

DEVELOPMENT AND IMPLEMENTATION OF A EUROPEAN FRAMEWORK FOR IT PROFESSIONALISM



Final report, January 2017

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DEVELOPMENT AND IMPLEMENTATION OF A EUROPEAN FRAMEWORK FOR IT PROFESSIONALISM

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Executive summary

This is the first time that a comprehensive proposal for a European Framework for IT professionalism has been developed. It is a major milestone contributing to the ambition to strengthen IT professionalism and increase Europe's digital talent pool. This report presents a first comprehensive European framework for IT professionalism, and shows the implementation actions that were carried out during this service contract¹. It aims to contribute to maturing the IT profession and in doing so to grow the supply of IT professionals, their mobility and to reduce mismatches that cause unnecessary unemployment. This summary explains:

- **why** the European framework for IT professionalism plays a key role in further maturing the IT profession;
- **what** the forecasted shortage of IT professionals is in Europe, and Canada, Japan and USA;
- **how** the European framework for IT professionalism establishes synergies for beneficiaries and users;
- **who** the early adopters of this European framework for IT professionalism are and what simple, demand-driven, pragmatic, scalable and sustainable actions were initiated;

Maturing the IT profession

Technology is changing our world. Nowadays, planes are being 3D printed² as are spine implants³, big data analytics on cell phones helps to understand spread of diseases, Blockchain is to disrupt transactions as we know them now, crowdsourcing solutions are changing consumer goods manufacturing, military operations are impossible to imagine without drones and robots have taken over warehouses completely. We read about these developments on our mobile device after being triggered by our smart watch, wearing digital make-up⁴ and while sitting behind the steer of our 'automated assist' car preparing ourselves for a run in a 'wearable' shirt that collects real-time exercise data. At the same time, deep-learning software is creating intelligent machines that might finally escape the pages of science fiction.

However, with the greater opportunities technology offers, comes a greater moral responsibility. Besides recent cases in automotive sector for instance, there are more examples of immoral (even illegal) behaviour by IT professionals. The extent to which IT is embedded in our lives is inevitably growing. The demarcations between physical and digital world are blurring, imposing challenges on us to protect personal privacy, data security and even our personal relationships. If we fail to take steps to mature the IT profession, it is likely that the risks to society from IT will grow to unacceptable levels⁵. **Maturing the IT profession is still an imperative to keep Europe competitive on a global scale. A joint and coordinated effort is needed from all the actors at EU and national level.**

Trust is the key word here. We must continue to nurture trust in IT professionals. Continuous development of knowledge, skills and competences is vital to reach that goal. Professionalism is absolutely fundamental to the effective practice of IT. The IT profession is relatively young, and maturing the profession will undoubtedly take time, but the time for engagement and action is now⁶. Obtaining the status of a profession requires professional bodies to set suitable standards of knowledge and codes of conduct.

Standardising is a means to further mature a profession. This is also the direction that the European Commission and key stakeholders are following: the European e-Competence Framework (e-CF) evolved in

¹ Please see project website: www.ictprofessionalism.eu

² <https://www.technologyreview.com/s/601268/airplanes-are-getting-lighter-thanks-to-3-d-printed-parts/#/set/id/601288/>

³ <https://www.weforum.org/agenda/2016/01/a-brief-guide-to-the-technologies-changing-world>

⁴ <http://mashable.com/2015/09/04/panasonic-magic-mirror/#WEP.qpz.egqa>

⁵ IVI/CEPIS: "e-Skills and IT professionalism. Fostering the IT Profession in Europe", prepared for the European Commission, 2012

⁶ <http://cepis.org/professionalism>

April 2016 into a European Standard (EN 16234-1). The ambition is to do more. A European framework for IT professionalism – as described in this report – would provide a standard that includes not only IT competences, but also other essentials for any IT professional: foundational body of knowledge, education and training qualification and certification, and finally ethics and code of conduct.

This report presents a first comprehensive European framework for IT professionalism that consists of these building blocks, and showcases implementation actions that contribute to achieving that end-goal of professionalising a.o. by means of standardisation.

Any organisation would want its IT staff to be professional in their practice, and to be recognised and accepted as being professionals. A European framework for IT professionalism helps employers in providing a common language for professional development of IT professionals across Europe (and potentially beyond), while stimulating the mobility of employees and offering them tools to develop their careers. The benefits to organisations and society include professionals having an adequate level of knowledge, providing a higher level of products and services, and abiding the professional standards and codes of ethics⁷.

This challenge of maturing the IT profession is not unique to Europe. The project reflects parallel efforts in other parts of the world, such as driven by IPA in Japan, or ICTC⁸ in Canada

Growing supply and reducing mismatches in Europe and Canada, Japan and USA

However, will there be sufficient staff? As it is clear that demand will outstrip the supply of IT professionals that can help organisations design, build, implement and manage new digital technologies. The demand will grow by a Compound Annual Growth Rate (CAGR) of 2.0% in the period 2015-2020 from 5.7 million in 2015 to 6.3 million in 2020. Over the same period, the available supply will grow at a slower CAGR of 1.9% from 5.5 million in 2015 to 6.1 million in 2020. Consequently, the gap in the skills demanded versus skills available will widen to reach 4% in 2020 with a steady increase over the period.

Outside Europe, we have observed a similar trend in countries like Canada, Japan and the USA. Our analysis shows that UK will experience the strongest growth in the gap between demand and supply of IT professionals, followed by Japan. Canada is the only country that will see the gap decrease over the period but at a very high level. The picture for the EU28 overall is of similar magnitude to the USA and to France, while the gap in Germany will widen the least.

However, although the demand for skills can change quickly, the supply of skills is less volatile due to the time it takes for people to gain the necessary education, capabilities and experience to join the workforce 'stock'. The ability of education and training systems – from graduate and executive formal education to on-the-job and lifelong learning approaches – to flex with changing demand is increasingly important as the rate of technology changes and adaption is speeding up. And at the same time, private education is taking a leap across Europe showing students looking beyond traditional options when deciding their future⁹.

It is also important to bear in mind that the gap is not just about absolute numbers missing in the total IT workforce, but also very much about skills mismatch compared to market demand. This is where the

⁷ Ridge, J., Australian Computer Society, Available online here: <http://press.anu.edu.au/apps/bookworm/view/Professionalism+in+the+Information+and+Communication+Technology+Industry/10791/ch02.xhtml>

⁸ See for instance: "Digital talent. The road to 2020 and beyond". A national strategy to develop Canada's talent in a global digital economy, Information and Communications Technology Council (ICTC) Canada, www.ictc-ctic.ca

⁹ The Economist, 'Class apart. A growing number of European students are opting to pay for their education', 19 March 2016. Available online here: <http://www.economist.com/news/europe/21695002-growing-number-european-students-are-opting-pay-their-education-class-apart>

European framework for IT professionalism can play a critical role in providing the instruments, tools, standards that could contribute to reducing the mismatch and increasing transparency of the IT profession.

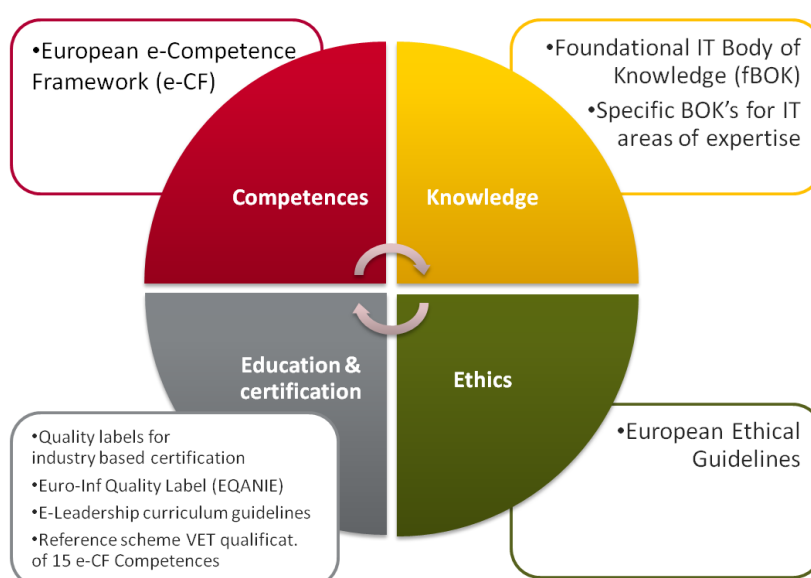
Establishing synergies for beneficiaries and users

The current state of play of the IT profession shows a disparity in the level of maturity of the four building blocks and, more in general, reflects the insufficient integration between them. Many initiatives have been launched so far in various part of the world to promote IT professionalism, but most of them were still very fragmented and did not address the overall framework. Thus, a systemic approach is clearly required to tackle main challenging and pressing issues concerning the IT profession.

As the work under this service contract demonstrated, **managing the four building blocks in an integrated and complementary way is the key success factor for developing a European Framework as a point of reference for all beneficiaries dealing with IT professionalism in Europe.** It will serve students and IT professionals while orienting and planning their education and career as well as support education and training providers, professional associations, industry, government and public sector, in creating the right conditions to mature and promote greater IT professionalism, and ultimately increase Europe's digital talent pool and competitiveness.

The European Framework for IT Profession is designed to be more than the sum of its parts. There are four building blocks and each of them includes standards or instruments to support further development of the IT professional as well as the IT profession itself. These four building blocks are: (Bodies of) Knowledge, Competences (e-CF), Education, Training & Certification, and Professional Ethics. The main strength of the proposed framework is the combination of stable components with a high degree of flexibility allowing rapid adaption of IT changes and emerging market requirements. This report showcases examples of how these building blocks establish synergies for both the IT professionals as well as for the many users that exist in Education, Government, Professional Associations, Certification providers and Employers.

Figure 1: The four building blocks of the European framework for IT professionalism and available instruments



The European Framework for IT Profession is user-centric and offers value in each stage of the IT professional's career path. Use cases are elaborated for: 'preparing to enter the IT profession', 'starting a career in IT', 'changing a career', and 'developing a career'. Each use case describes the challenges encountered in these stages of a career, and how the Framework instruments could help.

Clear value propositions are important to ensure the continued engagement of stakeholders in further development and uptake of the framework. Currently, there is a general consensus among the stakeholders on the advantages deriving from the adoption of joint solutions at EU level to overcome the national fragmentation, to find a common ground for interaction. It however requires the stakeholders to not only understand and agree on their role, but also be equipped with instructions and guidelines to fulfil that role.

Early adopters that initiate implementation of the Framework

Begin with the end in mind. In the long-term, the European Commission aims for recognition of the Framework as a standard that is used (implemented) by all European countries. Early adopters taking the first actions in the process of implementation will trigger others to follow, and eventually reach that long-term goal. This project, on the short-term, will identify these early adopters, select feasible actions that can be started during the course of this project and support the initial steps. Commitment of these early adopters is necessary to continue and monitor the actions initiated after this project has ended.

The support for this Framework and further maturing the IT profession is overwhelming. It is also a prerequisite to any successful implementation and therefore leaves us confident that – also after the project ends – there will be continuation of the actions initiated under this project, as well as follow-up on other important ideas raised in the first phase of this project. It is a great step towards establishing an IT profession that is mature, transparent, and trustworthy.

The service contract expected the project to initiate at least three concrete activities. However in the end, considering the momentum and interest this project gained from various organisations we can report on seven activities.

Four concrete implementation actions were initiated by Spain, two by Italy and one by Ireland. Their actions match very well to the criteria set in advance (simple, demand-driven, pragmatic, scalable, and sustainable) and the stakeholders involved have shown strong commitment to take the action from the start. The representatives from these countries played a key role in setting-up a network of stakeholders and a draft action plan, from where they managed to engage a broader stakeholder network in their country and initiated the first steps of implementation. Credit must go to the Consejo General de Colegios Profesionales de Ingeniería Informática (CCII) in Spain, the Irish Computer Society (ICS) in Ireland, the Consorzio Interuniversitario Nazionale per l'Informatica (CINI) and *Fondazione Politecnico Milano* in Italy for making this happen.

Three implementation actions can be characterised as ‘supranational’ as they do not cover a specific country but benefit a wide audience. These activities also primarily aim to further develop the Framework itself. These actions are:

1. Development of a European Ethical Guidelines v1.0, driven by Council of European Professional Informatics Societies (CEPIS) and with support of many stakeholders, and various national professional associations;
2. Initial collaboration document, and an initial mapping, of e-CF and SFIA (Skills Framework for the Information Age) – towards a global uniform language, increasing mobility for professionals and employers;
3. Adoption of the European framework for IT professionalism by the ASL-BISL foundation – one of the Services Libraries, or specific Body of Knowledge. With the aim of aligning the Framework with the services that this specific knowledge foundation offers. And also as a first step in convincing other foundations (ITIL etc.) to follow the same path – and hence creating uniformity and a common language for each role in IT;

Maturing the Professional Framework and the Profession go hand in hand. This report provides a long-list of possible implementation actions that contribute to achieving two sub-goals:

- The building blocks of the Framework should be further developed and reach a level that allows them to be recognised as standards – similar to the path of the e-CF;
- The Framework itself should be adopted by (professional organisations) countries in Europe, and used in practice.

The Framework also includes practical guidelines on how to manage the implementation – from framing the challenge through focusing and mobilising, to sustaining the results - and lessons learned from the above mentioned front-runners of implementation.

This project brought together a group of leading European experts from government, academia and industry to assist in the development and the implementation of the framework in Europe, coordinate actions and prevent fragmented initiatives. Their involvement will continue via the IT Professionalism Europe network (driven by CEPIS) and other committees such as the CEN Technical Committee (TC) 428 (responsible for e-CF maintenance) and the CEN Workshop on ICT Skills that will see to further development of the Framework and its instruments.

1 Introduction

1.1 A call for action

Technology has changed our world, and continues to do so. There are many examples across all industry sectors: from planes and spine implants¹⁰ being 3D printed¹¹ to big data analytics on cell phones to understand spread of diseases. Blockchain is expected to disrupt transactions as we know them now, while crowdsourcing solutions are changing consumer goods manufacturing. Defence, healthcare, retail, finance, public sector: all are affected by digital transformations. And it affects us too! Lesser citizens remember the times without mobile devices, navigation tools, and social media (to name a few), nor do they remember that our offices once consisted of a text writer and paper files.

However, with the greater opportunities technology offers comes a greater moral responsibility. Besides recent cases in automotive sector for instance, there are more examples of immoral (even illegal) behaviour by IT professionals. Our growing dependence on technology is blurring the demarcation between physical and digital world, imposing challenges regarding personal privacy, data security and even our personal relationships. Failure to take steps to mature the profession would increase the potential risks of harming the society at unacceptable levels¹².

The European Union needs to ensure that the knowledge, skills, competence and creativity of the European workforce, including its IT professionals, meet the highest global professional standard and are constantly involved in a process of effective lifelong learning for update. Developing and implementing a unique European framework for IT professionalism is the **way forward** to address the key structural challenges determined by the technological innovation and the fast growth of IT activity.

As underlined by the IVI/CEPIS Report in 2012, there are many reasons to foster the IT profession in Europe:

1. IT skills gaps and/or shortages, acting as a brake on European global competitiveness given IT's role as an enabler of business value;
2. Poor public image of the IT profession, impacting the numbers entering the profession and thus, its attractiveness towards new talented generations;
3. Low levels of IT expertise and/or silo-ed knowledge, hampering the view of the 'big picture' of IT, its interconnectedness, and its role in enabling organizational capability;
4. Impact of the 'IT black swans', failed IT projects resulting in failure of the business or severe reputational damage.

To accommodate a sound and responsible increase of digitisation of our society there is a clear need to further mature the profession that is responsible for that digitisation.

According to Eurostat, nearly 8 million persons in the European Union (EU) were employed as Information and Communication Technology (ICT) specialists, representing 3.7% of total employment. Over recent years, both the number and the share of IT specialists in total employment have continuously increased to better adapt to an ever digitalised world. Most recent Eurostat statistics on the size and composition of the IT workforce

¹⁰ <https://www.weforum.org/agenda/2016/01/a-brief-guide-to-the-technologies-changing-world>

¹¹ <https://www.technologyreview.com/s/601268/airplanes-are-getting-lighter-thanks-to-3-d-printed-parts/#/set/id/601288/>

¹² IVI/CEPIS: "e-Skills and IT professionalism. Fostering the IT Profession in Europe", prepared for the European Commission, 2012

across Europe shape the context of the change and bring further evidence to support the adoption of a framework in Europe¹³:

- Employment of IT specialists has been largely unaffected by the uncertainty seen on global labour markets during and after the economic crisis: the employment growth rate for IT specialists has remained on an upwards path averaging 3% growth per annum since 2006, i.e. it was more than eight times higher than the average growth rate of total employment over the same period.
- Most IT specialists – 61% in 2015 – have tertiary-level education.
- 64% of IT specialists in the EU-28 are aged over 35. The proportion of IT specialists over the age of 35 has increased by seven percentage points since 2005.
- The majority of jobs for IT specialists are held by men. Since 2005, the proportion of women working in this segment of the labour market in the EU-28 has declined to 16% in 2015.

The shortage of IT professionals becomes evident when we take a look at the hard-to-fill vacancies in enterprises. In today's companies, specialised IT skills are essential for the effective use of IT in business processes (e-business) and commercial transactions that are carried out electronically (e-commerce). Eurostat data¹⁴ reveals that:

- One in five EU enterprises employed IT specialists.
- Enterprises in all countries reported difficulties in recruiting IT specialists, particularly in Czech Republic, Slovenia, Luxembourg, Austria, Belgium and Estonia.
- Some 41% of EU enterprises which recruited or tried to recruit IT specialists in 2015 reported difficulties in filling vacancies.
- Some 10% of EU enterprises provided their IT specialists with professional training, while 19% provided IT training for other staff.

