – includes majority of major Unions in UK Scottish Trade Union Congress – majority of major Unions in Scotland.
Chambers of Commerce	BCC (British Chambers of Commerce)	www.britishchambers.org.uk/	Network of accredited Chambers of Commerce across UK
CERTIFICATION			
Certification Bodies	BCS Professional Certifications	www.bcs.org/certifications	Part of BCS - examination body created to raise the standard of competence and performance of people working in IT.
Accreditation Bodies	UKAS (UK Accreditation Service) OFQUAL	www.ukas.com www.ofqual.gov.uk/	Only recognized by government to assess, against internationally agreed standards, organizations that provide certification, testing, inspection, and calibration services. Office Of Qualifications & Examinations regulation Includes the QCF for UK, Wales and N. Ireland, SQCF for Scotland
Qualification Framework	OFQUAL	www.ofqual.gov.uk/	As above
E-COMPETENCIES			
Skills Framework	SFIA	www.sfia.org.uk/	Skills Framework for the Information Age – common reference model for the identification of Skills. Promoted by the SFIA Foundation, whose members include BCS, IET, e-skills UK, IMIS, ITSMF UK. Promoted as the standard of the Government IT Profession by the Cabinet Office. Also with considerable traction in other territories, eg Australia.

COUNTRY	UNITED KINGDOM	POPULATION	62,008,048 (Estimate 2010)
Type	**Name**	**Website**	**Specifics**
Enhanced skills framework	SFIAplus	www.bcs.org/	Formerly British Computer Society. Promotes wider social and economic progress through the advancement of information technology science and practice. SFIAplus provides extra granulation to the vanilla SFIA framework allowing clients to build job descriptions, skills gap analysis, professional development cycles etc
ETHICS			
Professional Body's Code of Ethics/Conduct	BCS (Chartered Institute for IT)	www.bcs.org/	Formerly British Computer Society. Has Code of Conduct but must be a member to view Code of Conduct.

Appendix D Acronyms

List of Acronyms	
ACM	Association of Computing Machinery
ACP	Associate Computing Professional
ACS	Australian Computer Society
AITTS	Advanced IT Training System
ANS	American National Standard
ANSI	American National Standard Institute
ASQ	American Society for Quality
ASTI	Association Française des Sciences et Technologies de l'Information
ASTM	American Society for Testing and Materials
BCS	British Computer Society
BFUG	Bologna Follow Up Group
BIS	Bureau of Indian Standards
BMBF	German Ministry of Education and Research
BOK	Body of Knowledge
C2i	Computer and Internet Certificate
CAP	Certified Authorization Professional
CBP	Certified Biometrics Professional
CBIP	Certified Business Intelligence Professional
CCE	Committee on Computer Ethics
CCP	Certified Computing Professional
C-DAC	Centre for Development of Advanced Computing (India)
CDMP	Certified Data Management Professional
Cedefop	European Centre for the Development of Vocational Training
CEI	Computer Ethics Institute
CEN	Comité Européen de Normalisation or European Committee for Standardisation
CENELEC	Comité Européen de Normalisation Electrotechnique or European Committee for Electrotechnical standardisation
CEPIS	Council of European Professional Informatics Societies
CGEIT	Certified in the Governance of Enterprise IT
CIAJ	Communications and Information Network Association of Japan
CIO	Chief Information Officer
CISA	Certified Information Systems Auditor
CISM	Certified Information Security Manager
CISSP	Certified Information Systems Security Professional
CompTIA	Computer Technology Industry Association
COPE	Committee on Professional Ethics
CPD	Continuous Professional Development
CRISC	Certified in Risk and Information Systems Control
CSDA	Certified Software Development Associate
CSDP	Certified Software Development Professional
CSI	Computer Society of India
CSSLP	Certified Secure Software Lifecycle Professional
EaSA CC	European e-skills Association Certification Council
ECDL	European Computer Driving License
e-CF	e-Competence Framework
ECTS	European Credit Transfer and Accumulation System
EeSA	European e-Skills Association

List of Acronyms	
EHEA	European Higher Education Area
EMEA	Europe Middle-East and Africa
EICTA	European Information and Communication Technology industry Association
EITO	European IT Observatory
EMF	European Metal Workers Federation
EN	European Standard
ENISA	European Network and Information Security Agency
EQF	European Qualifications Framework
eSCC	E-Skills Certification Consortium
ETF	European Training Foundation
ETSI	European Telecommunications Standards Institute
ETUC	European Trade Union Confereration
EU	European Union
EUCIP	European Certification of Informatics Professionals
FEANI	Fédération Européenne d'Associations Nationales d'Ingénieurs or European Federation of National Engineering Associations
FIPA	Finnish Information Processing Association
FOSS	Free and Open Source Software
HP	Hewlett Packard
IBC	Industry Based Certification
IC-Council	International Certification Council
ICCP	Institute for Certification of Computing Professionals
ICS	Irish Computer Society
ICT	Information and Communications Technology
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IET	Institute of Engineering and Technology
IFIP	International Federation for Information Processing
IITP	International IT Professional
IP3	International Professional Practice Partnership
IPA	Information Technology Promotion Agency
IPSJ	Information Processing Society of Japan
ISA	Information Systems Analyst
ISACA	Information Systems Audit and Control Association
ISC2	International Information Systems Security Certification Consortium
ISEB	Information Systems Examination Board
ISO	International Standards Organisation
ISP	Information Systems Professional
ISP	Internet Service Provider
ISSAP	Information Systems Security Architecture Professional
ISSEP	Information Systems Security Engineering Professional
ISSMP	Information Systems Security Management Professional
ITSS	IT Skill Standards
ITU	UN Agency for Information and Communication Technology
JEITA	Japans Electronics and Information Technology Industries Association
JEMA	Japans Electrical Manufacturers Association
KPI	Key Performance Indicator
METI	Ministry of Economy, Trade and Industry

List of Acronyms	
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MOU	Memorandum of Understanding
NCTEF	National Career Technical Education Foundation
NQF	National Qualifications Framework
PIN-SME	Pan European ICT & eBusiness Network for SMEs
PMI	Project Management Institute
PRISM	PRogram in Information Security Management
QF-EHEA	Qualifications Framework – European Higher Education Area
ROIS	Research Organisation of Information and Systems
SDO	Standards Developing Organisation
SCCI	States Career Cluster Initiative
SEI	Software Engineering Institute
SFIA	Skills Framework for the Information Age
SIG	Special Interest Group
SME	Small and Medium Enterprise
SSCP	Systems Security Certified Practitioner
USAID	United States Agency for International Development
WCET	Wireless Communication Engineering Technologies

Table 26: Acronyms

Appendix E Stakeholder Perspectives on ICT Professionalism

E.1 Perspectives on the framework

In order to facilitate understanding of how the proposed framework could operate in practice, we have created a series of perspectives, explaining the nature of the framework from the perspective of different stakeholders.

In doing so, we aim to simplify the task of communicating the impact, benefits and value of the framework for each stakeholder group.