In this report we present the figure for a sub-set of IT specialists, mainly the figures for IT professionals that encompass what we have called 'core of the IT profession'. The following chapter 2 will provide the definitions and also the statistics and forecast that are part of the measurement.

Surveys show that salaries in IT are on the rise because of the chronic skills shortage. This will make it very hard for companies that cannot offer these salaries to remain attractive for new employees and as a result will also have difficulties retaining their most talented workers¹⁵. As a consequence, the gap between high earners and low earners has widened substantially. New research¹⁶ suggests that a substantial part of the growth in this wage gap can be attributed to computer technology. New computer technologies require new skills. Workers who learn these skills see their wages grow, but many workers have difficulty acquiring these new skills and their wages have been stagnant, leading to a growing wage gap¹⁷.

The complexity of the challenges illustrated above suggest the limited value of driving change by any national strategy in isolation as well as, the impossibility for the market to achieve an equilibrium with self-regulation only. At the same time, there are growing public concerns about the possibility to control, or at least to keep

¹³ Eurostat, October 2016, available online here: http://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_in_employment

¹⁴ Eurostat, November 2016. Available online here: http://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_-_statistics_on_hard-to-fill_vacancies_in_enterprises

¹⁵ Brand-E, *UK faces deep tech skills shortage*, January 2016. Available online here: http://www.brand-e.biz/uk-faces-deep-tech-skills-shortage_36859.html.

¹⁶ Bessen, J., *How computer automation affects occupations: technology, jobs, and skills*. Boston University School of Law, 2016. Available online here: <http://www.researchoninnovation.org/research-summary.html>

¹⁷ Bessen, J., *Computers don't kill jobs but do increase inequality*, Harvard Business Review, March 2016. Available online here: <https://hbr.org/2016/03/computers-dont-kill-jobs-but-do-increase-inequality>

up with the path of change. **Maturing the IT profession is still an imperative to keep Europe competitive on a global scale but a joint and coordinated effort is needed from all the actors at EU and national level.**

This report introduces a comprehensive European framework for IT professionalism, as a value-driven and up-to-date reference base to address the challenges ahead by providing a common language that covers competences, knowledge, education and training and certification, and ethics to all the economic sectors.

This challenge of maturing the IT profession is not unique to Europe. This project also reflects on parallel efforts in other parts of the world, such as driven by IPA¹⁸ in Japan, ITIF¹⁹ in the United States, or ICTC²⁰ in Canada, and even more important initiated collaboration with key stakeholders in those countries to exchange knowledge and experiences on these issues that are global.

1.2 Project objectives

This project is commissioned by the European Commission, Directorate General Internal Market, Industry, Entrepreneurship and SMEs and aims to achieve three objectives as were depicted in the request for services:

1. Updating **key indicators and progress on the situation concerning the IT profession** based on the latest data, trends and developments, regarding:
 - The evolution of the supply and demand of IT professionals in Europe (2014-2016) and new updated forecasts for 2020, building on previous work on the topic;
 - The evolution of the situation concerning IT industry training and certifications and progress related to the development of a governance model based on multi-stakeholder partnership, the mapping of IT industry based certifications to the European e-Competence Framework and the provision of related online self-assessment tools.
 - The evolution at international level building on previous work of the European Commission and the Organisation for Economic Co-operation and Development (OECD) on the topic, including a detailed analysis and comparison of the situation for Canada, Japan, USA, Germany, France and UK.
2. **Development and implementation of the four foundational building blocks for a first comprehensive European framework for IT professionalism.** These four building blocks have already been defined in the report on "e-Skills and IT professionalism: Fostering the IT profession in Europe" (2012) as:
 - Body of knowledge: a method of establishing a profession is to define an appropriate body of knowledge⁶, which may be used to set standards and certification processes.
 - Education and Training: certifications, qualifications, non-formal learning and informal learning are mutually supportive components of a professional's career development and they attest to an individual's competences and skills.
 - Competences: an understanding of the capability and competency needs of individuals⁷ working in various roles is essential for organizations to effectively recruit and develop suitable employees.
 - Professional Ethics: a defining aspect of any profession involves adhering to professional ethical conduct.

¹⁸ Information technology Promotion Agency (IPA), see for instance the aim to protect and nurture the IT society: <https://www.ipa.go.jp/english/about/about.html>

¹⁹ Information Technology & Innovation Foundation (ITIF), see: <https://itif.org/about>

²⁰ See for instance: "Digital talent. The road to 2020 and beyond", A national strategy to develop Canada's talent in a global digital economy, Information and Communications Technology Council (ICTC) Canada, www.ictc-ctic.ca

Building on state-of-the-art achievements, best international practices and relevant on-going activities, the main goal will be to propose concrete solutions which could start to be implemented in the short term in at least three EU Member States before the end of the service contract.

3. **Establishment of a group of leading European experts** (with a 'core group' of 20 experts) in this field from key stakeholders, government, academia and industry to assist in the development and the implementation of the framework in Europe, coordinate actions and prevent fragmented initiatives. It will deal with the indicators, the building blocks and the articulation between qualifications and certifications vs. skills and competences. It will also facilitate progress during the implementation stage and follow-up activities.

1.3 Project approach

"If you want to go fast, go alone. If you want to go far, go together"

– An Old African proverb

Establishing the profession will take many years and proposals for its development will need to be flexible and open to change and adaptation. The end-goal is just as important as the road towards that goal. It is hence vitally important to bring together relevant stakeholders across Europe – and in other parts of the world - to discuss the current state of IT professionalism and how it must be developed for the common good.

This project consisted of two main phases. In June 2016 the consortium delivered an interim report that was also validated by the steering committee. This interim report included to a large extent the project's key deliverables. The final report at hand includes refining of the proposal made in the interim report following review, stakeholder interactions and other events that took place during the second phase of the project, and also the results from the implementation activities that were initiated during this second phase.

For each objective a short overview of activities and deliverables is presented below, with reference to the chapters where more details can be found.

1. The update of key indicators and progress on the situation concerning the IT profession based on the latest data, trends and developments is captured in **chapter 2** of this report and includes:
 - The measurement of key indicators on the supply and demand of IT professionals in Europe for the period 2014-2016, building on the previous work carried out on the topic, with the estimate of gaps, excess demand, and mismatches.
 - The forecast of the main indicators to 2020, based on the update and revision of the forecast scenarios.
 - A detailed comparative analysis of the key indicators for Europe (with a specific focus on France, Germany and the UK) versus the US, Canada and Japan.
2. The European framework for IT professionalism, - of which the results are presented in **chapters 3, 4 and 5** – followed three stages of development:
 - The first stage (BUILD) delivered an analysis of the current state-of-play of IT professionalism in Europe, European countries and Japan, USA, Canada and also as regards the status of the building blocks of the European framework for IT professionalism. This was completed taking into account stakeholders' views and expectations. The description of the Framework also includes a series of use cases that reflect different stages of a career in IT (orienting on a job, entering profession, changing career, developing career). This ensured a user-centric approach in the design of the Framework. Furthermore, the Framework is described

in terms of synergies as to provide an understanding of the possible value it can have for both IT professionals and for key stakeholders in the Skills ecology.

- The second stage (REFINE) focussed on further refining the framework through various stakeholder consultations (expert interviews, workshops, online survey, a project- and other conferences);
 - The third stage (RUN) concerned initiating at least three implementation activities of simple, demand-driven, pragmatic, scalable and sustainable solutions that bring clear added value at EU and international level. A long list of solutions was gathered from the knowledge base activities and these were further evaluated. **Six activities were started eventually, of which four in particular implemented the Framework, and two activities added value to the Framework construction and environment as a whole.** These all contribute to sustainability of the Framework and increased take-up across Europe. The activities concerning implementation are further described in **chapter 6**.
3. As regards the establishment of a group of leading European experts:
- A list has been proposed to the Commission, and this list was to be further expanded during the second phase of the project. At the same time, CEPIS launched their IT Professionalism Europe (ITPE) network which perfectly fits the purposes of this requirement. Together with the CEN Workshop on ICT Skills and the CEN/TC428, this results in a strong collaboration of stakeholders from all sectors.
 - Some individual countries started to map and engage their national network of stakeholders. Spain, by input of the CCII, has produced a stakeholder map of 75 key experts in Spain that will contribute to further implementation actions and sustainability of these actions. Other countries, such as Ireland, are joining forces under the national coalition that is being set-up following the revival of the Digital Skills and Jobs Coalition on December 2nd of 2016.

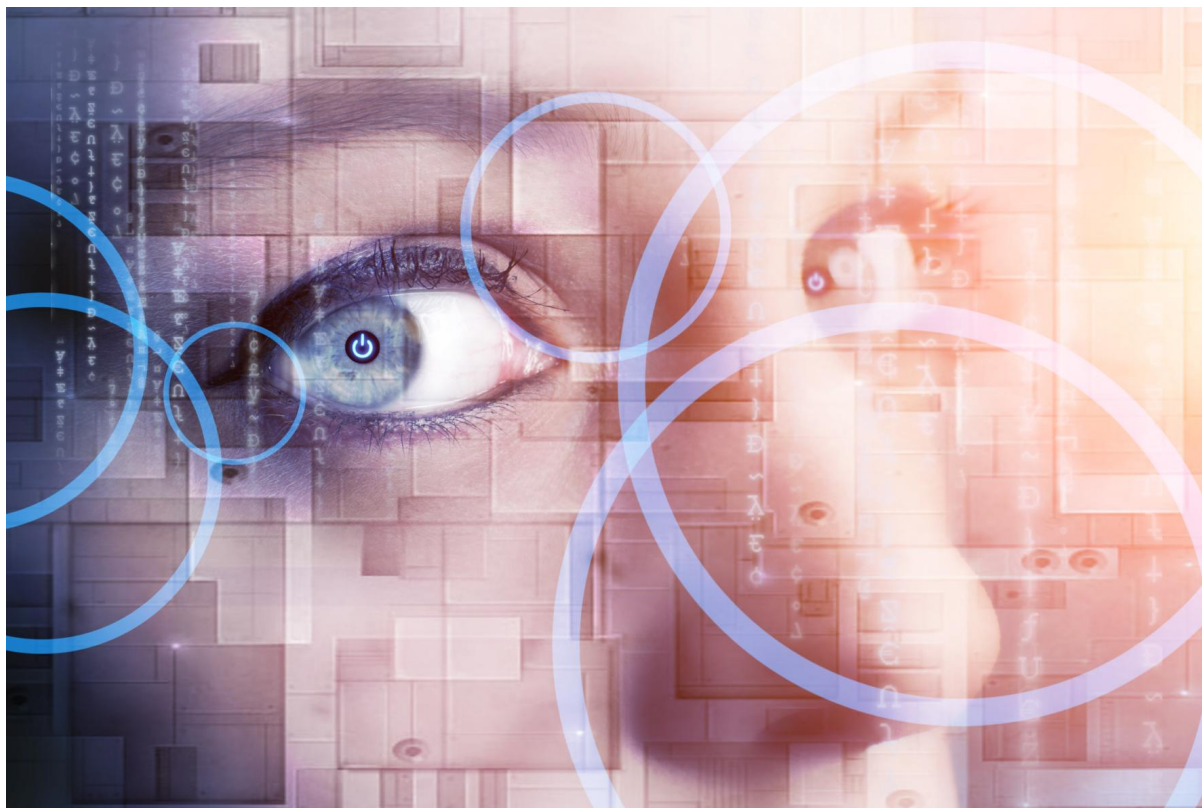
1.4 Reading guide

This chapter presents the call for action and project objectives, approach and planning.

The rest of the report is constructed as follows:

- Part A concerns key indicators for the IT profession on the supply and demand of IT professionals:
 - In Chapter 2 the current state-of-play in Europe, USA, Canada and Japan concerning the IT profession is described, as well as a section on gender;
- Part B concerns the European framework for IT professionalism, and specifically sets out:
 - In Chapter 3 the rationale for this Framework is explained as well as insights into current policy developments at EU, national and international level, and the relationship with topics e-Leadership and KETs;
 - In Chapter 4 the state-of-play of each of the building blocks of the Framework and its synergies;
 - In Chapter 5 the target audience of the Framework and its users;
- Part C concerns implementation of the European framework for IT professionalism:
 - Chapter 6 describes end goal and challenges in getting there, the approach towards implementation, a long list of suggested initiatives and the results from the initiated implementation actions;
 - Chapter 7 concludes the report with key recommendations for the way forward.

Part A: Key indicators for the IT profession on the supply and demand of IT professionals



2 State-of-play in Europe, USA, Canada and Japan

This section will show what trends are driving the demand for IT skills. It also answer the question: will there be sufficient and well qualified staff for organisations to take full advantage of the opportunities that technology offers? And how does Europe compare in this regard to leading economies such as Canada, Japan and the United States of America? This chapter provides a burning platform that a European framework for IT professionalism should aim to extinguish (as will be part of the next chapters in this report).

2.1 Technology and business trends driving the demand for IT professionals

This section describes the main technology and business trends that are driving the demand for IT skills²¹.

2.1.1 Technology Driven Business Transformation

It is widely considered that adopting advanced technologies will dramatically transform every-day life, businesses, and the global economy. This trend started in the beginning of 2000s, and most analysts believe that this technology-driven business transformation – often termed digital transformation – will be evident in the upcoming years. It will lead to disruption in the industry landscape and the way modern industries work, produce, and deliver. There are already several examples of this happening, Netflix in movie rental, Uber in taxi services and Airbnb in accommodation booking.

The main structural characteristics of digitally transformed industries will be:

- **Integration and structured organisations.** Digital transformation will drive an unprecedented reorganisation of production processes, of value creation and of industry structures. Digital platforms and social connections may help achieving scales previously attainable only by large organisations. Since even the smallest company can achieve global reach, the size of the business may not be as relevant as it was in the past.. The emergence of industry platforms will create new products and services, and modify and integrate the supply chain: more integration but also more flexibility will be a characteristic of the future production processes. Industry platforms will allow personalisation of products both in B2B and B2C relationships, which were previously inconceivable without high costs. A new generation of organisational concepts and work skills are going to be necessary; new work skills will come from game design, neuroscience, and happiness psychology.
- **A globally connected world.** The past couple of decades have witnessed both increasing globalisation of products and services and increasing globalisation of the production system. Nowadays, availability of computing power, memory, connectivity, and high-speed networks are increasing the ability to connect factories and businesses, much more than what was possible just a few years ago. This connection capacity is changing the way manufacturers interact with customers and with their suppliers, and is modifying the traditional relationships and exchanges along the supply chain. Previously, economic theories and analysis were based on the idea that large companies could take advantage of scale factors around cost and supply-chain efficiencies. With the digital factory, we need to re-think production processes, competitive advantages, and stakeholders' relationships.

²¹ A more detailed description is available in "Leadership Skills for Digital and Key Enabling Technologies in Europe [SCALE] - Business, Industrial and Technological Trends Analysis and Impact on e-Leadership Skills by IDC, January 2016". Available online here: <http://www.eskills-scale.eu/home/>

- **Transforming work with automation driven by artificial intelligence.** Digital innovation is progressively increasing the activities that can be automated. The magnitude of the automation benefits seems to be very relevant and they can provide unexpected competitive advantages. Sometimes we can hear that automation is a threat for employment. Nevertheless, it is not known whether the net effect on employment is positive thanks to the competitive advantage provided by automation. Automation will transform the vast majority of occupations which will require a redefinition and a transformation of business processes. The benefits will not only affect cost savings aspects but they may extend beyond that and require a profound re-organisation of business processes. This will create new social and economic challenges and require a change in the governance of the labour market.

2.1.2 Underlying Technology Trends

In IDC's vision, the IT industry is in the midst of a 'once every 20–25 years' shift to a new technology platform for growth and innovation (the 3rd IT Platform), expected to dominate the market by 2020 (see Figure 2.1). This platform is characterised by the disruptive combination of the following technologies:

- The widespread adoption of cloud computing, a disruptive delivery model of IT software and services, based on flexible and on-demand business models;
- The rapid penetration of mobile devices and technologies, including mobile apps and M2M, machine to machine connectivity through billions of sensors (the Internet of Things);
- The emergence of Big Data analytics, driven by the huge increase of data generated by mobile devices and the Internet;
- The adoption of social technologies, migrating from the personal to the business environment will be affecting profoundly business and social interactions within enterprises and in supply chains.

In addition, it is necessary to consider another, horizontal transformational trend, that is:

- **IT security:** affected by the new technology environment, shaped by emerging cyber threats and the evolution of regulation, this trend requires specific attention and influences the mix of skills required to deal with these new challenges.

These core technologies have already built momentum, but they are now becoming the 'building base' for an additional wave of technologies – called innovation accelerators by IDC – which will radically change and expand the possibilities and opportunities that IT can bring in terms of innovation and value creation. The additional innovation accelerators that IDC assesses will have a major impact in Europe out to 2020 are:

- **The Internet of Things (IoT):** IoT enables objects sharing information with other objects/members in the network, recognizing events and changes so to react autonomously in an appropriate manner. The IoT therefore builds on communication between things (machines, buildings, cars, animals etc.) that leads to action and value creation.
- **Virtual/augmented reality:** Technology that allows immersive visual experience that removes or complements external visual input and follows the user's head movement;
- **Wearables:** At the broadest level, wearable computing devices include any wearable device with a microprocessor. 'Wearable' implies that the device operates in a hands-free fashion and the user can readily put it on and take it off. 'Computing' means that it is capable of digitally processing data.
- **3D printing of all kinds:** Materializing all sorts of physical things from digital blueprints — from food to clothing to eventually even living tissue and organs.

- **Cognitive systems and robotics:** Systems that observe, learn, analyse, offer suggestions, and even create new ideas — dramatically reshaping every services industry. Includes artificial intelligence (AI), machine learning, cognitive computing, and robotic process automation.