E.2 ICT Professionals

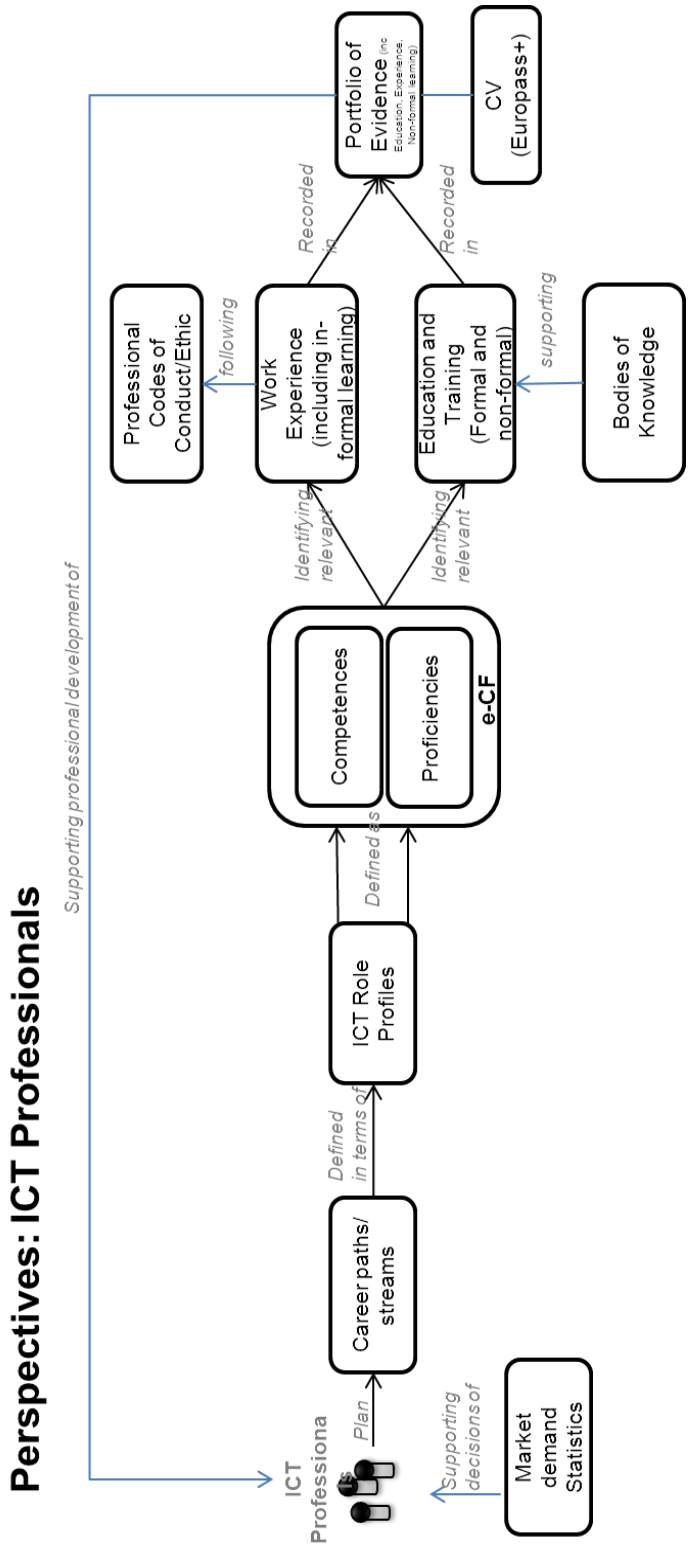


Figure 53 ICT professionals' perspective

E.2.1 Notes on ICT Professionals' Perspective Diagram

The availability of granular market demand statistics (for example by CEDEFOP, Eurostat, OECD) would provide ICT professionals with appropriate information on which to base

important career decisions, with respect to the level of demand for specific competences and the location in which the demand is increasing/decreasing.

The provision of standardised career paths and ICT role profiles defined in terms of competences and proficiencies would offer support for worker mobility across companies and national boundaries. It would assist career planning in terms of identifying jobs to pursue sequentially for professional development, in identifying competence gaps and future competence requirements.

The alignment of certifications/qualifications by certification providers and academic institutions to a common competence framework would result in improved transparency of courses and would support the identification of relevant training and education programmes to develop required competences. Further, the alignment of non-formal and informal education with a common competence framework (ostensibly via validation from a higher education institute) would facilitate the entry of experienced practitioners with no prior qualifications/certifications into the profession. Practitioners could therefore have an alternative pathway to be able to enter the profession, and progress from Associate to Professional (and higher) without the obligation of attending a university course (or certification equivalent).

An up-to-date portfolio of evidence, outlining all CPD initiatives, would provide the basis for advancement along career paths and would serve as the ICT professionals' key marketing tool during recruitment initiatives.

A Europass CV incorporating appropriate ICT-specific extensions (mapped to the competences/proficiencies of the e-CF) could help practitioners to be considered for employment outside of the country in which they acquired their original experience, qualifications and certifications.

Adhering to Codes of Ethics/Conduct helps build the individuals reputation within the profession. The alignment by Professional Associations of their Codes of Ethics/Conduct to a common set of criteria and procedures would result in a more uniform approach to ethical conduct across Europe, which is of particular relevance in cases of worker mobility.

E.3 Employers

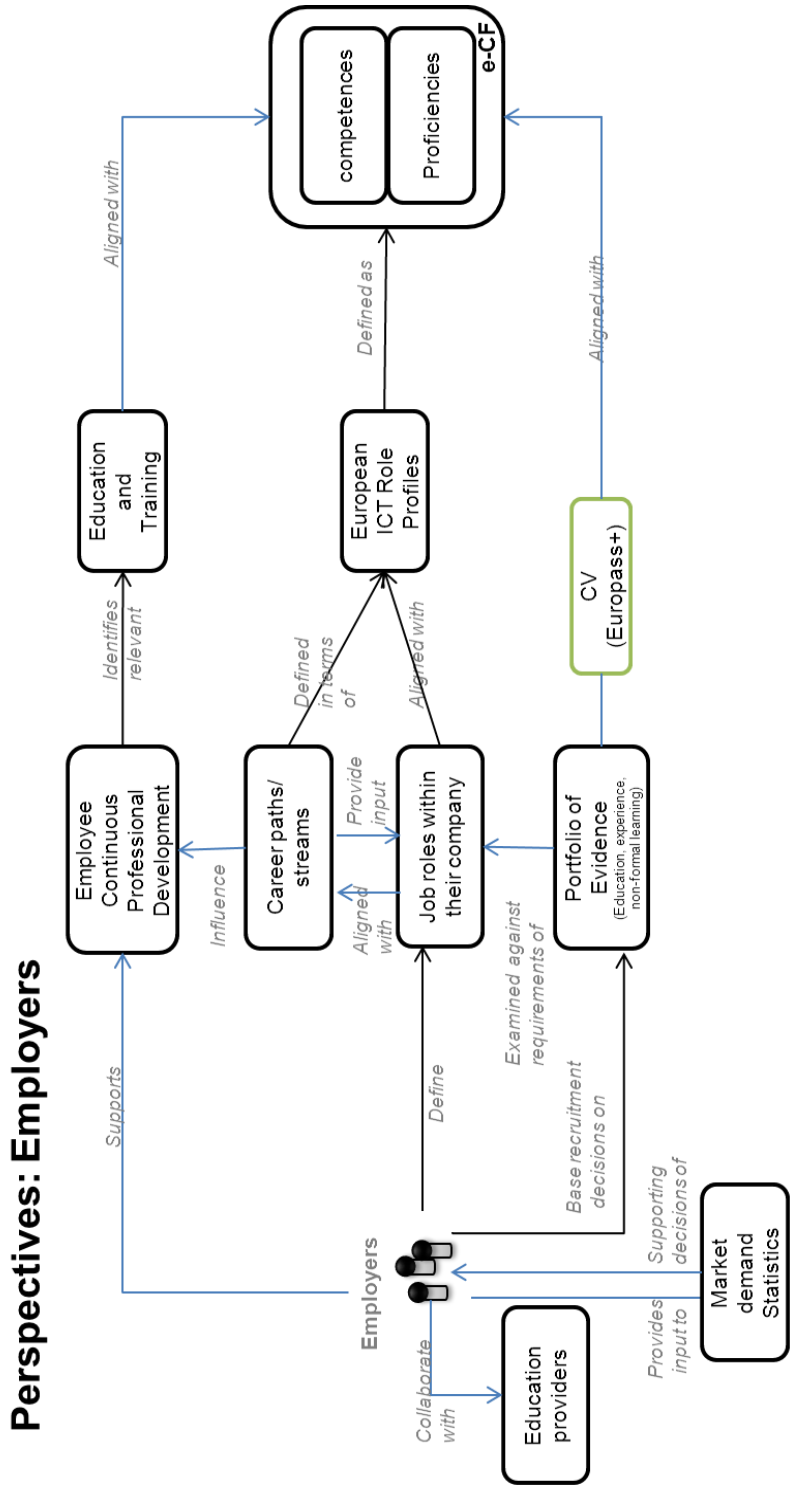


Figure 54 Employers' perspective

E.3.1 Notes on Employers' Perspective Diagram

Collaboration with education providers would ensure the development of courses that are relevant and up-to-date with respect to the demands of industry and emerging technological trends. This would ensure the availability of appropriate training to fill competence gaps within organisations.