Figure 2: The 3rd Platform and Innovation Accelerators

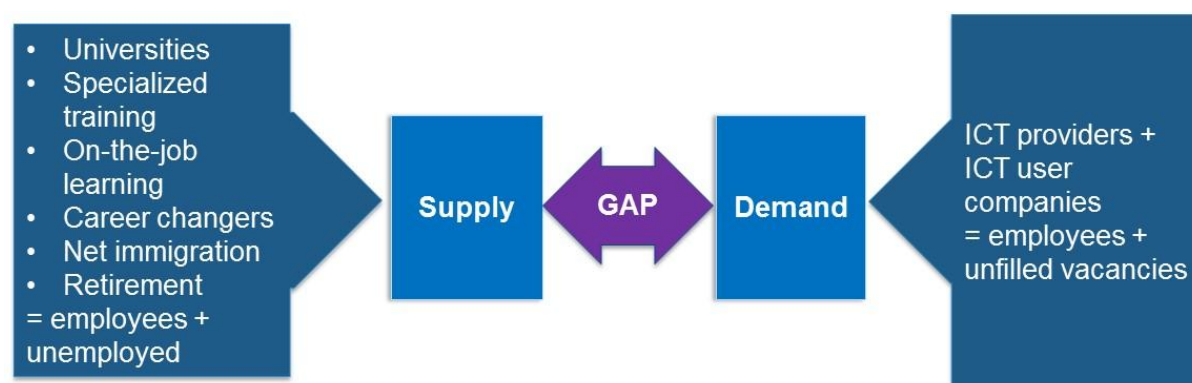


Source: IDC, 2016

2.2 Supply and demand of IT professionals in Europe

Since 2009, IDC and empirica has worked together to develop estimations of IT skills demand and supply and provided forecasts of development for the coming years to enable for a continuous monitoring and benchmarking of developments in precursor service contracts for the European Commission. The approach taken in this study follows the same methodology and approach. The figure below provides a simplified outline of the baseline supply-demand model.

Figure 3: IT Workers Demand and Supply Model, Simplified Outline



Source: IDC and empirica, 2016

Essentially, the supply side of the model in the base year (in this case 2015) includes individuals in IT practitioner positions and unemployed IT professionals. The movements in the supply stock arise from new entrants, such as new graduates, net career changers and net immigration. On the demand side in the base

year (again 2015), the model measures the size of the IT practitioner workforce that the market would absorb given a set wage level. Limitations, such as the availability of skills in general and at the wage level that employers are willing to pay can result in unfilled vacancies. Movements in the demand will be influenced by factors such as IT investment patterns and efficiency improvements including through new IT delivery models. It should be considered that the model does not compute the mobility flows of IT workers between EU MS (for lack of good quality data) and the results are a snapshot of a constantly evolving labour market.

The demand and supply model described above has followed a broad definition of IT skills, based on ISCO-08. However, the project at hand is focusing on a narrower set of occupations, namely the core IT professions²² – note that Communications roles are no longer included. Consequently, the key indicators included below are a subset of the broad Eurostat/OECD definitions and presents a view of the IT professional skills demand and supply picture, which is aligned to the work related to create an IT Professional Framework.

2.2.1 Forecasting supply and demand to 2020

Applying the approach briefly described above, the overall supply and demand forecast for the EU has been developed for the period 2015 to 2020 and is shown in the table below. Detailed breakouts for demand and supply of IT professionals in France, Germany and the UK will be provided later in the chapter.

Figure 4: TOTAL EU28 IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	5, 684, 000	5, 804, 000	5, 936, 000	6, 044, 000	6, 163, 000	6, 280, 000	2.0%
Supply	5, 503, 000	5, 603, 000	5, 741, 000	5, 850, 000	5, 959, 000	6, 060, 000	1.9%
Gap	181, 000	201, 000	195, 000	194, 000	204, 000	220, 000	4.0%
Gap %	3.2%	3.5%	3.3%	3.2%	3.3%	3.5%	

Source: IDC and empirica, 2016

The demand will grow by a Compound Annual Growth Rate (CAGR) of 2% in the period 2015-2020, from 5.7 million in 2015 to 6.3 million in 2020. Over the same period, the available supply will grow at a slower CAGR of 1.9% from 5.5 million in 2015 to 6.1 million in 2020. Consequently, the gap in the skills demanded versus skills available will widen to reach 4% in 2020 with a steady increase seen over the period. Historically, the unemployment rate of IT workers in Europe has always been considerably lower than the general unemployment rate (2% on average in the years 2006-2010 vs. 8 to 10% general unemployment rate)²³. This reinforces the model results about a persisting imbalance between supply and demand of IT professionals and not simply a consequence of mismatches and inefficiencies of the labour market: there is a genuine lack of IT professionals, rather than a difficulty to match demand and supply.

Key Messages

The acceleration in demand, while not excessively strong, is outgrowing the increase in the supply stock of IT professionals in the EU. A key reason for this is that the investments in new digital technologies is taking off

²² The core definition consists of the following ISCO-08 codes: 1330: ICT service managers; 2511 Systems analysts; 2512 Software developers; 2513 Web and multimedia developers; 2514 Application programmers; 2519 Software and multimedia developers and analysts not elsewhere classified; 2521 Database designers and administrators; 2522 Systems administrators; 2523 Computer network professionals; 2529 Database and network professionals not elsewhere classified; ICT operations technicians; 3512 ICT user support technicians; 3513 Computer network and systems technicians; 3514 Web technicians.

²³ OECD (2012), "IT Skills and Employment: New Competences and Jobs for a Greener and Smarter Economy", OECD Digital Economy Papers, No. 198, OECD Publishing. <http://dx.doi.org/10.1787/5k994f3prlr5-en>

strongly across most European countries – and in many cases faster than was expected a few years’ ago. IDC is now estimating that, on a global basis, IT investments in the 3rd Platform technologies (see above) will outstrip investment in 2nd Platform technologies (essentially technologies centred on client server architecture) already this year. Since 3rd Platform technology spending is also dramatically outgrowing 2nd Platform technologies (12.7% CAGR in the 2015-20 period compared to -5.1% CAGR), this creates significant future demand for new skills. While this is global data, this shift is also seen in Europe – and will become stronger as the large SME sector in Europe also embrace the digital trend as demonstrated from some of the commentary in the stakeholder interviews undertaken for this project:

“Digital transformation is a strong and rapidly developing trend in Denmark. There are especially two groups that are digitalizing: the public sector and the large companies.” (Bo Sejer Frandsen, CEO, IT Forum, Denmark)

“Digital transformation is a trend throughout Europe but the rate of change varies across countries.... [but] it is not yet reaching SMEs as it should.” (Fabrizio Gagliardi, Chair ACM Europe)

However, although the demand for skills can change quickly, the supply of skills is less volatile due to the time it takes for people to gain the necessary education, capabilities and experience to join the workforce “stock”. Consequently, the development in skills supply is relatively stable over the forecast period. The ability of education and training systems – from graduate and executive formal education to on-the-job and lifelong learning approaches – to flex with changing demand is increasingly important as the rate of technology changes and adaption is speeding up. This issue of how the education and training system keeps up with the changing demand was discussed by many of the stakeholders interviewed for this project. Although there are many ideas and approaches to what can be done, there are few threads running through most opinions: make the education systems provide a strong holistic education that will provide strong grounding and understanding of what is needed from the future employers. And then use boot camps, MOOCs, shorter courses etc. to teach on specific new technologies. In addition, since the rate of change is so rapid, it is important to stimulate and encourage on-going or life-long learning. But underlying all of this is to ensure that graduates have the ability – and hunger – to learn. Said Brenda Byers, Chair, Canada’s Association of IT Professionals – CIPS: *“Graduate attributes should be evaluated, not in terms of specific technology knowledge, but on their ability to stay updated, to maintain their professional attributes rather than the specific technology skills. Soft skills are fundamental. Some of the specific attributes qualified graduates need to provide are the problem solving, leadership, project management, data analysis skills.”*

2.2.2 IT professionals in France

Just as can be seen in other countries, the trend towards using new digital technologies to transform businesses is strong in France alongside the application of IT to increase the efficiency of the business. According to a survey of European organisations conducted by IDC in February and March 2016²⁴, the main strategic IT priorities over the next two years is for 30% of French organisations to make the business more cost effective and for 26% to drive non-cost related business improvements (such as supporting top-line revenue growth). These strategies will be fulfilled by adopting new technologies, in particular cloud (46% of respondents) and Big Data/Analytics (24%). These future plans will have a strong impact on the skills that French organisations will be demanding. The same survey also found that French organisations will try to address these issues through a range of different approaches, including re-skilling existing staff and developing internship/apprenticeship programmes for new graduates.

²⁴ IDC European Enterprise Services Survey, March 2016

Specific Assumptions for France

Despite the high unemployment rate in France over the past several years (at around 10%) and subdued growth in IT spending, driven by a weakened economy, France has still been experiencing a lack of professionals with relevant IT skills. This has been largely due to skills mismatches (i.e. the right types or levels of capabilities not being available in the market) combined with the fact that French organisations have been less open to pursuing other avenues to resource IT projects and operations for example through outsourcing. However, looking forwards some of these dynamics are changing and are taken into account in the specific assumptions for the development of the supply and demand balance presented below for France:

- IT spending in France will increase by a CAGR of 3.7% from 2015 to 2020, including internal IT spending from dedicated IT as well as Line of Business budgets. This data is based on forecast by IDC.
- GDP growth in the model has been aligned to the GDP forecast published by the IMF.
- The number of computer science graduates will grow by 1% each year and 95% of these will enter the IT workforce while graduates from other STEM education will be relatively stable with only 10% entering the IT workforce.
- There will be a net migration into France of mainly intra-EU people entering the workforce.

Supply and Demand Balance

The supply and demand forecast for France showed a gap of 28, 000 in 2015. This represented 4.4% of the total demand. The gap is expected to increase to 6% in 2016 and continue to increase till 2020. By then, it is forecasted that there will be a gap of 50, 000 or 7% as shown in the table below.

Figure 5: France IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	642, 000	655, 000	671, 000	684, 000	700, 000	713, 000	2.1%
Supply	614, 000	616, 000	628, 000	640, 000	653, 000	663, 000	1.5%
Gap	28, 000	39, 000	43, 000	44, 000	47, 000	50, 000	12.3%
Gap %	4.4%	6.0%	6.4%	6.4%	6.7%	7.0%	

Source: IDC and empirica, 2016

Key Messages

The demand and supply mismatch or gap in France will grow strongly over the forecast period, driven by strong pent-up demand for technology refresh and application of new digital technologies to address business improvement issues. French organisations have been quite reluctant to embrace the use of outsourcing and especially offshoring to resource IT activities and operations. However, this is changing – and the Indian offshore companies (such as Tata Consultancy Services and Infosys) are now more often than not asked to bid in Request for Proposal (RFP) situations in large French organisations. In addition, Atos and Capgemini (the largest French-based IT services providers) are also building out their offshore capabilities to service their customers – including their domestic market.

However, the demand for new IT skills will not only come from the large companies. As stated during one of the stakeholder interviews for this study:

“.....the digital economy is going to get more and more important, that digital processes will involve all industries and all business dimensions and all industries: professionals, SMEs, and large enterprises into all

industries. Businesses will have to digitalise their processes, otherwise they will not survive.” (Francis Behr, Consultant, Syntec Numerique).

2.2.3 IT professionals in Germany

The German economy has generally performed at a much more stable level than the rest of Europe. This has also been reflected in IT investments in the country which has been relatively stable. German organisations are looking at how to adopt new technologies to drive revenue growth initiatives and improving customer engagements. According to IDC’s European Enterprise Services Survey, half of German organisations see growth in existing markets as a key driver for digital transformation, while almost 40% is looking to expand into new markets (multiple answers allowed). Having said this, there is also a strong focus to drive efficiencies in the organisation (48% of respondents). All in all, the need for new technologies is clear in driving the change necessary in German organisations. And just like their French counterparts, German organisations are prioritising investments in Big Data/Analytics and cloud to help achieve these strategic goals – with the resulting impact on demand for new IT skills that can help lift these projects.

According to the same survey, German organisations are planning two main strands of activities to ensure that they have the right skills in place: hiring people with the right experience into the organisation (51%) and reskilling/retraining the existing workforce (49% - multiple answers allowed). However, the question is how easy it will be to use the former approach considering the current skills demand and supply balance in Germany.

Specific Assumptions for Germany

The stable environment in Germany – both in terms of the economy and in terms of IT investments – has resulted in Germany facing a higher skills gap over the last few years than many other European countries. With the stronger focus towards adoption of digital technologies to grow top line revenues, this is set to continue over the forecast period. Similar to France, German organisations have been more reluctant to embrace outsourcing and offshoring than many other European countries, but again similar to France, this is also changing even if still not reaching deep into the all-important *Mittelstand*.

These are some of the specific assumptions behind the development of the supply and demand forecast for Germany:

- IT spending in Germany will increase by a CAGR of 2.1% from 2015 to 2020, including internal IT spending from dedicated IT as well as Line of Business budgets. This data is based on forecast by IDC. This growth rate reflects the fact that we have seen steady IT investments since 2008 and hence are seeing less pent-up demand being released.
- GDP growth in the model has been aligned to the GDP forecast published by the IMF.
- The number of computer science graduates will grow by 1% each year and 95% of these will enter the IT workforce while graduates from other STEM education will be relatively stable with only 10% entering the IT workforce.
- There will be a net migration into Germany of mainly intra-EU people entering the workforce.

Supply and Demand Balance

The supply and demand forecast for Germany showed a gap of 34, 000 in 2015. This represented 3.6% of the total demand. The gap is expected to increase to 5.5% in 2020 at which stage, it is forecast that there will be a gap of 57, 000 as shown in the table below.

Figure 6: Germany IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	945, 000	968, 000	990, 000	1, 008, 000	1, 022, 000	1, 037, 000	1.9%
Supply	911, 000	918, 000	941, 000	957, 000	970, 000	980, 000	1.5%
Gap	34, 000	50, 000	49, 000	51, 000	52, 000	57, 000	10.9%
Gap %	3.6%	5.2%	4.9%	5.1%	5.1%	5.5%	

Source: IDC and empirica, 2016

Key Messages

Germany is facing quite a significant gap in IT skills over the forecast period. Based on the IDC survey data presented above, many German organisations are hoping that they can hire people with the relevant experience to fill their needs. However, considering that there will be close to 60, 000 extra IT professionals needed, this seems to be a difficult approach – and an expensive one at that as salary levels are likely to increase. As mentioned, some of the gap could be closed by using offshore resources – but this is currently most often considered by large, private organisations and the trend towards digital transformation and the accompanying skills need affect all types of organisations. As stated by one of the interviewees for this study:

“Digital transformation is a dominant trend in Germany, and there is high recognition at policy level by associations about the relevance of this trend. In some branches this trend is very fast; it is the case of automotive, financial services, industry machines, IoT (which accelerate a lot this trend)... The digital transformation is affecting SMEs as well as large enterprises, in Germany (Stephan Pfisterer, Bitkom, Germany).”

2.2.4 IT professionals in the UK

The UK economy has seen a steady return to growth over the past two years and with this also more stable IT budgets. Adoption of some of the new digital technologies, such as cloud, has taken off faster in the UK than in many other parts of Europe. In addition, the UK has been open to outsourcing and offshoring for a long time, which has created IT skills dynamics that different from e.g. Germany and France in that most UK organisations – even the public sector – are open to look at alternative approaches to resource IT projects and operations. Nevertheless, the trend towards business transformation through the use of new digital technologies continues to drive much of the new IT spending, from the IT department as well as from IT.

IDC’s European Enterprise Services Survey mentioned above showed that almost half of UK respondents are currently undergoing digital transformation with another 45% planning on embarking on this in the next two years. It is especially the need to meet or exceed new customer expectations that are driving these projects (50% of respondents) followed by a continued eye on organisational agility and efficiencies (44% - multiple answers allowed). The use of cloud, Big Data/Analytics and social media technologies are important in achieving these goals. This echoes the findings from the stakeholder surveys undertaken from this study. Said Margaret Sambel, Head of Strategy for The Tech Partnership:

“Big data, cloud computing, e-commerce, and cyber security are the leading technologies and the most relevant for the new IT skills. The skills gap can definitely damage the competitiveness of the European industry.”

Specific Assumptions for the UK

While, as mentioned, UK organisations are happy to explore alternative strategies for finding the right skills needed, the strong growth in adoption of new technologies is expected to outstrip the renewed interest in STEM and specifically computing degrees seen in the latest enrolment data in the UK. In addition, there is expected to be a large outflow from the workforce due to retirement and other replacement demands with a large number leaving the workforce annually.

These are some of the specific assumptions behind the development of the supply and demand forecast for the UK:

- IT spending in the UK will increase by a CAGR of 1.7% from 2015 to 2020, including internal IT spending from dedicated IT as well as Line of Business budgets. This data is based on forecast by IDC. This takes into account the expected economic impact of Brexit. It is expected that IT investment levels dampen in 2017 and further into 2018-2020 as the full impact of the UK leaving the EU becomes a reality
- GDP growth in the model has been aligned to the GDP forecast published by the IMF.
- The number of computer science graduates will grow by 1% each year and 95% of these will enter the IT workforce while graduates from other STEM education will be relatively stable with only 10% entering the IT workforce.
- The strong focus on attracting people into the IT profession over many years and new initiatives, such as the UK Government's Apprenticeship Levy, which comes into effect in 2017, focused on supporting apprenticeships across UK businesses, including IT apprenticeships are bearing fruit and will cause the IT skills gap to narrow.
- Exits from the IT workforce includes 2.5% of professionals and 3.5% of managers that will leave the workforce annually
- There will be a net migration into the UK of mainly intra-EU people entering the workforce.