The availability of granular market demand statistics (for example by CEDEFOP, Eurostat, OECD) could provide employers with insights on the availability, location, and demand for specific competences, and could provide input for recruitment decisions and targeted recruitment drives. (In this respect, employers could also help facilitate improved granularity of demand when using the toolset for exploiting the e-CF, by submitting details of their own demand for specific competences/proficiencies, and allowing this data to be provided on an anonymised basis).

Employers defining job roles in terms of a standardised set of ICT competences and proficiency levels (via, for example, the e-CF) are able to establish increased consistency within an organisation, including across national boundaries. This would help eliminate the overhead in maintaining different competence models internally, and facilitate planning across an organisation (e.g. identifying existing competence gaps, future competence requirements, and training needs). Moreover, potential employees would more easily understand the precise requirements of roles as the terms used would be consistent across organisations and countries, thereby augmenting the potential number of applicants for any role advertised. Existing employees could also benefit from understanding what competences they must develop in order to be considered for career progression.

Alignment with a consistent set of role profiles (an optional step) would facilitate further consistency across an organisation, although it is likely that most organisations would require some customisation of job profiles internally.

Provision of an appropriate toolset to define job roles against an established competence framework could prove particularly attractive to SMEs as it would remove the need for the maintenance of an in-house framework. Further, the potential benefits of applicants from other countries could more easily be assessed due to a consistent use of competences/proficiencies. Similarly, the same framework would also support long-term career planning within such organisations. Some larger organisations who have developed in-house competence frameworks may opt to retain their in-house solution – nonetheless, mapping the in-house solution to the e-CF could still provide such companies with access to a potentially larger resource pool (across borders) and facilitate the recruitment process by providing a consistent understanding of competences/proficiencies (regardless of the country in which the education/experience was acquired).

An up-to-date portfolio of evidence, with ICT specific competence extensions (also included in an amended Europass CV), would provide the basis for selection of employees from the pool of job applicants, based on the degree of fit between their experience/qualifications and the requirements of the company's job role

If a Register of ICT Education was developed, it could help to partly validate an applicant's Portfolio of Evidence. This could be achieved by storing details of the educational and professional accomplishments of each ICT professional (for example, details of courses attended including the competences covered and proficiency levels achieved). These details could be submitted by the relevant provider (once each practitioner had opted in to the scheme). The data held in the register would be viewable at all times by the ICT professional but only viewable to other individuals when using a temporary access key provided at the discretion of the ICT professional.

The alignment of education and training courses to a common competence framework would enable employers to support their employees Continuing Professional Development; more specifically, the improved transparency of courses would help highlight relevant training and education programmes employees should pursue in order to fill competence gaps in-house.

E.4 ICT Certification Providers/Higher Education Institutions

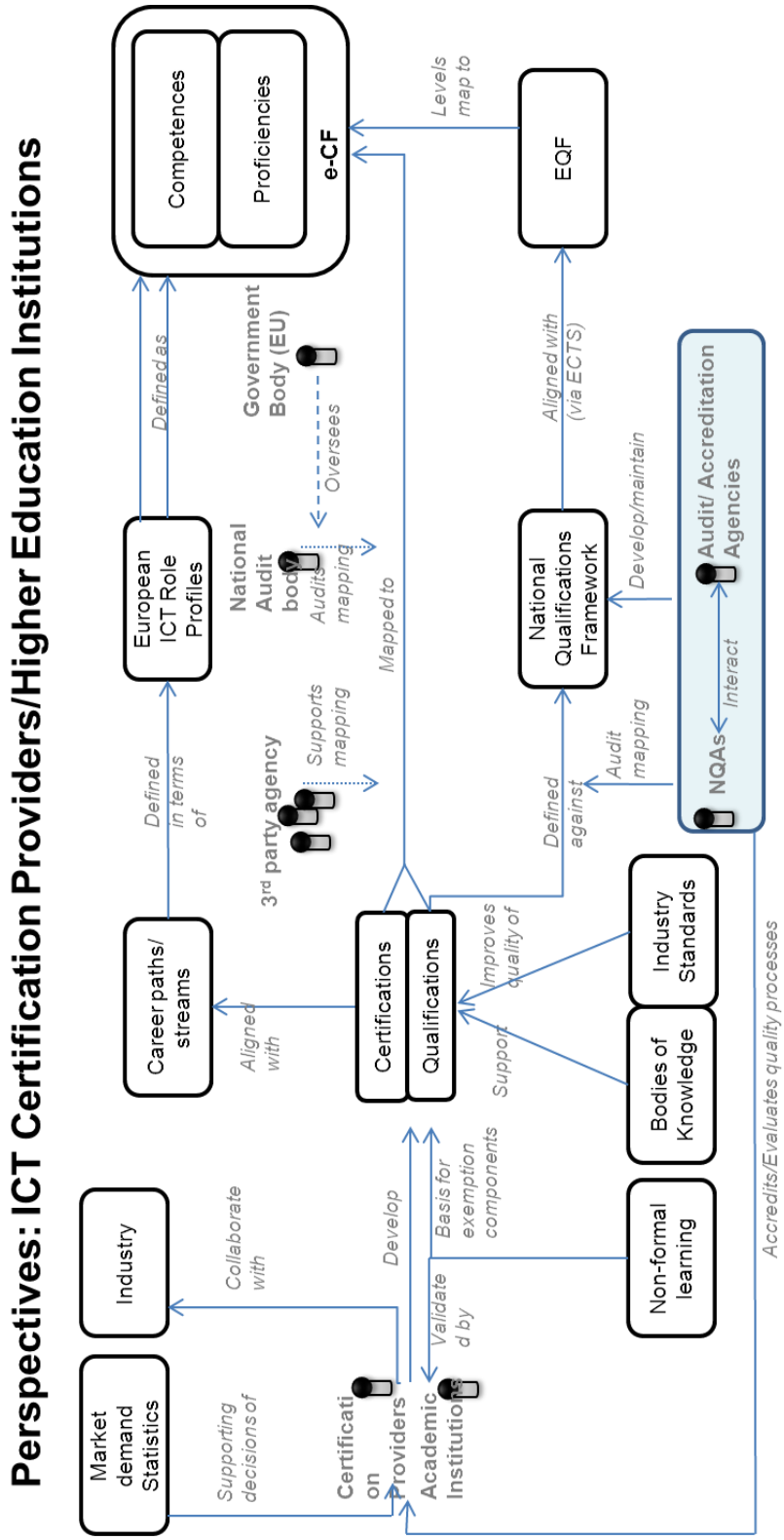


Figure 55 ICT education provider perspective

E.4.1 Notes on Education Providers Diagram

The provision of granular market demand statistics (for example by CEDEFOP, Eurostat, OECD) offers certification providers and academic institutions information on for example the level of demand for specific competences. Gaps in current training/qualification offerings pertaining to specific competences can drive development of courses that are relevant and in demand.

Collaboration with industry (and with each other) enables certification providers and academic institutions to develop relevant courses, in line with evolving organisational needs, and explore further avenues for course delivery.

The use of established bodies of knowledge and recognition of appropriate standards in certification/ qualification development improves the quality of courses. High quality, relevant products are a minimum requirement to attract potential candidates.

Non formal and informal learning, on the ICT practitioners' part, could form the basis for module component exemptions on courses offered. Non-formal and informal learning experiences, with supporting evidence by employers, could also be validated by higher education institutions resulting in a formal qualification that is mapped against the competences of the e-CF.

The mapping of certifications/ qualifications (with appropriate audit mechanisms) to a common competence framework that serves as the basis for defining role profiles and career paths would improve course transparency by highlighting the competences developed. This improved understandability of course content would potentially result in a greater number of candidates. It would also enable the identification of gaps in one's own courses compared to market leaders and compared to the competences demanded in the labour market.

The mapping of certifications/qualifications (with appropriate audit mechanisms) to a national qualifications framework and thereby the EQF provides another mechanism for increasing course transparency. It facilitates comparison with the levels of other certifications and academic institutions qualifications within a specific country and across the EU.