Supply and Demand Balance

The supply and demand forecast for the UK showed a gap of 22, 000 in 2015. This represented 1.8% of the total demand. The gap is expected to decrease over the forecast period to reach only 0.7% in 2020, representing a gap of 10, 000 as shown in the table below.

Figure 7: UK IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	1, 248, 000	1, 276, 000	1, 305, 000	1, 322, 000	1, 350, 000	1, 379, 000	2.0%
Supply	1, 226, 000	1, 258, 000	1, 291, 000	1, 310, 000	1, 342, 000	1, 369, 000	2.2%
Gap	22, 000	18, 000	14, 000	12, 000	8, 000	10, 000	-14.6%
Gap %	1.8%	1.4%	1.1%	0.9%	0.6%	0.7%	

Source: IDC and empirica, 2016

Key Messages

The demand for IT skills in the UK will outstrip the supply over the forecast period but not as strongly as in other countries. Aside from the apprenticeship initiatives mentioned above, computing courses are also outperforming general enrolment rates. In addition, there have been several initiatives announced that would help to address re-skilling/re-training of people from other careers into IT, such as the British Council and Tata Consultancy Services announcing a partnership focused on training 1, 000 new graduates between 2016 and

2020. Another example is Capgemini announcing its intention to create 100 highly skilled jobs over the next three years at a new application delivery centre in South Wales over five years backed by Welsh Government Business Finance Funding. While the numbers are small on an annual basis, the frequency with which such initiatives are announced is increasing.

2.2.5 The On-going Gender Issue

Despite the topic having been discussed for several years, the ability to attract women into the IT profession remains difficult. Recent EUROSTAT statistics on the size and composition of the IT workforce across Europe²⁵ show that the majority of IT positions are held by men (82% of IT specialists)²⁶. There are several studies that have looked at this issue in great detail²⁷ and there is significant focus on this also from an EC perspective²⁸.

As a starting point, it is necessary to attract girls onto the relevant educational tracks first of all, such as the STEM courses – and then inspiring them to pursue careers in IT. However, there is perhaps a bit of a catch-22 in this: without strong female role models for girls to follow into IT, it is hard to get girls to join and then to become role models for others.

This is an issue that resonates across Europe. From discussing the issues with the stakeholders as part of the research process, it is on everyone's agenda to address. And there are several initiatives that are aimed at attracting females, such as The TechFuture Girls school club that the Tech Partnership is running. Professional and scientific societies, such as ACM and IEEE, have very successful initiatives that have the benefit of supporting the entire IT community and forging linkages to educational institutions. The IEEE Computer Society in collaboration with Intel offers an annual Prize to the best female led software development team in the Game Sig College Competition. This is designed to encourage more females to take a leadership role in the profession. However, the common feeling is that there are a lot of competing initiatives without a central coordination that is needed to ensure effective and concrete results, unless the issue is addressed. Furthermore, there are also views that the issue here is much more complex than the attractiveness of IT to women, but goes back to how the working social and legislative environment developed over the years, and existing culture.

However, it is very clear that this is an issue that needs addressing in order for the IT sector to benefit from the skills and competences that women can bring to the profession. At Stanford University, Computer science is now the most popular major for female students²⁹. Let's hope this example will become more common.

2.3 IT professionals – an international comparison

The skills demand and supply mismatch is a common issue amongst most developed countries across the globe. As part of this project, a comparison of the skills demand and supply forecast for France, Germany and the UK has been made to the US, Canada and Japan. This chapter provides a short profile of each of the latter

²⁵ The presented statistics are the result of a survey on IT usage and e-commerce in enterprises carried out by EUROSTAT in 2015 but only 148 800 out of 1.5 million enterprises with at least 10 employees in the EU-28 were surveyed.

²⁶ The sharpest gender disparities could be found in Luxembourg, Cyprus and the Netherlands where men in the IT-specialist workforce were more than 8 out of 10 in 2014. On the contrary, some countries such as Bulgaria, Estonia and Romania recorded the top female percentages (around 30% of the total IT-specialist workforce).

²⁷ The Women in IT Scorecard, 2015 – The Tech Partnership and BCS

²⁸ **CONNECT**: <https://ec.europa.eu/digital-single-market/en/blog/women-digital-gap-and-opportunity>

²⁹ "Computer science now most popular major for female students at Stanford", Online available here: <http://www.bizjournals.com/sanjose/news/2015/10/12/computer-science-nowmost-popular-major-for-female.html>

three countries, the general trends in the market and the underlying assumptions behind the data before providing the forecasts and the key messages to be drawn. These assumptions and messages draw strongly upon stakeholder interviews as part of this project as well as desk research undertaken.

Finally, the chapter will conclude by presenting a comparison of the six countries and highlight the key takeaway points from this analysis.

2.3.1 IT professionals in Canada

Similar to what is observed in European countries, Canadian organisations are facing a lack of critical IT skills – especially for new technologies – that can hamper technology adoption and ultimately competitiveness of Canadian enterprises in the global economy. And the impact can be dramatic: The Canadian Information and Communications Technology Council (ICTC) assert that a 1% increase in labour productivity as the result of adopting advanced technologies would yield \$8 billion to the Canadian economy³⁰.

Specific Assumptions for Canada

As seen in Europe, IT spending for Canadian organisations is driven by the digital transformation wave underpinned by technologies, such as cloud, mobility, Big Data and social – not to mention security and IoT. And digital is also in Canada a board room topic. All of this drives demand for strong specific technology skills – but also for people that can bridge between technology and business. As stated by Meenakshi Gupta, Senior Director, Policy and Research for Information and Communications Technology Council (ICTC): *“In Canada, Job growth in IT outpaced the overall economy by over 4 to 1 in recent years, and among the fastest growing IT careers is cyber security. The digital trend is very much reaching SMEs as well. About 30% of SMEs have adopted these technologies.”*

In terms of specific assumptions for the development of the supply and demand balance presented below, the following has been applied:

- IT spending in Canada will increase by a CAGR of 5.5% from 2015 to 2020, including internal IT spending from dedicated IT as well as Line of Business budgets. This data is based on forecast by IDC.
- GDP growth in the model has been aligned to the GDP forecast published by the IMF.
- Overall, enrolments in postsecondary programmes have increased between 2-3% a year in the period 2009-2013. The supply forecast assumes a similar growth rate in enrolment going forward and 3 years for students to join the job market. For Mathematics, Computer Science and Statistics, growth in enrolment has been even higher at a CAGR over the period at 4.5% and this is also assumed for the forecast period. This is data issued by Statistics Canada.

Supply and Demand Balance

The supply and demand forecast for Canada showed a gap of 44, 000 in 2015. This represented 7% of the total demand. The gap is expected to decrease towards 2020. However, by then there will still be a gap of 53, 000 or 6.8% as shown in the table below.

Figure 8: Canada IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	628, 000	667, 000	698, 000	725, 000	762, 000	784, 000	4.5%

³⁰ "The Smart Economy Reshaping Canada's Workforce: Labour Market Outlook 2015-2019"; ICTC 2015

Supply	584, 000	613, 000	643, 000	667, 000	705, 000	731, 000	4.6%
Gap	44, 000	54, 000	55, 000	58, 000	57, 000	53, 000	3.8%
Gap %	7.0%	8.1%	7.9%	8.0%	7.5%	6.8%	

Source: IDC, 2016

Key Messages

The impact of not having enough right resources is significant and can hold back Canadian businesses' ability to respond, can reduce productivity and inhibit innovation in corporate Canada. According to research by IDC Canada, the Canadian IT skills gaps is a major contributor to the use of offshoring, which has led to over 70, 000 positions moving to lower wage countries over the past decade.

Canada faces a skills gap that is not only about the lack of absolute numbers of IT professionals but also about having access to the right skills. According to the ICTC: "Collaborative focus needs to shift to "right skilling" of the workforce, as an appropriate skills strategy that is aligned with economic and digital strategies is crucial for Canada's competitive strength".

2.3.2 IT professionals in Japan

Trends in IT spending in Japan – and therefore the trends related to the IT skills needed to design, develop, implement and run IT – are in some ways different from the other countries included in this study. While most of Europe, Canada and the US are seeing a strong shift in IT spending growth going towards the new digital technologies, spending on "traditional" technologies will still constitute by far the largest part of spending by 2020. However, Japan is like the other countries also seeing the most acute lack of skills for the new digital technologies. For traditional skills, Japan is a strong user of offshore resources to fill the need.

Specific Assumptions for Japan

However, Japan – like the other countries studied – face a real risk that the lack of skills for new digital technologies can hold back adoption and thereby also business opportunities and economic growth. As stated by the IPA (Japan's Information Technology Promotion Agency): *"The high risk is a loss of business opportunities [brought about] by the skills shortage. It is also considered that businesses' [ability] to take advantage of these technologies is insufficient."*

Specific assumptions for the development of the supply and demand balance presented below include:

- GDP growth over the forecast period expected to grow at an average of 1.7% (based on Japan's statistical office)
- Total IT spending is expected to increase by a 2.8% CAGR over the forecast period including internal IT spending from dedicated IT as well as Line of Business budgets. This data is based on forecast by IDC.
- According to statistics on enrolment in higher education from Japan government statistics, the number of new students has been declining from 2010 and 2012 (-1% from 2010-11 and by -1.9% from 2011-12). It is assumed that this trend will continue in the forecast period with an annual decline of 1.5%. Science studies fared even worse with declines of 11% and 14% respectively in the 2010-12 periods. Enrolment in Engineering meanwhile increased by 3.7% and 2.7% in the years.
- The forecast model was calibrated to be in line with existing statistical information on IT workers employed in 2012, 2013 and 2014 as supplied by IPA.

Supply and Demand Balance

The supply and demand forecast for Japan showed a small gap of only 18, 000 in 2015 or 2.2% of total demand. However, due to factors relating both to supply (decreasing addition of students with relevant background) and the increasing shift towards spending on new digital technologies on the demand side, the gap is expected to increase strongly throughout the forecast period to 8.7% in 2020. This will represent a gap of 81, 000 – or almost 5 times the gap in 2015.

Figure 9: Japan IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	832, 000	849, 000	867, 000	883, 000	905, 000	931, 000	2.3%
Supply	814, 000	821, 000	828, 000	829, 000	846, 000	850, 000	0.9%
Gap	18, 000	28, 000	39, 000	54, 000	59, 000	81, 000	35.1%
Gap %	2.2%	3.3%	4.5%	6.1%	6.5%	8.7%	

Source: IDC, 2016

Key Messages

While Japan is currently not seeing a large gap in skills, this is about to change over the forecast period. The country faces a significant skills gap unless underlying conditions improve. It is quite clear that the technology shift is unlikely to abate – and nor is it desirable for this to happen since digital technology adoption is at the heart of innovation in most industries. So, the obvious area to address is how to improve the supply trends.

There is a strong focus on promoting the IT profession in Japan by the Ministry of Economy, Trade and Industry (METI) and the Ministry of Internal Affairs and Communications, led by IPA taking action in collaboration with the IT sector and IT user companies. Part of what is needed is to improve the profile and attractiveness of IT. If IT is not seen as providing interesting job prospects and the IT department is not recognised as a valuable and highly strategic part businesses this can be difficult.

2.3.3 IT professionals in USA

The US economy continues to improve overall but in a fairly volatile manner. The past seven years have caused organizations to keep a strong cost and efficiency focus in any investment plans, including IT budgets. However, changing customer demands and a need to start seeing growth on the revenue line, means that organizations are looking for ways to free up funds for transformation - and new digital technologies play a crucial role in this.

Specific assumptions for the USA

However, many of these developments are still only taking shape – and so are the skills needed to take full advantage of the technologies. In the words of Dr John Keppler from the IEEE Computer Society: *“It is important to keep in mind that these new IT technologies are still evolving and far from being mature. More and more new skills will evolve and develop as Big Data, Cloud Computing, Mobile, Social Media, and IoT, evolve and develop.”*

Specific assumptions underlying the skills demand and supply forecast for the US includes:

- IT demand overall is growing by a CAGR of 3.9% but there is a much stronger adoption of e.g. cloud in the US than in many other countries, which – with its economy of scale – should have lower requirements for number of skilled people. This data is based on IDC forecast.

- The US has a strong heritage in driving IT innovation which has continued to drive interest into IT as a career. While overall enrolment in higher education increased by between 2-3% from 2010-2013, enrolment in mathematics, computer and information science increased by 3-6% per annum according to information from the National Center for Education Statistics.

Supply and demand balance

The US is expected to see a gradual increase in the skills gap over the period to 2020 from 3% in 2015 to 3.7% in 2020. This means that the gap will increase from a low 4, 000 in 2015 to 111, 000 in 2020. The main reason for this growth is the speed of change in customer demands, in the competitive forces that drive change and in availability and adoption of new technologies. Underlying the numbers presented in the table below is a skills mismatch. As stated by Professor William Agresti from Johns Hopkins Carey Business School as part of the research for this study: *“Big data, and especially predictive analytics, combined with IoT, will place the greatest demands for new IT skills.”*

Figure 10: USA IT Skills Demand and Supply Forecast

	2015	2016	2017	2018	2019	2020	15-20 CAGR
Demand	2, 798, 000	2, 831, 000	2, 871, 000	2, 903, 000	2, 949, 000	3, 008, 000	1.5%
Supply	2, 714, 000	2, 742, 000	2, 778, 000	2, 804, 000	2, 843, 000	2, 897, 000	1.3%
Gap	4, 000	89, 000	93, 000	99, 000	106, 000	111, 000	5.7%
Gap %	3.0%	3.1%	3.2%	3.4%	3.6%	3.7%	

Source: IDC, 2016

Key messages

Demand will increasingly outstrip the IT skills that are available in the market. The US is in an interesting position, the country dominates in terms of IT innovation overall. It furthermore has a tradition for supporting new innovative start-ups through venture capital funding, which means that from a perspective of positioning IT as a career, it is probably further ahead than many. However, not all IT professionals will become millionaire entrepreneurs – many still have to take on the more mundane tasks internally in IT departments. In the US there is a need for promoting the career. As Dr Keppler stated: *“We need to be more proactive in communicating to young candidates about the importance of IT and describing the potential IT careers available to them as early as possible, highlighting that these careers are good prospects for entrepreneurship and offer high wages.”*

2.3.4 International comparisons of main trends

Most of the key trends that are influencing the demand for IT skills are the same whether looking at the UK, Germany and France or further ahead at the US, Canada and Japan. However, scratching under the surface as we have seen there are different dynamics affecting the overall skills demand and supply balance – mostly relating to the supply side issues.

The Figure below presents the skills gap for the six countries discussed above as well as the EU28.

Figure 11: Skills gap for FR, UK, DE, US, CA, JP, EU 28



Source: IDC and empirica, 2016

This analysis shows that Japan will experience the strongest growth in the gap between demand and supply of IT skills followed by France and Germany. Canada and the UK will see the gap decrease over the period but at a very high level for Canada and a very low level for the UK.

The picture for the EU28 overall is of similar magnitude of the US.

2.4 Summary Conclusions

The trend towards adoption of digital technologies is strong across all countries included in this study. There are variations in the levels of adoption of these – and the main strategies driving the adoption. However, it is clear that demand will outstrip the supply of IT professionals that can help organisations design, build, implement and manage new digital technologies, such as cloud and Big Data as well as the all-important security technologies to protect organisations, their customers and their employees.

Considering the general acceptance that the inability of organisations to adopt new technologies to improve efficiencies, grow new and existing revenue streams and service their customers better – and indeed innovate to ensure that they are not overrun by emerging competitors, this is a major concern and could influence the economic recovery, which is still fragile in many countries.

Although the lack of IT professionals has been debated and considered for a long time, the fact is that the speed of change on the supply side is relatively slow and it takes a while for new initiatives to be embedded and to show results. However, it is important to bear in mind that the gap is not just about absolute numbers missing in the total IT workforce. It is also about the actual skills and levels of experiences that people are missing. This is also very much about skills mismatch compared to market demand – and about how easy it is

to assess which skills the individual IT person possess. This is where the European framework for IT professionalism can play a critical role.

The lack of women in the IT profession is also an issue that needs addressing. Interestingly, this is not just an issue that affects Europe: also in Canada, Japan and the US is there a need to make the IT profession more attractive to women. Initiatives to get more women to join needs to start early targeting young girls – and even targeting parents so that they will consider that IT is a suitable profession for their daughters. Perhaps the emergence of many of the new technologies may help on this? While it may still be difficult to attract women to e.g. hardcore network technology jobs, many new jobs will require more “hybrid” skills such as business/technology (e.g. data scientists), design/technology (e.g. customer experience and user interface development). The technology development itself may finally attract females to IT.

Part B: developing a European framework for IT professionalism



3 Rationale for a European framework for IT professionalism

“The digital economy merges with the real economy. We need leadership and investment in digital technologies in areas like advanced manufacturing, smart energy, automated driving or e-health”

– Elżbieta Bieńkowska

Commissioner for Internal Market, Industry, Entrepreneurship and SMEs

Europe is strongly depending on sufficient skills to further boost the Digital Economy. The previous section made clear that demand will outstrip the supply of IT skills that can help organisations design, build, implement and manage new digital technologies. This section provides an overview of policy initiatives concerning IT professionalism at European level and within some of its Member States, as well as what is happening at a global stage. It also puts this project on IT professionalism in the context of developments concerning e-Leadership skills and Key Enabling Technology (KET) skills. The next chapter 4 will elaborate on what the European framework for IT professionalism encompasses and provides the current state-of-play.

3.1 IT professionalism is key for boosting the digital economy in Europe

As we have seen in the previous chapter, almost 202, 000 unfilled core IT vacancies are estimated to be in Europe by 2020. Closing the gap between the number of job seekers in Europe and the number of unfilled digital jobs has been the main priority of the European economy for nearly a decade.

In September 2007, the European Commission adopted a Communication on “e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs” which included a long term EU e-skills agenda for Europe. Two evaluations of its implementation for the period 2007-2010 and for the period 2010-2013 concluded that good progress has been made and that efforts should be intensified. The following developments in particular should be mentioned:

- E-skills activities have been included in the 'Digital Agenda for Europe' (2010)³¹;
- The Communication "Towards a Job-rich Recovery" (2012)³ presents key actions for the promotion of IT employment and e-skills³²;
- The President of the European Commission together with four Commissioners launched a 'Grand Coalition for Digital Jobs' at the conference on 'e-Skills and Education for Digital Jobs' on 4th March 2013 in Brussels³³. As part of this long-term effort to align the European economy to the digital market trends started with the EU e-skills strategy and the 'Grand Coalition for Digital Jobs', the European Commission launched an EU-wide 'e-Skills for Jobs' campaign.³⁴ The aim of the campaign is to raise awareness of the opportunities that digital skills offer for employment and employability. Targeting young people, unemployed people, IT professionals, enterprises (in particular SMEs) as well as business leaders and policy makers, the campaign provides a response to the unmet demand for IT-skilled professionals across all industry sectors.

Delivering on its Strategy to create a Digital Single Market, the European Commission recently³⁵ unveiled its first industry-related package with plans to help European industry, SMEs, researchers and public authorities make the most of new technologies. A set of measures to support and link up national initiatives

³¹ See: <http://ec.europa.eu/digital-agenda/>

³² See: http://europa.eu/rapid/press-release_IP-12-380_en.htm

³³ See: <https://ec.europa.eu/digital-single-market/en/grand-coalition-digital-jobs>

³⁴ Further information is available on: <http://eskills4jobs.ec.europa.eu/>

³⁵ On 19 April 2016 the following press release was published: http://europa.eu/rapid/press-release_IP-16-1407_en.htm

for the digitisation of industry and related services across all sectors and to boost investment through strategic partnerships and networks was presented.

Following this package, the Commission released a comprehensive **Skills Agenda for Europe**. The aim is to ensure that people develop a broad set of skills from early on in life and to make the most of Europe's human capital, which will ultimately boost employability, competitiveness and growth in Europe. The agenda calls on EU countries and stakeholders to improve the quality of skills and their relevance for the labour market. It looks to reduce the number of Europeans lacking adequate reading, writing, numeracy and digital skills. At the same time, it seeks to help highly-qualified young people find work that suits their potential and aspirations, make it easier for employers to recruit employees with the right profiles and to equip people with the skills and mind-set to start their own businesses.

The Commission proposed 10 concrete actions to be taken over the next two years:

1. A Skills Guarantee to help low-skilled adults acquire a minimum level of literacy, numeracy and digital skills and progress towards an upper secondary qualification.
2. A review of the European Qualifications Framework for a better understanding of qualifications and to make better use of all available skills in the European labour market.
3. The 'Digital Skills and Jobs Coalition' bringing together Member States and education, employment and industry stakeholders to develop a large digital talent pool and ensure that individuals and the labour force in Europe are equipped with adequate digital skills.
4. The 'Blueprint for Sectoral Cooperation on Skills' to improve skills intelligence and address skills shortages in specific economic sectors.
5. A 'Skills Profile Tool for Third Country Nationals' to support early identification and profiling of skills and qualifications of asylum seekers, refugees and other migrants.
6. A revision of the Europass Framework, offering people better and easier-to-use tools to present their skills and get useful real-time information on skills needs and trends which can help with career and learning choices.
7. Making Vocational Education and Training (VET) a first choice by enhancing opportunities for VET learners to undertake a work based learning experience and promoting greater visibility of good labour market outcomes of VET.
8. A review of the Recommendation on Key Competences to help more people acquire the core set of skills necessary to work and live in the 21st century with a special focus on promoting entrepreneurial and innovation-oriented mind-sets and skills.
9. An initiative on graduate tracking to improve information on how graduates progress in the labour market.
10. A proposal to further analyse and exchange best practices on effective ways to address brain drain.

The e-Skills Manifesto³⁶ states that, "Digital technologies are a major engine for growth, fuelled by the ideas of **highly skilled IT professionals** and business leaders – or e-Leaders". The European Commission will support Member States in their efforts for the recognition of digital skills and qualifications and raise Europe's level of IT professionalism. The adoption of a European framework for IT professionalism would help achieve this goal.

At European level various projects have been undertaken that have proven to be important milestones in the further development of IT professionalism.

The relevant documents and initiatives are:

- 'E-Skills and IT Professionalism: Fostering the IT profession in Europe' (2012)

³⁶ The e-Skills Manifesto, 2015

- 'Towards European Quality Labels for the IT Industry Training and Certification' (2013)
- 'European e-Competence Framework 3.0' (2013)
- 'e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios,' (2013)
- 'European Foundational IT Body of Knowledge' (version 1.0): a first point of reference for anyone interested in working in IT (2014)
- 'e-Skills in Europe: Measuring Progress and Moving Ahead' (2014)
- 'The International Dimension and the Impact of Globalisation on e-Skills' (2014)

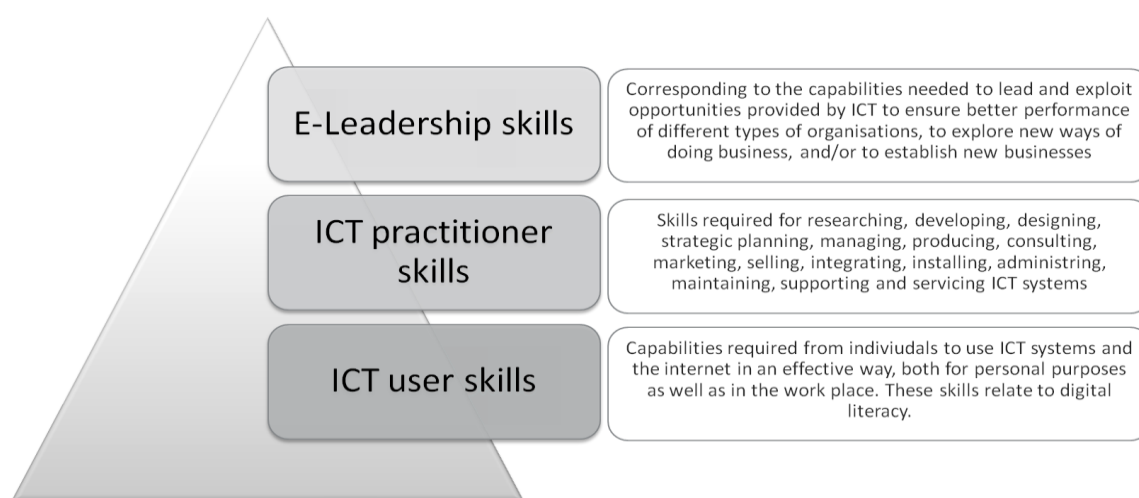
Short overviews of these reports are included in *annex C*. The next paragraph will inform about ongoing initiatives and how they interrelate.

3.2 Triangulation of IT professionalism, e-Leadership and KET skills

Current initiatives at EU level are focusing on IT professionalism, but also on the development of skills to apply Digital and Key Enabling Technologies (KETs) which are at the heart of the EU's industrial policy for growth, competitiveness and jobs, and on the promotion of e-leadership skills to provide Europe with a larger talent pool of highly-skilled entrepreneurs, managers and professionals (e-Leadership)³⁷.

These initiatives cannot be seen separately, and coordination is important to ensure consistency of approaches and terminologies. A feedback loop between these initiatives is essential. This paragraph describes how these topics are interrelated to provide a proper understanding of ongoing initiatives.

Figure 12: The e-Skills pyramid³⁸



The e-Skills landscape usually distinguishes three segments of skills, as is shown and explained in figure 3.1. Obviously there is a natural flow of people from 'IT practitioner' to 'e-Leader'. These are professionals that advance their career and reach to senior level positions that require these e-Leadership skills. Of course, not every management role in IT is considered as an e-Leader role, and it is also true that not every e-Leader

³⁷ In the areas of e-Leadership and KET skills several studies have been completed as well.

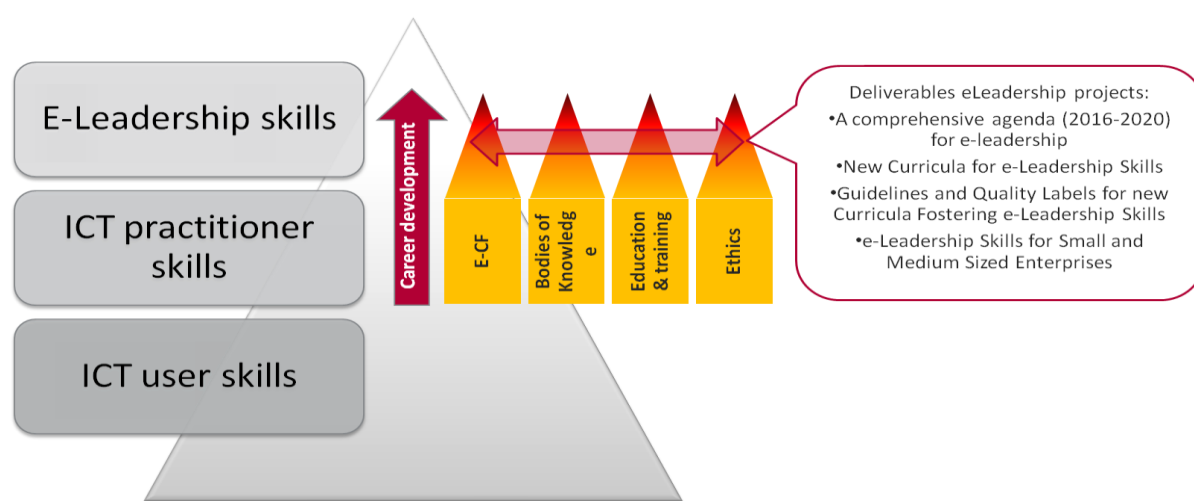
See: e-Leadership: <http://eskills-guide.eu/documents/> and <http://eskills-scale.eu/home/> and KETs: http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8764&lang=en&title=Final-report%3A-Skills-for-Key-Enabling-Technologies-in-Europe

³⁸ Based on the e-skills definition of the European e-Skills Forum, 2004.

necessarily has a background as IT practitioner. Nevertheless the relationship is obvious and follows a recognised career path.

The European framework for IT professionalism consists of four building blocks; each one is shown in figure 3.2. The e-CF also includes job profiles such as CIO that are close to what is defined as an e-Leader. The Foundational Body of Knowledge indicates IT Strategy & Governance as one of the knowledge areas of the IT spectrum. This visual also lists some of the deliverables of the e-Leadership projects, such as new curricula for e-Leadership skills and Quality labels for these new curricula. Obviously the skills these curricula describe should be aligned with, or even part of, these building blocks of the European framework for IT professionalism. It makes sense if e-Leadership curricula educate professionals in competences and knowledge that are described in job profiles for CIO's and are similar to the knowledge items included in the Foundational Body of Knowledge for IT Strategy & Governance. Or, the other way around: the curricula provide input for updating these instruments according to the latest insights.

Figure 13: Interrelation of e-Leadership projects and the European framework for IT professionalism

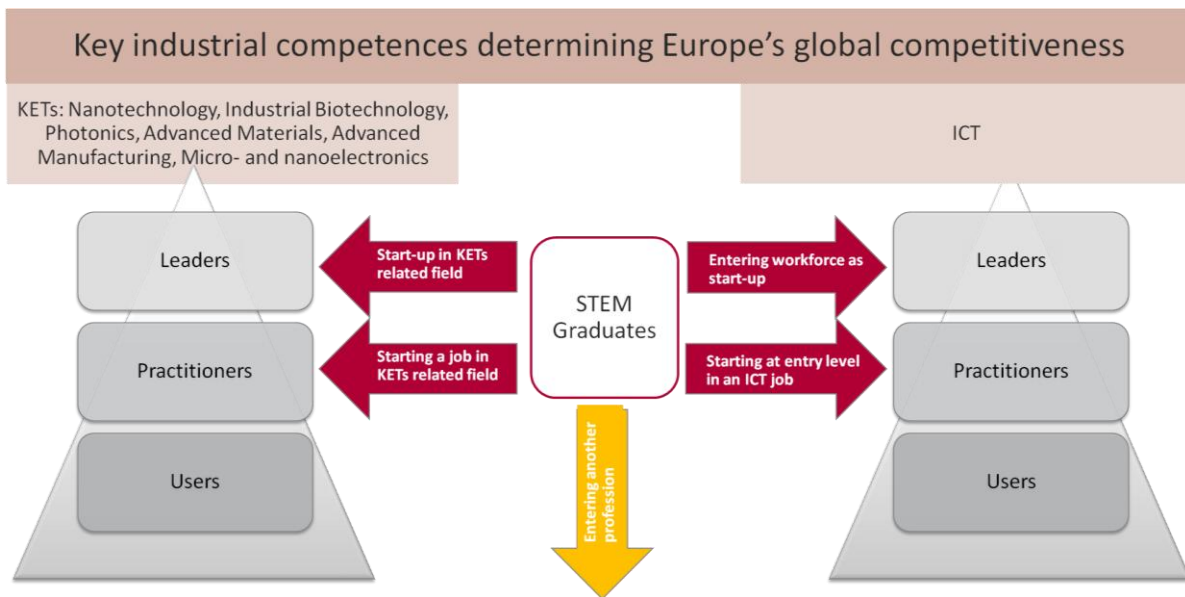


The relationship between IT professionals and developments around KET stems from the fact that both IT professionals and KET workers are (partially) recruited from STEM graduates. Both are key industrial competences determining Europe's global competitiveness³⁹. And both address the need to further align industry needs with educational programmes, the need for regular re-training/re-skilling as well as improving the image to attract more people to enter these fields. For instance, the KETs Skills Vision Report⁴⁰ indicates the need to train students in 'collective problem solving' and 'entrepreneurial adaptability'. These relate to the skills that are required from dual thinkers that the IT industry is asking for: both from professionals as well as leaders. Obviously these overlaps needs to be well coordinated to avoid different and/or incomplete messages sent to educational providers that would reduce the efficiency and effectiveness of these initiatives, and the overall skills strategy.

³⁹ Key industrial competences determining Europe's global competitiveness as per definition of the Horizon 2020 Framework Programme for Research and Innovation. Not mentioned in this figure, but distinguished in this programme besides KET and IT is 'Space'. Source available online here: <https://ec.europa.eu/programmemes/horizon2020/en/h2020-section/leadership-enabling-and-industrial-technologies>

⁴⁰ Skills for Key Enabling Technologies in Europe: "Vision for the Development of Skills for Key Enabling Technologies (KETs)", PwC, March 2016. Available online here: http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8764&lang=en&title=Final-report%3A-Skills-for-Key-Enabling-Technologies-in-Europe

Figure 14: interrelation of KET skills projects and the European framework for IT professionalism



Concluding, triangulation of these three topics will lead to optimal impact. The idea is that one can be more confident with a result if different methods lead to the same result.

3.3 IT professionalism in European countries

This paragraph presents an overview of the European countries that already in the first phase of this project showed commitment as regards taking-up the European framework for IT professionalism. This is a very positive sign and we believe their interest will trigger other countries to join as well.

3.3.1 IT Professionalism in Spain

The *Consejo General de Colegios Profesionales de Ingeniería Informática* (CCII) is the Spanish chartered informatics engineering organization and was set up in 2010 by a specific agreement of the Spanish Parliament. CCII has among its duties:

- Representation of the Spanish informatics engineering professionals on the national and international level;
- Organisation and regulation of the professional practice;
- Ensuring proper standards and promoting an ethical practice and contribution of informatics engineering to general interest;
- Disciplinary proceedings / notification of sanctions or disqualification proceedings for the professional practice;
- Deontological control of the professional and its values in good practice; guaranteeing the use of a single deontological code for the profession in Spain;

CCII is interested in the scope of the European framework for IT professionalism, and specially the least-developed fields as Ethics and Certifications and implementing Quality Labels.

Since 2014, CCII is involved in CEN TC 428 e-Competences and ICT Professionalism, whose main goal has been producing the upcoming EN 16234 (European Norm about ICT Profession Competences by the European Committee for Standardisation - CEN). The President of CCII is also the President of the corresponding Spanish

national subcommittee in the Spanish standardisation national entity (AENOR) and since June 2015 CCII is participating in CEN IT Skills Workshop.

In this scope CCII has been leading the promotion and assimilation of IT professional competences in all economic and social sectors of activity. CCII had had a strong commitment with AENOR to elaborate on a Spanish translation of the European Standard EN 16234 1 and to disseminate it in Spain, as strategic element for its real knowing and use, especially in non IT sectors like head hunting, social agents, etc.

In the field of professional ethics, CCII is working on the evolution from diverse regional and partial (forensics, etc.) deontological codes, to one single national deontological code. In the same working line CCII is defining a National Commission on Ethics. CCII decided to postpone its national actions and instead contribute to the implementation of the European Framework for IT Professionalism and in particular the activity that created the professional ethics guidelines, in order to have a common European basis for the national initiatives.

In the scope of professional practice, there is a very relevant initiative for defining a national standard about the documentation structure and formats in IT projects. This working line is being developed by a national working group created on September 2015. The first version of this standard was approved in May 2016 and it is available for use of professionals, companies, universities and the whole of IT sector and Spanish society in general, for free here <http://www.ccii.es/normas>

In scope of general IT regulation, CCI promoted an ambitious initiative called InformatiCALL: “Call on governments and society about Information Technology products, activities and services of the Information and Knowledge Society”, on April 20th 2015⁴¹. A pioneer example of growing concern about IT services and activities evaluation and its personal and societal IT impact, where the vision on IT professionalism as expressed in this service contract plays an essential role.