E.5 Entry into profession: students

In order to attract students and employees to a role in ICT, potential candidates need to be made aware of the opportunities that ICT offers. The career options must be 'sold' to potential students.

E.5.1 Promote ICT Careers

ICT career paths must be seen as exciting and offering a good return on the investment of money and time in developing the skills and competences needed. ICT like many other professions needs a life-long learning commitment. This needs to be put in context to ensure that potential ICT students understand that it is not disproportionate in relation to many other professions e.g. medicine, materials science, construction, architecture, law, social worker, politics, etc.

The historical growth that ICT has enjoyed is unprecedented and is expected to continue for some years to come. The innovative nature of ICT allows those working in the area to achieve very high levels of job satisfaction.

ICT is all pervasive and workers in ICT broaden their knowledge base over the years to overlap into sector specific areas (e.g. logistics, finance, manufacturing, government, etc). A solid ICT educational base has the potential to stimulate career opportunities in many organisations.

Career opportunities differ from small to large companies and by the HR/career progression policies of those companies. Notwithstanding, typical career profiles should be understood. These are well known for many other career paths like law, finance or nursing for example.

Suitable ICT promotional material (e.g. encompassing the Internet, career guidance teachers, posters, college application guidelines, etc) should be developed and communicated via multiple channels in order to raise awareness of the profession among potential ICT professionals.

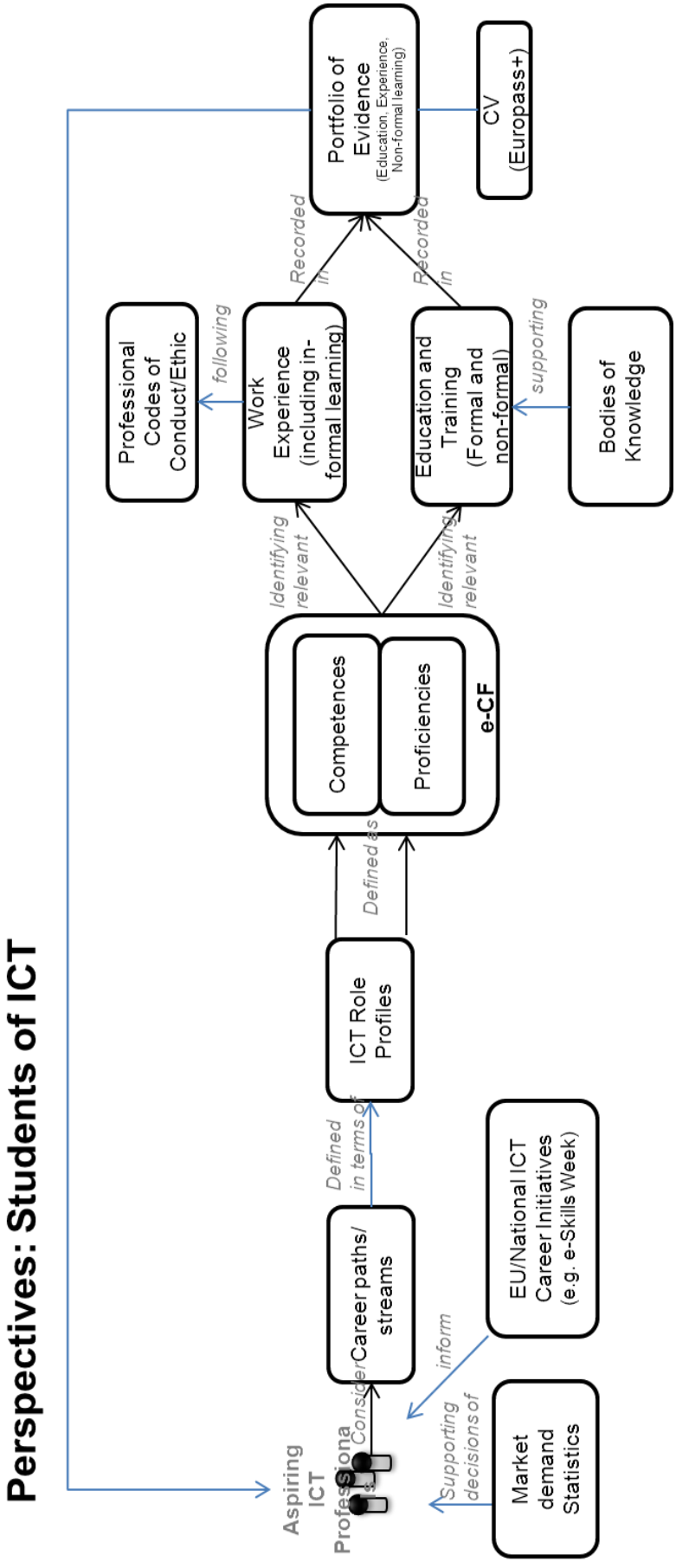


Figure 56 ICT student perspective

E.5.2 Notes on Student Perspective Diagram

The provision of granular market demand statistics (for example by CEDEFOP, Eurostat, OECD) would provide aspiring ICT professionals with appropriate information on which to make important career decisions, with respect to the level of demand for specific competences and the location in which the demand is increasing / decreasing. European, National and local governmental bodies could potentially facilitate equilibrium in this area via targeted promotional activities (e.g. e-Skills week).

The provision of standardised career paths and ICT role profiles defined in terms of competences and proficiencies would provide a detailed set of training and education objectives. ICT profession candidates can select the college courses and/or work with their employers to get the work experiences to achieve the competence levels required. Promotion packs for schools and employment information centres are important.

The alignment of certifications / qualifications by certification providers and academic institutions to a common competence framework would result in improved transparency of courses and support the identification of relevant training and education programs to develop required competences.

Adhering to Codes of Ethics/Conduct helps build the individuals reputation within the profession. The alignment by Professional Associations of their Codes of Ethics/Conduct to a common set of criteria and procedures results in a more uniform approach to ethical conduct across Europe, which is of particular relevance in cases of worker mobility.

An up-to-date portfolio of evidence, outlining all continuous professional development initiatives, provides the basis for advancement along career paths and serves as the aspiring ICT professional's key marketing tool during recruitment initiatives.

E.6 Graduate ICT Profession Entry

Undergraduate courses in the ICT stream of education courses will encompass the core fundamental knowledge base required for entry into the ICT profession at the associate level. It is expected that graduates will automatically qualify for entry to the profession.

Presently, many courses available are already aligned with existing core bodies of knowledge like those from the IEEE[55] or BCS[56]. The drive for this alignment originated with the students.

Once the associate professional has developed competences at level two, the professional rating may be raised to that of a 'professional'.

[55] The Institute for Electrical and Electronic Engineers http://ieee.org

[56] The British Computer Society http://bcs.org

E.7 ICT Manager with ICT degree and certifications

An experienced practitioner that has a primary degree in ICT is automatically over the level 1 or associate professional entry criteria. Specifically, s/he can demonstrate the core fundamental ICT knowledge base criteria are met.

The manager just like any other ICT professional is free to self-assess his or her own competences. If a Register of ICT Education was developed, it could be updated with any qualifications and/or certifications obtained. The colleges and certification providers who issued the qualifications and certification can be asked to confirm the entries. Some education and certification providers may no longer be in existence and confirmation may not always be possible.

The ICT Manager can by self-assessment move to ICT Manager or level 3. In effect, s/he continues to be "respected for innovative methods and use of initiative in specific technical or business areas; providing leadership and taking responsibility for team performances and development in unpredictable environments".

E.8 ICT Practitioner with 10 years' experience but no qualifications or certificates.

An ICT Practitioner who has no qualifications or certifications but many years of experience could undergo an evaluation or certification process that can attest that the core ICT fundamental knowledge criteria have been met. This service may be provided by public or private education providers or the service may be offered by ICT professional associations. Alternatively, the practitioner could self-assess their knowledge against the foundational meta-level ICT Body of Knowledge.

Once the base core knowledge criteria have been established, the experienced practitioner (as with all other ICT professionals) could self-assess their competence/proficiency against the e-CF to determine their level within the framework.