On the other hand, the situation of IT professionals in Spain follows the European trends. IT professional are one of the few Spanish professional sectors with full employment statistical indicators (less than 5% unemployment). Both government indicators and CCII reports show this positive situation and trends .

CCII has provided a proposal of a national implementation approach presented in workshop 1 “Towards a European framework for IT professionalism”, developed and improved later with several documents and virtual meetings to draft an action plan for implementation of IT Professional Framework in Spain, being the first basic action the presentation of IT Professional Framework in Spain, in the Digital Enterprise Show 2016, 24th May at Madrid, taking advantage of this international event to call and promote the support and participation of Spanish IT sector agents and organisations in implementation of IT Professional Framework in Spain.

The CCII organised several promotion actions across Spain about the implementation of the European Framework for IT Professionalism, with a national workshop in December 2016, where Spanish experts and project team discussed and improved the action plan and provided a wide roadmap for further implementation and evolution of the Framework. The roadmap of completed and ‘in-process’ actions can be found in Appendix D. The CCII – with support from the Politecnico di Milano – embarked on an implementation action concerning a transparent Open Certification Map. More details on this can be found in chapter 6.

⁴¹ Available both in Spanish and English in de address <http://www.ccii.es/informaticall>.

3.3.2 IT Professionalism in Italy

In Italy, the *Osservatorio* of Digital Competences 2015, promoted by the AgiD (Agenzia per l'Italia Digitale), has been published in March 2016. The *Osservatorio* shows that Companies and Government entities are highly aware (80-90% of respondents) about the impact of the 'digital transformation' and the need to adapt the digital skills especially in light of the new trends (mobile, digitization of flows and processes, business analytics, IoT, cloud computing, Web developments, electronic payments). In particular, main findings from the research provide a clear overview on the IT professionalism:

- The skill level of coverage (defined on the basis of the European system e-Competence Framework - e-CF), measured as the simultaneous presence of all the necessary components, ranging from 73% of the IT companies to 67% of in-house company of the Regions and Autonomous provinces 48% of business users, before falling to 41% in Central PA and 37% in local PA.
- The main recruitment channels for IT profiles are: professional network (around 70% of companies surveyed), company's research and selection (more than 50% of user organizations)
- The growth of internal expertise is based mainly on the on the job training (over 90% of the centralised units, 75% of those premises, 80% of business users, 87% of IT companies).
- The most required degrees are Informatics / Computer Science, together with other Engineering addresses. Both at the companies in the IT sector at the demand, in fact, are the degrees that are better adapted to the diverse challenges that the digital evolution implies. The appreciation is around 80% of respondents. For 80% of IT companies is also a key technical skills certification system.

In Italy, the most requested IT professions in 2014 were high qualified, managerial (70%), whilst technical professions decreased to around 24% (Excelsior –IT sector 2014, in *Osservatorio Competenze Digitali* 2014). In 2013, at least 22% of recruiting took more than four month, because of IT skills mismatch (Modis Italia White Paper 2013).

Since summer 2012, the main stakeholders' representatives, namely the five most important employer associations in Italy, *Confindustria Digitale*, *Assintel (Confcommercio)*, CNA and *Unimatica-Confapi*, with the scientific support from *Fondazione Politecnico di Milano*, set up a precompetitive network "*Rete Competenze per l'economia digitale*" (Grand Coalition for Digital Jobs Pledger, <http://www.linkedpolicies.eu/pledge/>), aimed at fostering IT professionalism in Italy .

The main topics of interest were: which kinds of competences are required by the IT market, how to develop them both in the school system and in continuing VET, how to build a recognised IT profession identity.

A very interesting tool already available in the market was the e-CF, developed in the CEN IT Skills Workshop context. The e-CF was the first European framework for IT competences mainly required by IT end-user companies, i.e. a common reference speaking a shared language, useful for comparisons and evaluations. Such stakeholders considered this tool as a concrete starting point around which building awareness and mutual understanding on e-competences needed to be competitive.

Several workshops had been organised in Milano and Roma addressing stakeholders from private and public sectors to present the e-CF and the relevance of e-competences for competitiveness.

The e-CF became the new reference for the local qualitative and quantitative surveys on the issue, carried out yearly by some employer associations such as Assintel.

The first concrete action was to make this framework a national standard, becoming Italy the first country with the e-CF as an official norm: UNI 11506:2013.

Meanwhile, a free of charge job-matching tool (JobICT) for enterprises and IT professionals, based on the e-CF, was developed by social partners (UilTucs, one of the main Italian trade Unions with the support of ASSINTEL) and IWA Italia with contributions from FPM (<http://www.jobict.it/>).

The National Agency for Digital Italy adopted the e-CF as the reference for the national guidelines on *Training, Competences and the Digital Culture*, to align the VET offer against the Public Administration's and IT SMEs' needs (<http://www.agid.gov.it/agenda-digitale/competenze-digitali>) .

Several e-CF-based training initiatives to develop new job profiles are being designed even within Ministerial projects, such as the forthcoming Ambient Assisted Living new professional profiles (Design4All CTN01_00128_297089).

For such stakeholders, a step ahead would be now to integrate the forthcoming European Foundational IT Body of Knowledge with the e-CF both in the VET programmes and in the above mentioned job matching tool; to align the local emerging VET programmes to the European training guidelines within the European framework for IT professionalism. In such a way, a clearer and clearer IT professionalism picture for the Italian context can be depicted as well. In this project, with the marvellous support of the National Interuniversity Consortium for Informatics (CINI), an assessment of the Foundational IT Body of Knowledge in relation to existing curricula within Italian universities on security management was completed. Details of this exercise are to be found in chapter 6.

3.3.3 IT professionalism in Ireland

The commitment of the Irish Computer Society (ICS) to drive professionalism in IT is well illustrated by the association's website⁴². It presents the Framework and its building blocks in a coherent manner, explaining the added value and referring to relevant instruments and tools where available.

The ICS is establishing a core group of experts that will further promote the IT Professional Framework and its specific components in order to increase awareness amongst the various stakeholder groups in Ireland, and eventually take-up. The ICS has listed several possible actions for European framework for IT professionalism implementation in Ireland (please find an overview in Appendix D).

One of these tools is a new career progression pathway for Ireland's IT professionals: Continuous Professional Development (CPD)⁴³, developed by the Irish Computer Society. CPD allows professionals to take ownership of their career development, to record CPD activities for verification and to track and review CPD progress.

The Irish Computer Society has developed for its members a free-to-use, online system to support their tracking of their professional development. This is a new career progression methodology for Ireland's IT professionals that is:

- Inspired by the work of the Council of European Professional Informatics Societies (CEPIS), in particular its landmark study prepared for the European Commission: 'e-Skills and IT professionalism: Fostering the IT Profession in Europe'.
- The result of lengthy consultations with industry experts, academics and other stakeholders about what IT professionals need from CPD, and what Ireland's innovative economy needs from IT professionals.

⁴² See: <https://www.ics.ie/professional/it-professionalism.php>

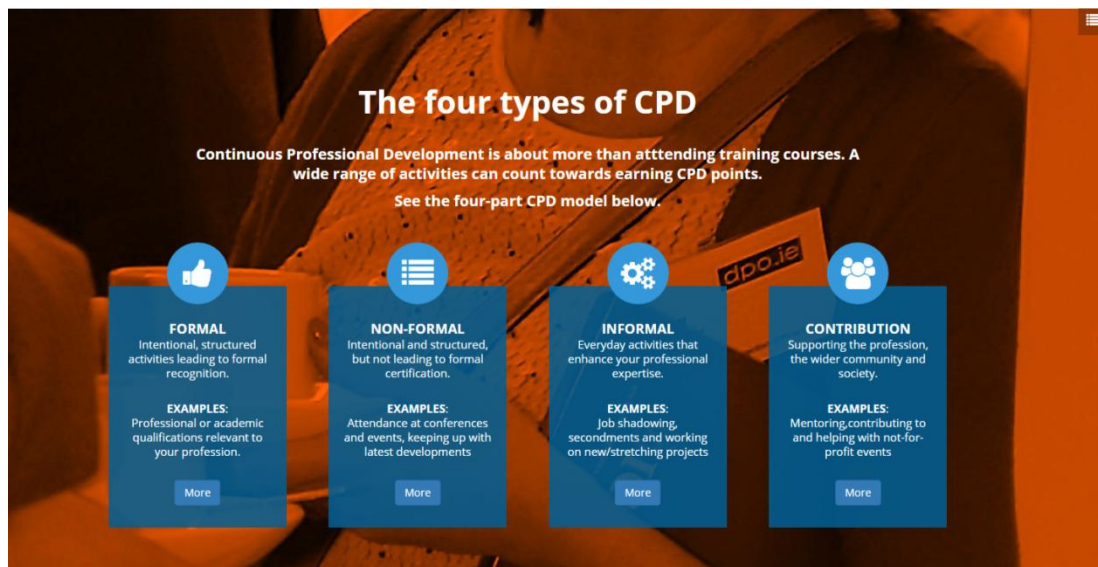
⁴³ More information online here: <https://www.ics.ie/certification>

- Facilitated and administered by the Irish Computer Society, in partnership with the members of its six-society professional network in the fields of IT architecture, data protection, IT service management, business analysis and health informatics.

In a visually appealing way, the ICS explains the benefits of pursuing and recording CPD for professionals and organisations as well as how it contributes to the profession as a whole. It also explains that CPD is a unique journey and that depending on where a professional is in his/her career, different needs regarding education arise. It distinguishes between IT students, IT professionals, and IT leaders.

Finally, it also includes the opportunity to track ‘contributions’ of the professional. The idea is that members should be recognised for their efforts to support the profession, their colleagues and aspiring IT professionals. This includes for instance signing up to the ICS code of conduct, but could also encompass research & publishing or volunteering in one of the numerous projects aimed at promoting IT as a career.

Figure 15: Continuous Professional Development by the Irish Computer Society⁴⁴

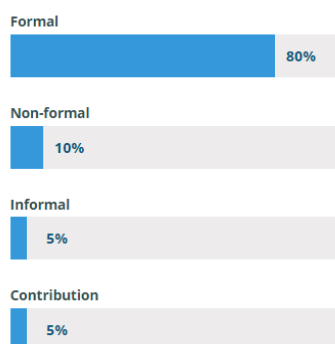


⁴⁴ More information online here: <https://www.ics.ie/cpd>

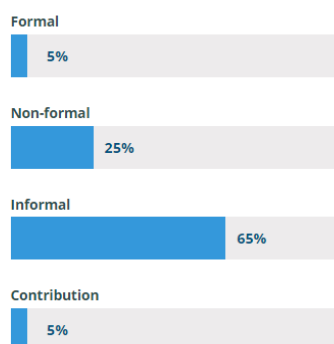
CPD over your career span

CPD is a unique journey for each professional – the skills and methods you develop and apply will evolve as your career does. As you grow in experience and expertise, you may focus on some CPD weightings more than others.

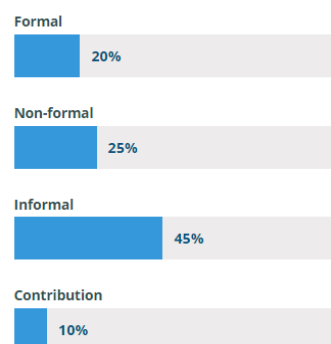
An **IT student** will typically allocate most of their time and effort to formal education and study. As you can see in the example below, some 80% of the individual effort is allocated to formal CPD.



An **IT professional** may allocate more of their time to on-the-job development and less to formal learning. Attending conferences and other events will further boost their non-formal CPD points.



An **IT leader** may decide to give back to the community or mentor junior professionals. They may also return to formal learning by pursuing a leadership development programme.



Ireland also has a good example of a short-term solution to ‘train the trainers’ with an out of field training⁴⁵, from the University of Limerick and Bridge 21 from Trinity College Dublin.

Other key initiatives include:

- Smart Futures: Initiative to promote STEM careers and act as an umbrella group: <http://www.smartfutures.ie/>
- Tech/Life Ireland: Promoting Ireland as a destination for tech talent: <https://techlifeireland.com/>
- Tech Skillnet Programmes, for example:
 - Technology Ireland ICT Skillnet: <http://www.ictirelandskillnet.org/> (there are several tech skillnets)
 - Springboard Programmes (many focused on tech): <https://www.springboardcourses.ie/>
- Supporting women in Tech and the workforce:
 - CWIT (Connecting Women in Technology): <https://www.facebook.com/ConnectingWomenInTechnology/>
 - 30% Club Ireland: <https://30percentclub.org/about/chapters/ireland>
 - Women Reboot: <http://www.softwareskillnet.ie/women-reboot/>

Ireland’s *ICT Action Plan 2014 – 2018*, *The Digital Strategy for Schools*, *Action Plan for Jobs 2017*, *National Strategy for Higher Education 2030* and *Digital strategy for Schools 2015 – 2020* all include elements affecting teacher training in Ireland and form the basis for on-going reforms to the Irish educational system. While the teacher training curriculum in Ireland is not being reformed in its entirety, the Irish government has enacted a number of policies of direct relevance to IT in education.

The Irish ICT Skills Action Plan includes a target of increasing the retention rates on higher education ICT programmes from 80% to 83% over the life time of the Plan, and notes that one of the key factors in the high

⁴⁵ Source: <http://epistem.ie/>

dropout rates is an inadequate level of maths proficiency. Against this background, one policy initiative is of particular relevance in the context of IT, namely the ongoing roll-out of “Project Maths” This includes the establishment of a new continual professional development Postgraduate Qualification for teachers of mathematics. The approach taken by the Irish government focuses not solely on basic IT training for teachers but rather on an increase in both volume and quality of mathematics teaching across Irish schools to allow pupils to pursue higher mathematics at a later stage as well as provide teachers with the necessary skills to teach mathematics at a high level.

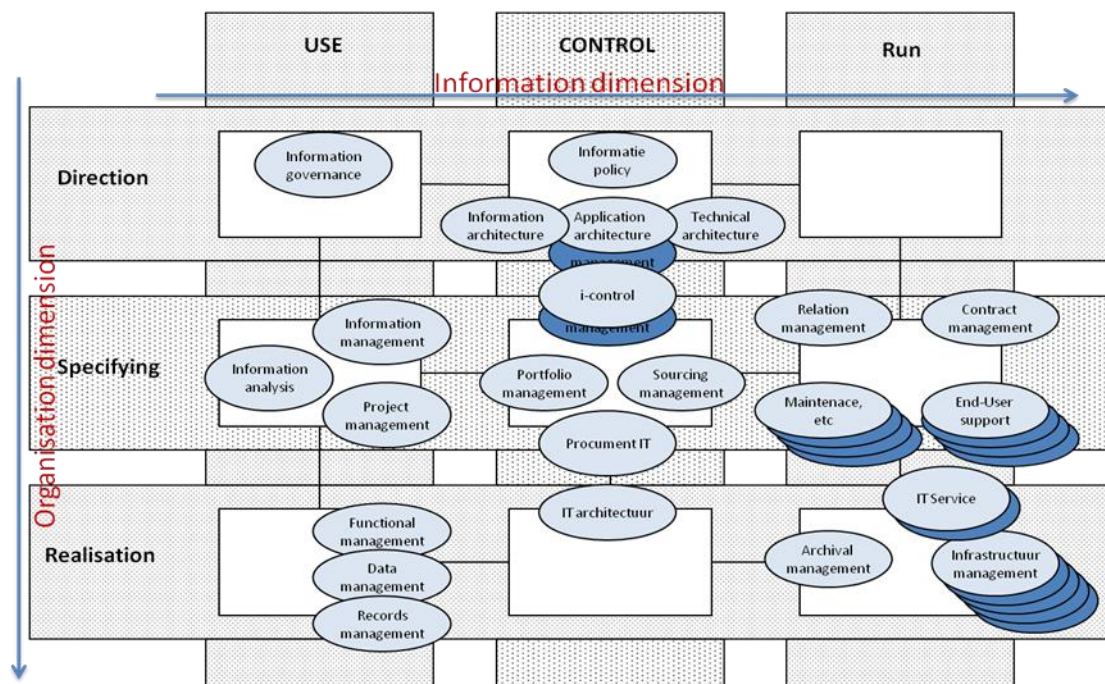
Furthermore, the Irish National Strategy for Higher Education 2030 stressed the need to build on the centrality of mathematics and science. The strategy argues that mathematical concepts, models and techniques are central to working in all sectors of employment and the proficiency level of students in mathematics is a key factor influencing the domestic supply of graduates for sectors with growth potential such as IT, as identified by the Irish Expert Group on Future Skills Needs. Therefore the need to equip teachers with the right skills to teach mathematics is of central importance.

A key deliverable of this initiative was the establishment of a Postgraduate Qualification for “out of field” teachers of mathematics. The course is a blended learning programme based on a two-year part-time university accredited diploma; it is delivered locally and through online modules. The course was introduced in 2012 with 390 places and is available nationwide free of charge, with specific provision for teachers in Irish-medium schools. The first cohort of teachers completed the programme in September 2014. The programme is funded by the Irish Department of Education and Skills as part of the national strategy to support the implementation of Project Maths and improve standards in mathematics education in post-primary schools by up-skilling out-of-field teachers of mathematics.

3.3.4 IT professionalism in the Netherlands

Since 2011 the Dutch central government aims at empowering commissioning of IT, development of IT professionals in public service (keeping professionals up to date and flexible and mobile between government units) and on enhancing IT user skills and e-Skills. The Dutch central government has adopted the e-CF in her approach to HR as standard and sets up all occupations following the e-CF. It brings great transparency and uniformity. As the central government organises this for all ministries and agencies at a national level this is quite a challenge. They developed a ‘Quality Framework IV’ that bridges from generic occupations within the national government to specific IT profiles and competences. It is grouped in Quality profiles that define results, and is mapped on SAME (2007).

Figure 16: The Netherlands Quality Framework



The Dutch government has started a project team to integrate the Foundational Body of Knowledge into their Quality Framework IV. The Quality Framework itself could very well be applied in the context of other countries that face similar challenges. The Dutch government is positive about sharing their knowledge with others and learning. The Quality Framework will also be leading for public procurement processes in the near future.

Besides being a user of e-CF, the Dutch government is also very keen on promoting IT professionalism and e-skills in general. The Ministry of Economic Affairs is leading in this and relies on the ECP for implementation of a vision for the information society. ECP stands for 'Platform for the Information Society' and is an independent platform where government, business and civil society work together and share knowledge with a view to the application of information and communication technologies in Dutch society.

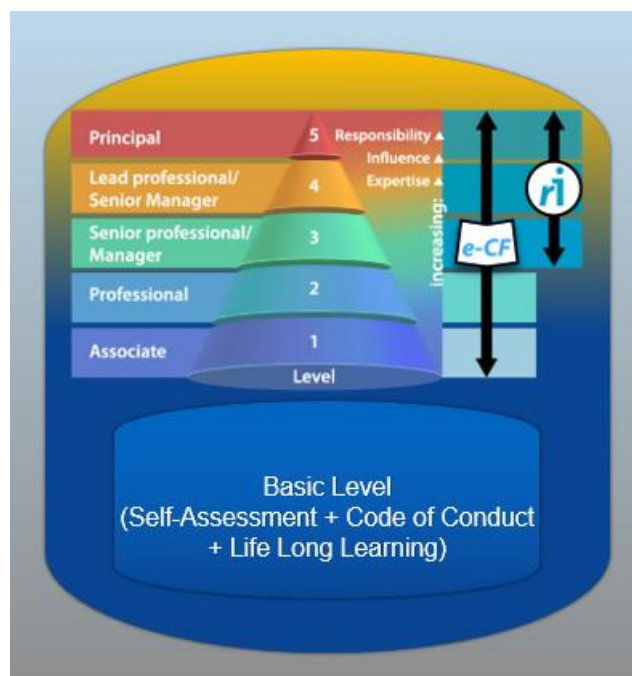
The work of ECP also closely relates to the work and interests of the Dutch IT trade association ('Netherlands IT'). *Netherlands IT* represents more than 550 IT companies in the Netherlands with the mission of deploying all existing knowledge and expertise to provide market incentives, act as a powerful representation in transcending business interests, offer personalised services in the field of legal, financial issues and HR, and facilitate a large network.

On the side of associations, the Ngi-NGN, the Dutch professional association for IT professionals and managers. It is an independent platform where members deepen their knowledge and network maintenance. The Ngi-NGN has been around since 1959. The Ngi-NGN provides the perfect opportunity to keep well with all the developments in IT, to increase knowledge and maintain your network. Members of the Ngi-NGN access content events, such as lectures, seminars and conferences. With this organisation we are a.o. exploring the option of publishing a peer-review assessment tool based on both e-CF as well as the other building blocks of the Professional Framework (Ethics, Knowledge).

In this regard also the Dutch Association for Computer Scientists Registry (VRI) needs to be mentioned. Each IT professional registered with VRI abides by a Code of Ethics and is thus visible as a professional of high integrity. At the moment, the VRI, together with Ngi-NGN, EXIN Foundation and several industry and education partners, have initiated the start of an e-CF register. This is a voluntary register aimed at providing

transparency in achieved competences of IT professionals while at the same time providing IT professionals with an opportunity of personal branding. The register is developed based on ISO standards (17024:2012) for certification. The register will start from the current VRI-register of informatics, but is aimed at all Dutch IT professionals. Registration will be based on self-assessment and/or a personal assessment. The launch of this initiative took place on 27 May 2016.

Figure 17: A voluntary e-CF register for IT professionals in the Netherlands



3.3.5 IT professionalism in the United Kingdom

The U.K. is usually considered a worldwide benchmark for policies regarding the promotion of e-skills and for multi-stakeholder partnerships in the IT domain. The country's initiatives related to e-skills development remain a point of reference for policy intervention and supporting activities in the area. They refer to both the development of digital literacy targeting the entire population and the IT practitioner skills.

As a starting point, the Information Economy Strategy of June 2013 underlined the fact that a lack of sufficiently skilled people was one of the biggest barriers to UK leadership and to reap the economic and social benefits in the global information economy. Two markets for skills development were identified: a publicly funded market built around qualifications, and a privately funded training market addressing business needs. Those markets did not align sufficiently. The ambition was to make the UK a global leader for cutting edge technologies. Therefore, the strategy supported long-term Industrial Partnerships through the Employer Ownership of Skills initiative⁴⁶ to enable businesses to take end to end responsibility for skills development.

In the last decade, the UK's approach has been characterised by **a strong financial engagement by the state and industry in IT-related policies despite the critic current economic environment**. An overview of current initiatives in the IT field is necessary to understand the national Digital Skills Strategy developed by the Information Economy Council (IEC) Skills Working Group.⁴⁷

⁴⁶ Further details are available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/305746/employer-ownership-of-skills-web-vision-report-final2.pdf

⁴⁷ Additional information is available at: <https://www.techuk.org/>

The **Tech Partnership**, recognised by the British government as the ‘Industrial Partnership for the Digital Economy’ and the skills, tackles the market failure in the supply of digital skills. It takes forward the work of the ‘e-skills UK’ and it involves the government, education providers and stakeholders across the economy in a joint effort to maximise the impacts of the action taken. The Tech Partnership is a growing network of employers collaborating to boost growth in the global digital economy. The primary objective is to increase young generations’ interest in technology to orientate the flow of young and talented people with different backgrounds into technology careers. In the development of this ‘world class pipeline of new talent’ for technology careers, a particular focus is put on attracting more females.⁴⁸ It is also intended to help companies develop their technological skills and competences necessary for the future. This partnership sets standards for skills and development, and brings coherence by embracing all able to contribute to its strategic objectives. As a consequence, it aims at influencing school curriculum and providing support to teachers. This would help the development of industry-backed or focused degree programmes and conversion courses.

According to the most recent data, many positive results and impacts of the Tech Partnership have been reported indicating a change in the skills landscape in the UK towards more coherence. With regards to skills development, a breakthrough has been achieved in setting skills standards. The Partnership has shift from 50 companies to over 550, two thirds of which are SMEs and it goes beyond the original ambition (total 400 companies). In close cooperation with professional bodies including *BCS, the Chartered Institute for IT* and IISP (for cyber security), a strong effort has been made to develop a unified framework for standards and professional progression. Since June 2014, over 180 private, public and third sector organisations have joined the Tech Partnership Stakeholder Alliance bringing more cohesion in the field.⁴⁹

As highlighted in the report, the ambition of the Tech Partnership is to deliver the skills for a million new digital jobs over the coming decade. This would lead to growth for businesses across the economy, and to a fundamental change to the capabilities developed in schools, colleges and universities across the UK.⁵⁰

Graduate entry is not the only route in to the profession for those at the start of their career. Apprenticeships are increasing in the UK. From March 2017 an apprenticeship levy will be introduced which any company with a salary bill of £3 million or more will be required to pay⁵¹. The money this generates will be used to fund further apprenticeships. It is widely anticipated that this will lead to an increase in the take-up of apprenticeships in all sectors, including IT.

The *BCS, the Chartered Institute for IT* has already triggered an important action concerning the European framework for IT professionalism. A workshop was organised as part of this project to take an important step towards closer alignment of two major IT competency models that have similar goals in providing a common language to describe the requirements of IT professionals, and hence meeting private and public needs around the globe. The ambition of both the SFIA Foundation and the European Commission is to bring these frameworks closer together. This initiative is described in more details in the chapter that deals with implementation of the Framework (please see 6.2).

3.4 Similar initiatives outside Europe

This challenge of maturing the IT profession is not unique to Europe. This project also reflects on parallel efforts in other parts of the world, such as driven by IPA⁵² in Japan, ITIF⁵³ in the United States, or ICTC⁵⁴ in

⁴⁸ The Information Economy Council Digital Skills Strategy, July 2014. Available online here: https://www.thetechpartnership.com/globalassets/pdfs/research-2014/informationeconomydigitalskillsstrategy_oct14.pdf

⁴⁹ The Tech partnership Progress update Report (April 2014 – March 2015).

⁵⁰ Ibid.

⁵¹ More information can be found here: <https://www.gov.uk/government/publications/apprenticeship-levy/apprenticeship-levy>

⁵² Information technology Promotion Agency (IPA), see for instance the aim to protect and nurture the IT society: <https://www.ipa.go.jp/english/about/about.html>

Canada, and even more importantly we initiated collaboration with key stakeholders in those countries to exchange knowledge and experiences. Policies and initiatives led at national, EU or international level may differ depending on local context, but there are common priorities addressed and this is essential in moving the IT profession forward. The section below summarises key elements of the strategies these non-EU countries take as regards Skills. The final report will see to add some more details about key success factors in these countries.

The World Economic Forum has taken on a multi-year initiative – New Vision for Education-and it is trying to identify and define the 16 most critical 21st-century skills in primary and secondary education for today's innovation-driven economy. In particular, IT literacy is included among the foundational literacies which will constitute the basis of a 'technology-enabled closed-loop instructional system'⁵⁵.

The following paragraphs include the most recent information on policies and initiatives for the promotion of the IT profession in Japan, Canada, and the USA.

3.5 Canada: developing talent in a global digital economy

Due to its favourable political and business environment and a vibrant digital ecosystem, Canada is likely to become a leader in the global digital economy. However, in order to achieve this, problems such as talent shortages, skills gaps, and the slow pace of digital adoption first need to be overcome⁵⁶.

The gap between the aging current IT workforce and not enough youth entering the IT labour market could lead to jeopardizing Canada's future competitiveness. Under a baseline scenario, it is expected that by 2019, over 84, 000 new IT jobs will have been created in Canada. Due to both replacement demand and retirements and other exits, the availability of home grown IT talent is expected not to be able to meet the demand resulting in a supply shortage of over 182, 000 IT professionals over the next five years⁵⁷.

Therefore, in 2015, the Canadian Information and Communication Information Council published the strategy 'Digital Talent: Road to 2020 and beyond' to 'contextualise Canada's digital landscape and labour market needs by 2020'. The paper puts forward a series of recommendations to be implemented by all stakeholders: industry, government, media and individual citizens.

The strategy focuses on 7 areas to help Canada become a leader in the global digital economy, namely:

- 1) Nurturing a strong youth talent pipeline;
- 2) Leveraging Canada's diverse talent;
- 3) Supporting workforce up skilling to enhance digital adoption;
- 4) Attracting and retaining global digital talent;
- 5) Strengthening digital literacy and digital skills for Canadians;
- 6) Fostering digital entrepreneurship; and
- 7) Building labour mobility pathways to fill high demand occupations.

⁵³ Information Technology & Innovation Foundation (ITIF), see: <https://itif.org/about>

⁵⁴ See for instance: Digital talent. "The road to 2020 and beyond: A national strategy to develop Canada's talent in a global digital economy", Information and Communications Technology Council (ICTC) Canada, www.ictc-ctic.ca

⁵⁵ Further information is available at: <http://widgets.weforum.org/nve-2015/#summary>

⁵⁶ Digital Talent: Road to 2020 and Beyond: http://www.ictc-ctic.ca/wp-content/uploads/2016/03/ICTC_DigitalTalent2020_ENGLISH_FINAL_March2016.pdf

⁵⁷ Labour Market Outlook 2015—2019: <http://www.digcompass.ca/labour-market-outlook-2015-2019/>

These 7 areas were then grouped into three areas: industry growth, education and skills, and diversity and inclusion. These three areas also formed the taskforces needed to develop an action plan with critical milestones to guide the strategy.

It is expected that if Canadian stakeholders successfully implement the above recommendations, it will be ensured that SMEs and other Canadian businesses as well as Canadian citizens will be better prepared and equipped to respond to the rapidly evolving global economy⁵⁸.

3.5.1 USA: incentivising public-private partnerships and strengthen STEM

Also the US is faced with a significant supply and demand gap in the IT sector. The main workforce issues could be attributed to: outsourcing, government resources, and role of government in industry's workforce initiatives, skills and training⁵⁹. In terms of demographics, only 12 percent of US innovators are women; 46 percent are immigrants or the children of immigrants; less than 8 percent of US born innovators are minorities; innovators are highly educated, especially in STEM fields; most foreign-born innovators are from Asia and Europe; and the median age for an innovator in the US is 47⁶⁰.

Over the last decade, new IT jobs were responsible for a 36% increase compared to just a 3% increase in the overall US job market. Although high wages and employment rates derive from high demand for IT workers, still around half a million jobs are yet to be filled with adequately skilled workers. An important factor for this imbalance could be attributed to primary and secondary schools having failed for the most part to adapt and teach in-demand computer concepts⁶¹.

Where many universities have taken steps to limit the number of students in CS courses, a new generation of non-profit organizations and advocacy groups, learning programmes and courses has emerged. Several NGOs focus on seeking to democratise access to CS education across gender lines and socioeconomic divides; introducing CS to students at a younger age; training more teachers; and putting CS into more schools.

Furthermore, most innovations in the US happen in very large or very small companies; small companies often rely on government funding to innovate; public-private partnerships are key to innovation; and 28 percent of innovations face barriers to commercialisation.

Therefore, the Information Technology & Innovation Foundation⁶² has called upon US innovation policymakers to:

1. Strengthen the STEM immigration pipeline;
2. Improve STEM education and empower students of all backgrounds to pursue these fields;
3. Incentivise collaborations between public and private entities; and
4. Expand government funding for innovation.

In early 2015 the White House announced a new initiative called TechHire which 'coordinates the efforts of the federal government, cities, corporations and schools to train workers for the thousands of current job openings in the tech sector'. In this initiative, a focus is put on coding schools like Galvanize, Flatiron School and Hack Reactor, which offer accelerated training in digital skills as a way to "rapidly train workers for a well-paying job." With most students being in their 20s and 30s, it was estimated that the USA with about 16, 000

⁵⁸ Digital Talent: Road to 2020 and Beyond: http://www.ictc-ctic.ca/wp-content/uploads/2016/03/ICTC_DigitalTalent2020_ENGLISH_FINAL_March2016.pdf

⁵⁹ US Department of Labor: https://www.doleta.gov/BRG/IndProf/IT_profile.cfm

⁶⁰ ITIF: https://itif.org/publications/2016/02/24/demographics-innovation-united-states#.Vt2EM_dQ8o4.mailto

⁶¹ The e-Skills Manifesto, 2015 – chapter 5: http://eskills4jobs.ec.europa.eu/c/document_library/get_file?uuid=b69ba1d7-6db4-415d-82e4-ac4d700a38b8&groupId=2293353

⁶² ITIF: https://itif.org/publications/2016/02/24/demographics-innovation-united-states#.Vt2EM_dQ8o4.mailto

graduates in 2015 would therefore be responsible for about one-third of the estimated number of computer science graduates from American universities⁶³.

3.5.2 Japan: discovering Young IT talent

In 2015 Japan's GDP growth rate was about 2%, making it the third largest worldwide after the US and China. An important reason for the rather low growth could be attributed to Japan's population decrease which will have an even bigger impact on the IT labour market as also in Japan there is a growing need for IT skilled professionals, especially with the Tokyo Olympic Games and Paralympics 2020 coming up. A specific growth rate is expected in cloud computing, big data, mobility, social media and the new business areas such as Internet of things. Where the Japanese IT sector used to be focused on system integration, IT is now increasingly used for new business development and new market creation. Moreover, due to a clear mismatch in required skills, Japan is losing business opportunities⁶⁴.

In order to increase digital skills within the Japanese workforce, the Japanese governmental Information Technology Promotion Agency (IPA)⁶⁵ is developing human resources within businesses and across the new hire base; developing the employment of female workers; and outsourcing from overseas. It is expected that both business growth and young entrepreneurs and start-up companies will lead be leading factors in this shift⁶⁶.

To tackle these issues, the IPA has taken the following steps to secure Japan's leading position:

1. Human resources development;
2. Qualifications in IT;
3. Digital skills framework;
4. 'MITOH' project (supporting the discovery of young IT talents); and
5. Information security human resources and security camp;

Furthermore, to strategically promote IT human resource development policies in these rapidly changing times, the Japanese IPA developed an 'I Competency Dictionary' to make it possible for companies involved in the training of IT professionals to flexibly combine and apply the Skill Standards for IT Professionals. Future objectives are to further enrich the contents of the Task Dictionary and Skill Dictionary; share examples of applications; and coordinate with the training programmes and qualifying/certifying examinations provided by educational institutions. It is meant to also provide an application system to support the use and application of the I Competency Dictionary by companies, organizations, and IT engineers involved in human resource development⁶⁷.

3.5.3 Israel: inspired by innovation

Israel has been long known for being on the cutting edge of research and development in advanced technologies. History and geography have made Israelis experts at identifying market needs, finding creative

⁶³ New York Times: <http://www.nytimes.com/2015/07/29/technology/code-academy-as-career-game-changer.html?ref=technology>

⁶⁴ The e-Skills Manifesto, 2015 – chapter 6: http://eskills4jobs.ec.europa.eu/c/document_library/get_file?uuid=b69ba1d7-6db4-415d-82e4-ac4d700a38b8&groupId=2293353

⁶⁵ The IPA promotes the various activities of the IT industry under the umbrella of the Japanese Ministry of Economy, Trade and Industry.