Appendix F European ICT Professionalism Roadmap

Ultimately, the objective is to establish an ICT profession: this profession must enable mutual recognition and facilitate cross-border mobility; the profession should be dynamic, adaptive, flexible and progressive; the profession once established should remain open to new entrants and play a part in promoting ICT career options; professionals will have a comprehensive understanding of a common body of knowledge; and, the profession will encourage the acquisition of education, the use and recognition of certifications and qualifications, on-the-job training and lifelong learning as ways of ensuring the competence and standing of professionals.

In order to achieve these goals, the stakeholder community and in particular, academics, government and industry need to take ownership and facilitate each other as the building blocks of an ICT Profession are developed. Winning and maintaining support for the development of an ICT profession should be recognised as a crucial goal or objective for the programme management.

The roadmap is shown in Figure 57. The descriptions below provide an overview of possible key initiatives to support the maturing of ICT professionalism across Europe. For each item, we have described its high-level objectives and we have also identified the lead stakeholder (shown in brackets). Although the lead stakeholder is responsible for initiating the activity, in practice, virtually all activities would require multi-stakeholder engagement and collaboration to enable success.

F.1 Roadmap components

ICT Professionalism Stakeholder Workshops (European Commission)

While separate initiatives are needed to tackle specific themes and issues (e.g. e-CF Governance initiative below), it is also important to recognise the importance of collaborating, cooperating and communicating on an on-going basis among relevant key stakeholders, in order to drive common understanding and awareness on key issues and to drive the creation of solutions to tackle the problems. Further, the engagement of relevant players at the right time is an activity which is absolutely fundamental to achieving success in the stated objectives. These on-going workshops will help to maintain dialogue and shape the profession.

Some themes which might stimulate further research and/or collaboration among stakeholders include: pooling of assessment data and pooling of employer demand data to provide a granular view of competence supply and demand across Europe; assessment of industry need for a register of ICT education (and how data for this might be pooled to provide a single view of each practitioner if separate data sets emerge in practice).

These workshops could also facilitate the formation and mobilisation of relevant stakeholder groupings at a national and European level (as per Action Point 2 in section 11 of this report)

Recognising the growing importance of ICT professionalism across the globe, efforts should also be made to understand the on-going professionalism initiatives being undertaken elsewhere (eg TechAmerica, ITA, etc.) in order to share best practices and foster alignment. To this end, a regular global workshop would facilitate this goal. (A first such workshop is now being planned for late 2012/ early 2013).

F.2 European ICT Profession Governance (European Commission -> Multi-stakeholder)

A detailed long-term sustainable business model and governance model for the ICT profession must be established, involving the appropriate combination of relevant stakeholders. This report outlines many of the key characteristics, but further dialogue is needed to develop and refine the models accordingly. While the European Commission can initiate and foster collaborative action through on-going workshops between industry players; ultimately, responsibility for establishing and promoting the profession will require the on-going engagement of multiple stakeholders. Some observers have called for the need for a new European body to oversee the development and management of key components of the European framework for ICT professionalism. An example might be a body that could be responsible for activities such as the governance and promotion of the e-CF in the long-term (including post-standardisation).

F.3 e-CF 3.0 Definition (CEN)

Develop an updated version of European e-Competence framework under the auspices of a multi-stakeholder partnership from industry, education and government. In doing so; enable participation of wider group of engaged stakeholders (potentially including US and Asian counterparts). The new version of e-CF must be capable of tackling all required use-cases robustly, providing adequate coverage and granularity of required competences. Initiative planned to start during 2012.

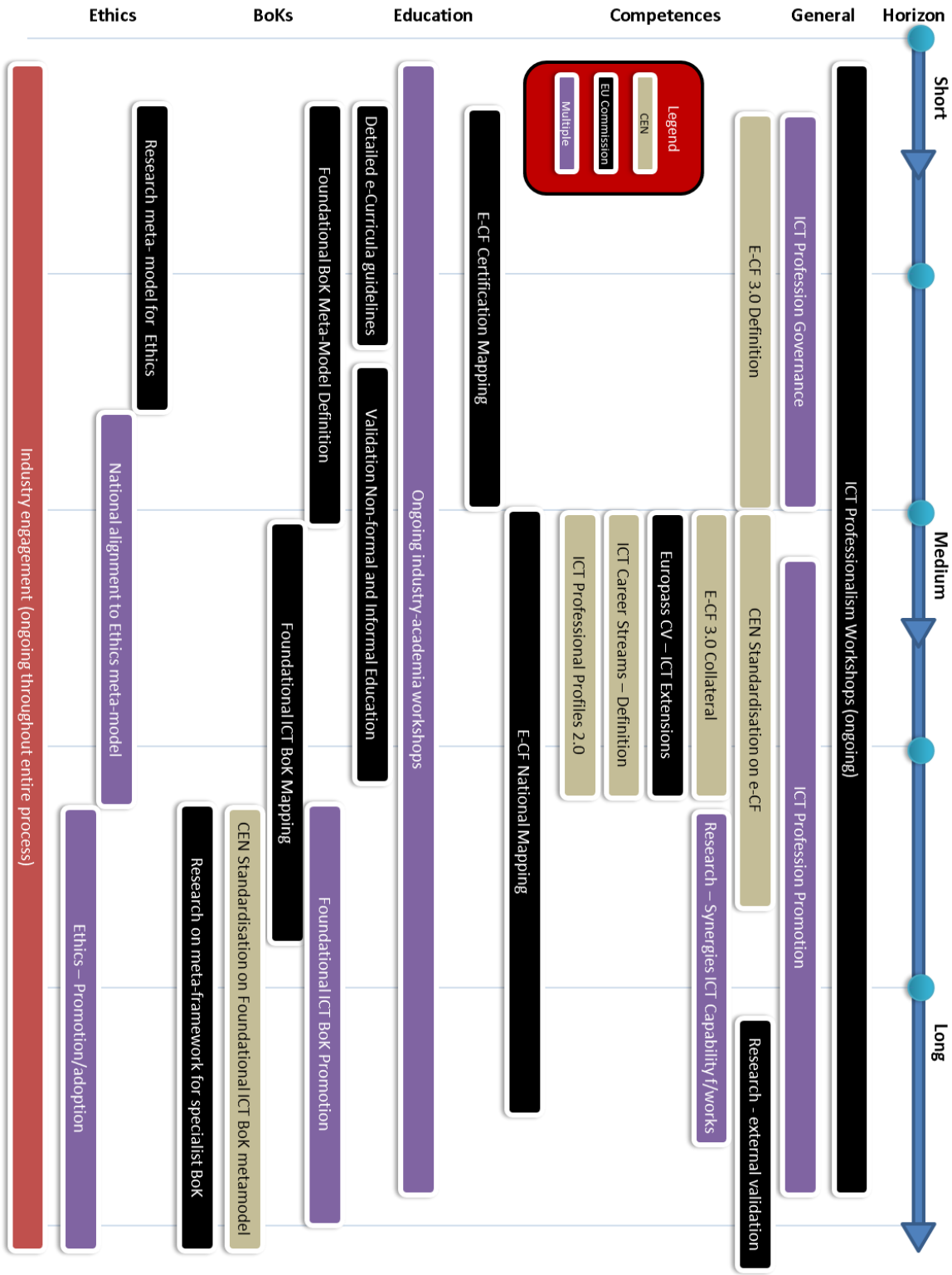


Figure 57 European Professionalism Roadmap (tentative)

F.4 e-CF 3.0 Supporting Collateral (CEN)

The development of relevant collateral will be needed in order to support organisations (employers, education providers, HR agencies) in transitioning to an ICT competence framework solution. This collateral is likely to be both instructional (e.g. operational aspects of adoption) and promotional (raising awareness of the e-CF).

F.4.1 CEN Standardisation on e-CF (CEN)

The establishment of a CEN Technical Committee to support the adoption of e-CF as a European standard is an important step in fostering widespread adoption of the e-CF in European, National and local government institutions – which in turn, will drive adoption across industry in Europe.

The process for establishing a Technical Committee from the current CEN Workshop for ICT Skills will require careful management, as will the subsequent process of facilitating adoption at a national level.

F.4.2 ICT extensions to Europass CV (European Commission)

Develop and agree series of ICT-specific extensions for Europass CV (aligned with the e-CF and foundational ICT meta-model; this activity includes defining relevant ICT extensions, fostering adoption by users, and providing user guidance in their usage.

Liaise with HR agencies (including online recruitment agencies) to support the adoption of standardised Europass ICT extensions.

F.4.3 Definition of ICT Career Streams (CEN)

Develop series of ICT careers streams aligned with e-CF and European ICT Professional Profiles projects, in order to show relevant career progression opportunities for professionals within ICT.

F.4.4 Expansion of ICT Role Profiles (CEN)

Next iteration of European ICT Professional Profiles deliverable, accommodating roles which are closely aligned with stakeholders outside of ICT (and therefore lying outside of traditional ICT Operations/Applications domains).

F.4.5 e-CF Certification Mapping (European Commission)

Foster mapping of third party certifications to e-CF. In addition to encouraging relevant industry based training and certification providers to map to the e-CF, it is important that the process can be performed consistently, in order to enhance the level of confidence in the outputs from the perspective of both practitioners and employers. Initiative commences Jan 2012.

F.4.6 e-CF National Mapping Consistency (European Commission / National Education entities)

Initiative to assess opportunities for establishing consistent national approaches to support the mapping of certifications, qualifications and non-formal and informal education to e-CF, and developing detailed proposals to support this moving forward at an individual country level. In addition to developing detailed proposals for the auditing mapping of third party offerings to the e-CF, the project should also investigate the mapping of national competence frameworks (where they exist) to the e-CF. This activity would build on the e-Certification mapping activity, but expanding the scope of the project outside of certification providers to encompass a broader range of education providers (eg Universities), and support the creation of relevant entities to support a consistent mapping approach.

F.4.7 ICT Profession Promotion (Multi-stakeholder)

Promoting the ICT Profession will require coordinated effort from multiple stakeholders and development of relevant promotional activities/collateral targeting individuals at different stages of their career (students, graduates, experienced practitioners, prospective professionals from other industries, etc). These activities will raise awareness of practitioner mapping to e-CF levels, generate interest in Foundational ICT Body of Knowledge, increase knowledge of multiple entry points/educational paths into the ICT profession, and educate practitioners on the importance of Ethics. This initiative will also involve engagement with e-Skills Week.

F.4.8 Synergies with ICT Capability Frameworks (Industry/Academia)

The e-CF represents only one component of organisational ICT capability: people. It does not take into consideration the process and technologies/tools aspects. Providing organisations with visibility of the "bigger picture" will support organisations in their adoption of the e-CF and foster improvements in overall ICT capability, thereby supporting the creation of additional business value. A research initiative to investigate the nature of the relationship between these ICT capability frameworks and e-CF will identify how best to embed these frameworks operationally in different types of organisations.

F.4.9 Research on external validation (European Commission)

At this juncture, there is no clear market demand for chartered ICT professionals (requiring detailed external validation mechanisms) across Europe from industry nor from practitioners; instead, a voluntary, self-assessment approach is currently more aligned with current ways of working and thinking. However, the economic and political landscape may change over time, and therefore due consideration should be given to reviewing and assessing market requirement for such an approach in the future. It is likely that demand for external validation, if required at all, will stem from specific industries, sectors, or initiatives – for example, Trustworthy ICT.

F.4.10 Detailed e-Curricula Guidelines (European Commission)

Building on the results of the earlier INSEAD European e-Competences Curriculum Guidelines (EeCCG) Project, this initiative is aimed at translating the earlier findings into specific projects and actions. In doing so, this project will also help contribute to bridging the gap between education providers and industry.

F.4.11 Validation of Non-formal Education and Informal Education (multi-stakeholder)

Validating non-formal education and informal education is a topic which expands beyond ICT professionalism. However, the importance of these educational channels to the ICT profession is such that concerted effort from industry and HEIs is required in order to pursue this objective. Some countries (notably Germany and France) have implemented successful initiatives with respect to validating non-formal education, but identification of best practices, particularly those specific to the ICT profession and which could be shared across Europe would be very helpful for countries where validation of such education is immature.

F.4.12 Foundational ICT Body of Knowledge Meta-Model Definition (European Commission)

Initiate research activity to define meta-model for a Foundational ICT Body of Knowledge. This research activity would require the involvement of education providers, industry and government in order to construct a solution which was relevant, useable, and maintainable.

The precise nature of the meta-model would be defined as part of the project although the intention is that the structure used would be flexible enough to support the dynamic nature of the ICT industry (for this reason, a meta-model approach is proposed).

F.4.13 Foundational ICT Body of Knowledge - Mapping (European Commission)

This is an initiative to define the process for education providers to map their respective offerings to the Foundational ICT Body of Knowledge meta-model. This project should also develop plans for encouraging wider adoption of the meta-model and raising awareness among practitioners.

F.4.14 Foundational ICT Body of Knowledge – Promotion (Multi-stakeholder)

This initiative should build on the outputs of the mapping project to put into practice the plans for encouraging wider adoption of the Foundational meta-level ICT Body of Knowledge.

F.4.15 CEN Standardisation on Foundational ICT Body of Knowledge meta-model (CEN)

In the long term, the establishing the Foundational meta-level ICT Body of Knowledge will help foster its adoption across Europe.

F.4.16 Research on meta-framework for Specialist BoKs (European Commission)

Based on the level of success that is achieved for the Foundational meta-level ICT Body of Knowledge, an approach for defining specialist ICT Bodies of knowledge should also be considered. Again, this would most likely be based on a meta-modelling approach.

F.4.17 Research into meta-model for ethics (European Commission)

A single code of ethics/conduct across the whole of Europe is unrealistic, given our different cultures, languages, histories and values. However, a meta-model based on shared core elements might contribute towards alignment. This research would build on existing work undertaken by several national and international societies and academics, and engage with these stakeholders to help foster consensus.

F.4.18 National Alignment to Ethics Meta-model (Multi-stakeholder)

Once a meta-model had been constructed, a process of agreeing roadmaps for national bodies to realign their existing codes would help improve consistency.

F.4.19 Ethics – Promotion / Adoption (Multi-stakeholder)

Professionals should behave with integrity, and alignment on codes of ethics via a meta-model is important, but awareness of these codes also has to be driven at a national and international level to drive adoption at practitioner level.

F.4.20 On-going Industry Engagement

Although this project cannot impose any specific actions on industry, it is essential to recognise the importance of industry's engagement in this entire process, as their involvement is absolutely fundamental to success.

Besides the insight and contribution into the nature and content of assets such as the e-CF, the foundational ICT Body of Knowledge meta-model, and ethical codes – it is industry that will ultimately drive increased maturity of ICT professionalism.

Some industry participants already have identified clearly defined roles (e.g. certification providers) but other roles will emerge over time, reflecting new business opportunities – for example:-

- Toolsets to support practitioners self-assessing against e-CF, and employers in defining job roles appropriately,
- Toolsets to support ICT Capability Gap Analysis
- Toolsets to track employer ICT competence demand forecasts
- Consultancy services to support organisations moving to a competence model based on e-CF
- Provision of ICT competence benchmarking (at practitioner, department, organisation, national, European level)
- Provision of granular ICT competence supply/demand data (to provide insight into government policy)

Appendix G ICT Professionalism – definitions

This appendix contains a table of definitions collected from many of the source documents used in the desktop research, as well as definitions created during the course of the project (eg "ICT professional").

Term	Definition	Source
Accreditation	Assessment of conformity of an object of interest with specific obligatory or voluntary standards. Process of accrediting an institution of vocational education or training, a programme of study, or a service, showing it has been approved by the relevant legislative and professional authorities by having met predetermined standards.	"ICT Skills Certification in Europe Report" 2005
ADM	Architecture Development Methodology promoted in the TOGAF.	
Assessment	The sum of methods and processes used to evaluate the attainments (knowledge, know-how, skills and competences) of an individual, and typically leading to certification.	"ICT Skills Certification in Europe Report" 2005
Body of Knowledge (BOK or BoK)	is a term used to represent the complete set of concepts, terms and activities that make up a professional domain, as defined by the relevant professional association. While the term *body of knowledge* is also used to describe the document that defines that knowledge — the *body of knowledge* itself is more than simply a collection of terms; a professional reading list; a library; a website or a collection of websites; a description of professional functions; or even a collection of information. It is the accepted ontology for a specific domain. Bodies of knowledge will typically contain knowledge on generally accepted good practice.	Wikipedia 24/May/11. PMBOK®
Certificate/ diploma	An official document, issued by an awarding body, which records the achievements of an individual following a standard assessment procedure.	"ICT Skills Certification in Europe Report" 2005
Certification (of skills and competences)	Certification results from a voluntary evaluation process whereby an individual's knowledge and/or skill in a particular area of interest are validated against a set of predetermined skills requirements e.g. skills standards by means of an objective assessment.	"ICT Skills Certification in Europe Report" 2005
Certification process	The certification process comprises all activities by which a certification body establishes that a person fulfils specified competence requirements.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Certification process	All activities by which a certification body establishes that a person fulfils specified competence requirements, including application, evaluation, decision on certification, surveillance and recertification, use of certificates and logos/marks.	"ICT Skills Certification in Europe Report" 2005
Certification scheme	Specific certification requirements related to specified categories of persons to which the same particular standards and rules, and the same procedures apply.	"ICT Skills Certification in Europe Report" 2005
Certification system	Set of procedures and resources for carrying out the certification process as per a certification scheme, leading to the issue of a certificate of competence including maintenance.	"ICT Skills Certification in Europe Report" 2005
CIO	Chief Information Officer The chief information officer (CIO), or information technology (IT) director, is a job title commonly given to the most senior executive in an enterprise responsible for the information technology and computer systems that support enterprise goals. A chief innovation officer or CIO is a person in a company who "originates new ideas but also recognizes innovative ideas generated by other people."	http://en.wikipedia.org/wiki/Chief_information_officer Heidrick & Struggles (Time Inc. website) "What Makes a Successful Chief Innovation Officer?
Comparability	The extent to which it is possible to establish equivalence between the level and content of formal qualifications (certificates or diplomas) at sectoral, regional, national or international levels.	"ICT Skills Certification in Europe Report" 2005
Competence	A demonstrated ability to apply knowledge, skills and attitudes for achieving observable results	Cited by Jutta Breyer, CEN e-CF & ICT professional profiles project development leader, Jan 2011
Competence	Demonstrated ability to apply knowledge and/or skills and, where relevant, demonstrated personal attributes in a habitual or changing situation, and/or as defined in the certification scheme.	"ICT Skills Certification in Europe Report" 2005
Craft	A craft refers to a set of practices shared by a community of practice, but it has no special social status. Wood crafting and programming are examples.	(Peter J Denning, 2011)
Discipline	A discipline refers to a field of study or research that provides knowledge. Chemistry and computer science are examples.	(Peter J Denning, 2011)

Term	Definition	Source
e-Business skills	are defined as the capabilities needed to exploit opportunities provided by ICT, notably the internet, to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organisational processes; and/or to establish new businesses.	European e-Skills Forum (2004) established by the European Commission and cited in "e-Skills — The Key to Employment and Inclusion in Europe" Sponsored by: Microsoft
Education	Education is responsible and lays the foundation for the initial transfer of core knowledge and basic understanding (know-how) of ICT workers. Education e-Skills Certification in Europe teaches concepts, theories, problem solving capabilities and constitutes the prerequisite to be trained on specific job requirements.	"ICT Skills Certification in Europe Report" 2005
e-Skills	e-skills encompasses a wide range of capabilities (knowledge, skills and competences) and issues with an e-skills dimension span over a number of economic and social dimensions. The term 'e-Skills' includes ICT Practitioner Skills, ICT User Skills and e-Leadership Skills.	"ICT Skills Certification in Europe Report" 2005
e-Skills deficiencies	**Shortage**: an insufficient number of skilled people in the labour market or in an occupational segment **Gap**: a competence shortfall between the current and needed competence levels of individual staff within organisations; mismatch: a mismatch between the competence of the trainee or graduating student/learner and the expected competence needs of the employers. **Mismatch:** is assumed to arise from course/curricula misalignment	EUROPEAN E-SKILLS 2009 CONFERENCE FOSTERING ICT PROFESSIONALISM, 20 November 2009, Brussels - CONFERENCE REPORT
e-skills Gap	A competence shortfall between the current and needed competence levels of individual staff within organisations.	
e-skills Shortage	An insufficient number of skilled people in the labour market or in an occupational segment.	
Formal learning	Learning that takes place in the form of physical, face-to-face, teacher-centred classroom training (instructor-led training).	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Fundamental truth	Pertaining to the foundation or basis; serving for the foundation. Hence: Essential, as an element, principle, or law; important; original; elementary; as, a fundamental truth; a fundamental axiom. So basic as to be hard to alter, resolve, or overcome	http://www.brainyquote.com/words/fu/fundamental167551.html#ixzz1LnD3AFKD Oxford Dictionary of English, 2nd Edition, 2005, Seiko electronics version
Future internet	The future internet will be faster, cheaper and it will encompass machine-to-machine (M2M) connections and services. It will be based on IP6 addresses and enable concepts like the "Smart Grid", smart dust; in effect smart connected everything. The opportunities to automate, innovate and transform the way we and machines do things is vast.	Project team
Generally recognised	**"Generally recognised"** means the knowledge and practices described as applicable to most projects most of the time, and there is a consensus about their value and usefulness.	PMBOK® Version 4.
Good practice	**"Good practice"** means there is general agreement that the application of these skills, tools, and techniques can enhance the chances of success over a wide range of projects. Good practice does not mean the knowledge described should always be applied uniformly to all projects; the organisation and/or project management team is responsible for determining what is appropriate for any given project.	PMBOK® Version 4
ICT	Information and Communication Technology	
ICT	Information and communication technology (ICT) is technology which provides for the electronic input, storage, retrieval, processing, transmission and dissemination of information.	"ICT Skills Certification in Europe Report" 2005
ICT practitioner	(synonyms: IT practitioner, IT or ICT professional, IT or ICT worker): people whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems) (cf. "ICT practitioner skills").	
ICT practitioner skills	Defined as the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems. ICT practitioners are people whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems). For their surveys, Eurostat has operationally defined the following: "ICT specialists or IT specialists have the capability to specify, design, develop, install, operate, support, maintain, manage, evaluate and research ICT and ICT systems. ICT is the main job."	European e-Skills Forum (2004) & Eurostat

Term	Definition	Source
ICT practitioners	ICT practitioners possess the capabilities required for specifying, designing, developing, installing, operating, supporting, maintaining, managing, evaluating and researching ICT systems, for the benefit of others. ICT Practitioners include both professional ICT ("Informatics") and non-professional ICT workers.	"ICT Skills Certification in Europe Report" 2005
ICT Professional (Project definition)	ICT Professionals: • possess a comprehensive and up-to-date understanding of a relevant body of knowledge[57], • demonstrate on-going commitment to professional development[58], via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education; • adhere to an agreed code of ethics/conduct[59] and/or applicable regulatory practices and, • through competent practice[60] deliver value for stakeholderss.	Definition derived during the course of the project and accepted by CEPIS Council members.
ICT skills	The skills needed for efficient use of ICT. Professional ICT skills: ability to use advanced ICT tools, and/or to develop, repair and create such tools. Applied ICT skills: ability to use simple ICT tools in general workplace settings (in non-IT jobs). Basic ICT skills or "ICT literacy": skills needed to use efficiently the basic functions of information and communication technologies (ICT). Ability to use ICT for basic tasks and as a tool for learning.	"ICT Skills Certification in Europe Report" 2005

[57] The term "relevant body of knowledge encompasses the requirement for a broad and deep knowledge base which is up-to-date, accommodating both a common ICT body of knowledge, and pertinent specialist knowledge and skills.

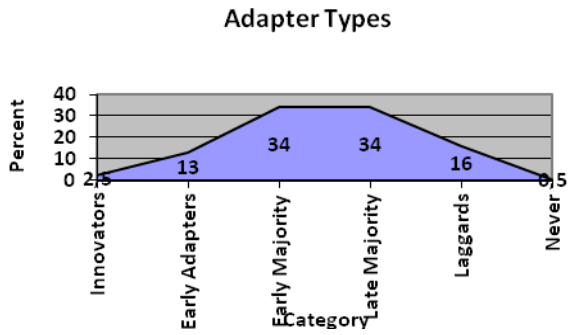
[58] Professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. keeping abreast of latest technological trends) as well as non-technical aspects (e.g. developing better presentation skills).

[59] Professionals are accountable to themselves, the ICT Profession and society, through an agreed code of ethics/conduct or applicable regulatory practices.

[60] Competent practice communicates the concept of quality of products and services being delivered by practitioners.

Term	Definition	Source
ICT user skills	are defined as the capabilities required for the effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialised tools supporting business functions within industry. At the general level, they cover "digital literacy". For their enterprise ICT surveys, Eurostat has operationally defined the following: “Capabilities enabling the effective use of common, generic software tools (basic user skills) or advanced, often sector-specific, software tools (advanced user skills). Jobs requiring ICT user skills: ICT is an important tool for the job and is used to produce work output and/or used intensively at work (in day-to-day activities)”.	European e-Skills Forum (2004) established by the European Commission and cited in “e-Skills — The Key to Employment and Inclusion in Europe” Sponsored by: Microsoft
ICT users	ICT users need the capabilities required for effective use by the individual of ICT systems and devices. ICT users make use of the systems as tools in support of their own work, which is, in most cases, not ICT. User skills cover the utilisation of common generic software tools, such as word processing, spread sheets, presentations, e-mail and internet, and use of specialized tools supporting business functions within user sectors.	"ICT Skills Certification in Europe Report" 2005
Informal learning	Learning which takes place in the work context, relates to an individual’s performance in their job and/ or their employability, and which is not formally organised into a programme or curriculum by the employer. Learning resulting from daily activities related to work, family or leisure. It is not organised or structured (in terms of objectives, time or learning support). Informal learning is in most cases unintentional from the learner’s perspective. It typically does not lead to certification.	"ICT Skills Certification in Europe Report" 2005
Know-how	Practical knowledge or expertise.	"ICT Skills Certification in Europe Report" 2005
Knowledge	Knowledge summarises the capabilities and skills applied by individuals to provide solutions for specific problems. Two major categories for knowledge are: explicit and implicit. Explicit knowledge can be accessed and transferred by other individuals; implicit knowledge is bound to the personal capacities and experience of a certain individual.	"ICT Skills Certification in Europe Report" 2005
Knowledge base	Is a superset of the *bodies of knowledge* that includes all necessary current information as is appropriate to the business and its technology management positioning; as an innovator, early adapted, early or late majority or laggard. The augmentation of the bodies of knowledge is typically achieved, through research and partnership with vendors, suppliers, industry associations, academic links and open collaboration. Influencing and shaping is often achieved via participation in standards bodies, lobbying and political awareness.	

Term	Definition	Source
Learning	Learning is a cumulative process whereby individuals gradually assimilate increasingly complex and abstract entities (concepts, categories, and patterns of behaviour or models) and/or acquire skills and competences.	"ICT Skills Certification in Europe Report" 2005
Learning outcome(s)/ learning attainments	The set of knowledge, skills and/or competences an individual acquired and/or is able to demonstrate after completion of a learning process.	"ICT Skills Certification in Europe Report" 2005
Learning outcomes	Statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning.	Learner Centred Methodologies, UCD School of Education and Lifelong Learning, P17, 2005
Lifelong learning	All learning activity undertaken throughout life, with the aim of improving knowledge, skills and/or qualifications for personal, social and/or professional reasons.	"ICT Skills Certification in Europe Report" 2005
Non-formal learning	Non-formal learning includes any organised, learner-centred, more flexible educational activity outside the established formal system.	"ICT Skills Certification in Europe Report" 2005
Practice	Practice refers to the skills displayed by professionals at various levels of competence as they render service.	(Peter J Denning, 2011)
Practitioner	Practicing professionals are often called practitioners.	(Peter J Denning, 2011)
Profession	A profession is a community of practice that forms to take care of people's enduring concerns in some area of life or work.	(Peter J Denning, 2011)
Professional	A professional is a member of a profession who renders service to clients of a profession.	(Peter J Denning, 2011)
Qualification	Demonstration of personal attributes, education, training and/or work experience. Qualification as certificates or diplomas or other evidence linked to the delivery and assessment of training received. The requirements for an individual to enter or progress within an occupation.	"ICT Skills Certification in Europe Report" 2005
Quality standards	Quality standards are provided in formal way by independent standardisation bodies and sector associations documented in form of normative documents. De facto standards are offered by public and/or private initiatives and are achieved through a broad acceptance by the actors in a specific sector/field. Quality standards can be distinguished concerning their focus e.g. on process, method, content.	"ICT Skills Certification in Europe Report" 2005
Recognition	The process of granting official status to skills and competences either through the award of certificates or through the grand of equivalence, credit units, validation of gained skills and/or competences (formal recognition). The acknowledgement of the value of skills and/or competences by economic and social stakeholders (social recognition).	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Skills	The knowledge and experience needed to perform a specific task or job. Capabilities of an individual, definable by content, to be acquired and activated through related professional training. In this context, capabilities are the physical or psychological attributes of an individual to be applied in activity-related approaches.	"ICT Skills Certification in Europe Report" 2005
Technology adapter categories	 Adapted from Rogers E.M. 1995. Diffusion of Innovations **Innovators** typically make up the most innovative 2.5% of the population. They have been described as rash, risky, and daring. An ability to work with complex and often underdeveloped technology as well as substantial financial resources help them absorb the uncertainties and potential losses from innovations. Innovators are not usually opinion leaders when it comes to new innovations; their skills and risk taking behaviour often set them apart from the rest of the social system, but they often play a large role in importing innovations from outside and adapting them for broader adoption. **Early adopters** are more integrated with the existing social system than innovators, and often have the greatest degree of opinion leadership, providing often potential adopters with information and advice about a new technology. Change efforts surrounding new innovations often target this population first as they represent the successful, discrete, and objective adopters that hold the respect of the larger social system. **The early majority** adopts just ahead of the average population. They have much interaction within the social system but are not often opinion leaders; instead they typically undertake deliberate and, at times, lengthy decision making. Because of their size and connectedness with the rest of the social system, they link the early adopters with the bulk of the population, and their adoption signals the phase of rapid diffusion through the population. **The late majority** is described as adopting innovations because of economic necessity and pressure from peers. While they make up as large a portion of the overall population as the early majority, they tend to have fewer resources and be more sceptical, requiring more evidence of the value of an innovation before adopting it. **Laggards** are the last in a social system to adopt a new	Hargandon A.B., Diffusion of Innovations

Term	Definition	Source
	innovation. They tend to be relatively isolated from the rest of the social system, have little or no opinion leadership, and focus on past experiences and traditions. They are the most cautious when it comes to risking their limited resources on a new technology.	
Technology Leader	The first firm to introduce a new generation or technology in an industry.	Launch Strategies for Next generation Products, Michael R. Hagerty and Prasad Naik
Test	Provision of information about an individual's standing with respect to a specific set of knowledge, skills, and competence as defined by a specific job profile or occupational role.	"ICT Skills Certification in Europe Report" 2005
TOGAF	The Open Group Architecture Framework	
Trade	A trade refers to an organised group of practitioners, such as a guild or labour union with restrictions imposed by society in return for freedom to practice for the benefit of society.	(Peter J Denning, 2011)
Validation of informal/ non-formal learning	The process of assessing and recognising a wide range of knowledge, know-how, skills and competences, which people develop throughout their lives within different environments, for example through education, work and leisure activities.	"ICT Skills Certification in Europe Report" 2005
Vocational and education and training (VET)	Education and training which aims to equip people with skills and competences that can be used on the labour market.	"ICT Skills Certification in Europe Report" 2005
Work experience	Continuously gathered by individuals fulfilling their occupational role, and gained in the daily working process, but as well by informal learning and continuous professional development.	"ICT Skills Certification in Europe Report" 2005

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