⁶⁶ The e-Skills Manifesto 2015 – chapter 6: http://eskills4jobs.ec.europa.eu/c/document_library/get_file?uuid=b69ba1d7-6db4-415d-82e4-ac4d700a38b8&groupId=2293353

⁶⁷ I Competency Dictionary: <http://www.ipa.go.jp/english/humandev/icd.html>

solutions, and shortening the development process to turn them into commercial products. Thousands of start-ups have been created in Israel over the years, making it second only to the US in this sector.

The Israeli entrepreneurship spirit combines original thinking, excellence in science and technology education, strong business drive and the ability to dare. All these factors join to create the “start-up nation”: a deep and buzzing eco-system of strong networks between industry, government, academia, private investors and young companies.

Accordingly, over 50% of Israel’s industrial exports stem from high-tech and life science industries, and almost 4.1% of GDP is spent on R&D – the highest rated among OECD countries⁶⁸.

The gap in Israel is not so big because of the sufficient supply. Computer science has been taught in almost every school for almost 30 years. It’s a part of the culture in Israel and it started with teachers. After overcoming resistance in the early years, in particular to ensure teachers understood what they were expected to teach, the community of teachers and the curricula are now key testimony to the successes achieved.

Language is important. In the words of Mr Avi Cohen, Inspector-in-chief Computer Science & information technology of the Ministry of Education in Israel: ***‘I refer to computer science as the ‘language of technology’ to illustrate to people and to convince investments are required to keep on matching demand. Computer science is the language of technology, and mathematics is the language of computer science.’***

Education trends in Israel consist of three key tracks:

- Computer software engineering
- Telecommunications
- Cyber knowledge management – for managers, (and thus entangled with the topic of e-Leadership)

However, this might be changing. While many entrepreneurs and investors made good money from Israeli start-ups over the past two decades, increasingly firms acquired by foreign buyers are then either shut down, with their intellectual property moving abroad, or turned into R&D centres for the parent company. Israel’s successful high tech industry attracts major global players who have been eager to snap up local start-ups. This could obviously affect the demand for jobs in Israel. In the words of Karin Mayer Rubinstein, head of the Israel Advanced Technology Industry association: ‘the Israeli government might need a long-term plan for incentives and support rather than simply early-stage aid’⁶⁹.

⁶⁸ Reuters, *Insight Israel’s high-tech boom is double edged sword*, 19 January 2015.. Available online here: <http://www.reuters.com/article/israel-tech-ma-idUSL6N0UR1GO20150119>

⁶⁹ Idem

4 Defining the European framework for IT professionalism

The year 2013 marked the 40th anniversary of the very first piece of literature paving the way for IT professionalism. In this foundational book famous book “Social Issues in Computing⁷⁰” published in 1973, Calvin Carl Gotlieb and Allan Borodin tackled, among others, the topic of “professionalization and responsibility, ” whereby they addressed notions such as education, professional development, ethics, etc. Their work paved the way for a European framework for IT professionalism.

Since the publishing of this book significant development has been made in the IT sector regarding professionalism, in- and outside of Europe. Many stakeholders and governments have invested time and means to further mature the IT profession at both national and international level.

This chapter sets out the current state-of-play of the IT profession in Europe, following the four proposed building blocks of the European framework for IT professionalism – as constructed by the Innovation Value Institute (IVI) and the Council of European Professional Informatics Societies (CEPIS) in 2012: competences, knowledge, education and training and certification, and ethics.

4.1 The four building blocks of the European framework for IT professionalism

In Europe, there is no coherent perception of the “IT Profession” or common understanding of the possible career opportunities it offers. Thus, it is important to clarify the concept of IT professionalism.

A first definition of IT professionals was developed by the Innovation Value Institute (IVI) and the Council of European Professional Informatics Societies (CEPIS) in 2012 and widely accepted by the CEPIS Task Force on IT Professionalism, and CEPIS Council members.⁷¹ As recalled in the CEPIS final report on e-skills and IT professionalism (CEPIS, 2012; EC, 2015), IT professionals:

- Possess a comprehensive and up-to-date understanding of a relevant body of knowledge⁷²
- Demonstrate ongoing commitment to professional development⁷³ via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education
- Adhere to an agreed code of ethics/conduct⁷⁴ and/or applicable regulatory practices and
- Through competent practice⁷⁵ deliver value for stakeholders.

In an era of rapid digital transformation where the IT literacy is embedded in society and has extensively penetrated the labour market, the development of a comprehensive framework at EU level is key to spread more consciousness of the IT professionalism.

⁷⁰ Calvin Carl Gotlieb and Allan Borodin, *Social Issues in Computing*, Academic Press, 1973 - 284 pages

⁷¹ CEPIS Council is the governing body of the Council of European Professional Informatics Societies (CEPIS).

⁷² The term relevant body of knowledge refers to a broad and up-to-date knowledge base encompassing both a foundational IT body of knowledge and specialist knowledge and skills.

⁷³ Professional development implies the improvement of competences and both technical and non-technical skills towards better individual performance and career progression.

⁷⁴ Professionals are kept accountable to themselves, the IT Profession and society, through agreed code of ethics/conduct or regulatory practices.

⁷⁵ Competent practice refers to products and services’ quality delivered by professionals.

The fundamental elements of the definition of IT professionals introduced above, are reflected in the key components of the framework explained in the CEPIS report and recalled in this study.

The whole architecture of the **IT framework** pivots on its fundamental elements, also called *building blocks* common to most of the professions: Bodies of Knowledge; Education and Training; Competences and Ethics.

As an overarching theoretical structure, the European framework is intended to both systematise and synthesise the corpus of concepts developed and the lessons learned from the experiences in the IT domain without imposing a one-stop-shop solution but rather, providing a basis for future developments in the field.

In essence, this framework is not developed to crystallise the IT profession into static blocks but rather, to evolve dynamically with the surrounding tech eco-system reacting to a wide range of internal and external stimulus.

During the last decades, concrete steps have been made in each of the four building blocks both at EU and national level. As part of our research, the framework builds on the legacy from past policy strategies and initiatives and it paves the way to a new approach for people willing to start an IT career.

As part of our research, an overview of the four building blocks is provided below. For each building block, the report describes its origin and the progress made so far, the current state of play as well as the value for its users and the steps needed to advance.

Figure 18: The four building blocks of the European framework for IT professionalism



4.1.1 Competences: the e-CF

According to an agreed definition within the IT community, a “competence is a demonstrated ability to apply knowledge, skills and attitudes to achieving observable results”.⁷⁶ This building block of the European

⁷⁶ User guide for the application of the European e-Competence Framework 3.0. CWA 16234:2014 Part 2.

framework for IT professionalism is composed by the e-CF. The following paragraphs will introduce this standard on e-competences that is gaining ground in both Europe and other parts of the world.

History

A debate on the type of competences and digital skills needed by the IT workforce to adapt to a fast changing tech environment and to meet the highest-level international standards, has aroused in recent years. Many lists of IT competences have been dressed by individual European firms and different national-based frameworks have been adopted by Member States. The risk for IT professionals' cross-border mobility and recognition of qualification was high. From this perspective, the adoption of a unique EU framework on IT competences (e-CF) represented a cost-saving solution to meet the requirements of the IT labour market.

The first version of the e-CF (CEN e-CF 1.0) was issued in 2008 under the guidance of the CEN Workshop on IT Skills involving approximately 100 entities in the project. It was stated that the “The e-CF is a component of the European union’s strategy for e-Skills in the 21st Century supported by the European Commission and The Council of Ministers”.⁷⁷ Published as a “Workshop Agreement”, the document gathered the consensus of the members of the CEN Workshop on IT Skills. Based on the inputs provided from a wide range of stakeholders and experts from different countries, the first version of the e-CF comprised 36 IT competences and five proficiency levels. It uses a common language to describe the competences of IT professionals that are important to the business sector and other relevant organisations as well as informing the policy-makers about the needs and priorities for e-skills related strategies and initiatives both at regional and national level.

The second version of the e-CF was released in 2010 and in parallel other CEN projects, dealing with its application to IT professional profiles, certification offerings and the specific realm of SMEs, were run. In detail, a set of typical 23 European IT Professional Profiles has been developed by the CEN Workshop on IT Skills to complement the e-CF and to provide a starting point for future profiles.⁷⁸

An updated version of the e-competence framework (e-CF 3.0) was issued in 2014 after an 8 year multi-stakeholder dialogue within the e e-CF user community⁷⁹ and as a result of the CEN IT skills Workshop Project “e-CF support and maintenance – towards e-CF version 3.0” (from May 2012 to December 2013). The e-CF 3.0 reviews the principles and contents of the previous versions building the results on a structured feedback mechanism (December 2013 by CEN Workshop Agreement).

Similarly to the previous versions, it provides a common language to use for competences, skills and proficiency levels across Europe.⁸⁰ The e-CF represents a sector-specific application of the European Qualifications Framework (EQF) which made existing qualifications more readable and comparable across the EU by linking together different national qualifications systems and frameworks in a common European reference thus serving the twofold objective of promoting citizens’ mobility and supporting lifelong learning.⁸¹

77 A common European Framework for IT Professionals in all industry sectors (2009) www.ecompetences.eu/ Retrieved March 2016)

78 CWA 16458:2012

79 European e-Competence Framework 3.0. A common European Framework for IT Professionals in all industry sectors. CWA 16234:2014

80 Further information is available on the website: <http://www.ecompetences.eu/>

81 European Communities (2008). The European Qualifications Framework for Lifelong Learning (EQF), Brochure.

There is a “rational and consistent relationship” between the EQF learning levels of the e-CF competence levels to allow a coherent interpretation of both of them.⁸²

Strongly endorsed by the European Commission and by European large companies, the development of a **European e-Competence Framework (e-CF)** has represented a response to facilitate the IT professionals’ recruitment and assessment within any IT company or organisation.⁸³ In line with the European Union’s strategy for e-Skills in the 21st century⁸⁴ led by the European Commission and the Council of Ministers, the e-CF has been seen as an instrument to attain the key policy objectives of the Grand Coalition for digital Jobs⁸⁵ targeting a wide user community.

With the introduction of version 3.0 in 2014 the CEN started the process to make the e-CF a European standard and in early 2016 the European e-Competence Framework has been formally published as a European standard⁸⁶. After ten years of growth and development and three released versions, the European framework of IT competences is going to become standard for Europe.⁸⁷

The e-CF has become the basis for the work of CEN TC 428, the new CEN technical committee set up with the contributions of National Standard Bodies from several countries. The aim of the CEN TC 428 is to turn the e-CF into a European Norm (EN). In February 2015, the new standard was approved by the TC and the process of formal approval by the National Standards Bodies of Europe began.

At the time of this report, the work to update the e-CF (to e-CF 4.0) is about to start. This is due to the need to strike a balance between stability of the adopted references for users and the obligation to constantly update the framework to maintain its value. The Commission also launched a project to update the job profiles that are part of the e-CF, which will run into 2018.

Implementing e-CF in Estonia: three take-aways

1. All Estonian professional qualification standards in IT field (developed under and approved by the Estonian Qualifications Authority) have been based on eCF from 2010 already. The qualification standards on EQF level 3, 4 and 5 (Vocational Education (VET) level) are officially the basis for development on national curricula for teaching these specialities in VET schools in Estonia. All IT education on VET level in Estonia by today is all eCF based. This has clearly changed the content of VET education to fit more the needs of the employment market.
2. On EQF levels 6 and 7 (Bachelor’s and Master’s) where all the colleges and universities are not bound to occupational standards and develop their individual curricula, the same procedure – developing competence profiles to better define the outcomes of the curricula, is used together with experts from business.

Also all universities are mapping their existing curricula to eCF.

⁸² CWA 16234:2014

⁸³ Building the e-CF – methodology documentation, e-CF 2.0 CWA Part III, 09/2010 www.ecompetences.eu

⁸⁴ COM(2007) 496 final

⁸⁵ The ‘Grand Coalition for Digital Jobs’ is a multi-stakeholder partnership launched by the European Commission in March 2013 to find solutions to solve the problem of the digital skills gap in Europe and the IT-related vacancies surplus in all industry sectors.

⁸⁶ EN 16234-1 e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all industry sectors - Part 1: Framework).

⁸⁷ For further information please visit: <http://www.digitalsme.eu/the-e-competence-framework-is-coming-of-age/>

This gives a very good basis to foster mutual understanding between employers, IT specialists and academia.

3. I would like to point out one very promising International initiative: Estonian – Finnish – Latvian joint project in developing IT security specialists skills in all three countries. It is called „IT Security in VET – ITSVET project“, which is a EU Central Baltic Programme initiative to develop competencies, curricula and learning resources for VET and Life-long Education. In that programme using eCF gave a kick-start for building mutual understanding what really the needs and needed competencies are between the different countries (<http://itsvet-project.eu>). First again the competence profile was built and agreed on between all the countries. Without eCF this process would have been tremendously more cumbersome and time consuming.

Current state of the play

The e-CF 3.0 clearly defines a competence in a holistic fashion as “a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results”⁸⁸. As recalled in the guiding principles, the e-CF is an *enabler* aimed at empowering users and a *neutral* and *durable* tool which requires an update every three years to keep its relevance as reference. In regard to the content, the e-CF comprises a set of 40 competences which are deemed essential and desirable within the IT workplace for IT Professionals including both professionals and managers. E-competences are structured into four dimensions presenting the organisational perspective as opposed to the individual one and in relation to the European Qualifications Framework (EQF) bridging with the individual competences.⁸⁹

Therefore, an IT professional has to exhibit certain characteristics to be considered “*professionally competent*” including skills specific to the area(s) of specialism and quality standards.⁹⁰ Working in the IT domain with a scant qualification is not sufficient to be regarded as an IT Professional across all the EU Member States. On the contrary, there is a T-shaped portfolio of skills. Expertise in new technologies is required to allow the development of successful and efficient organisations. The definition adopted for the scope of the study clearly expresses the need for the IT professional to gain a core set of competences together with a constant commitment to develop them through work experience and formal/informal training or education. This would be essential to match the demand expressed by the IT labour market recruiters and consequently to deliver value to users.

Value for users

The framework on e-competences represents a cost-saving solution and a key driver of an IT-enabled economy (EC, 2012). A common framework would provide a unique language thus, supporting a more coherent understanding of IT competences across the EU. By providing a unique basis for the dialogue, an alignment between recruiters and applicants is expected to take place. Shifting from the theoretical to the practical dimension, the adoption and application of the e-CF might lead to positive effects for a wide range of users (e.g. public entities, private sector companies, HR departments, education providers, policy makers).

Firstly, the e-CF allows any professional to **objectively assess his competences**, skills and proficiency levels against those required by both private and public sector to successfully perform multiple tasks and assignments. As a consequence, it would increase the **transparency** of the IT career paths and development. Secondly, its application by companies across Europe offers the possibility to **better orientate the internal processes** for development. Thirdly, the e-CF might be used **to inform national policy-makers** on the priorities and needs expressed by the market allowing them to better design their policies and strategies.

⁸⁸ Ibid.

⁸⁹ A detailed description of the e-CF 3.0 is introduced on the website: <http://www.ecompetences.eu/>

⁹⁰ European Commission (2012)

On a large scale, the adoption of the E-CF by both public and private companies and organisations is expected to lead to an **efficient development of IT human resources** towards higher proficiency levels favouring the supply-demand matching in the market and stimulating their mobility across Europe. Finally, the e-CF will **positively affect the competitiveness** and innovativeness of the EU IT Labour market.⁹¹

Literature review and different uses cases have shed light on significant applications of the e-CF suggesting its potential benefit for different users:

- **For IT professionals:** The e-CF, provides self-assessment tool for selecting appropriate training, education and certification programmes. This application will contribute to improve the available online tools for competences development and to better design education and training programmes.
- **For Employers and HR function:** The e-CF serves as a common tool to develop job profiles through a common understanding of the required competences. It can be used to improve job descriptions, to clearly identify the roles of IT professionals and to establish a predictive competence management system as part of the corporate strategy. The e-CF value lies in the possibility to better orientate the e-skills industry thus providing the IT professionals access to more opportunities. To this end, the e-CF has been used as a tool to support decision-making for the alignment between the company's competence development and its business strategy, objectives and purposes. This is valid especially for SMEs activities and business for the effective assessment of capabilities. The e-CF has a significant value for the IT SMEs to prove their core competences, to assess their "know how" and to communicate it to the wider public.
- **For Education and Certification providers:** The e-CF serve as guidelines for competence driven curricula. Education provider can the set of competences, levels and knowledge as described in the e-CF to design, improve or map their programmes in order to match learning outcomes with certification requirements and industry needs. In regard to the IT marketplace, the framework would allow a better alignment of learning modules supply and individual career progression demands. The e-CF allows qualification providers to answer market needs providing evidence of their adherence to European guidelines.
- **For professional Associations:** IT professional associations usually establish entry-level criteria for membership. The assessment of newcomers' skills and competences can be based upon the e-CF in order to ensure mutual recognition of personal competences across Europe and thus, to generate a common sense belonging.

The added value of the e-CF lies in its accessibility and wide applicability. By providing a common vocabulary at EU level, it satisfies the requirements a wide range of organisations and companies. Therefore, it can also be used as benchmark of professional capabilities at international level.

Interestingly, in Italy all IT companies have been asked to map their professionals to e-CF. An initiative steered by the unions, and with support of an AICA self-assessment tool. Since 2013, Capgemini Italy used EUCIP (the European standard before e-CF) in the Back on Track programme in order to evaluate the IT skills. Both employers and Unions appreciated this approach very much. After the launch of the e-CF launch, Italy (UNI) set it as national IT competences standard. Clearly, the e-CF is now closer to the 'market language' than the internal career framework. Capgemini leveraged both views for employability evaluations and through a unique online test (AICA) for assessing both e-CF and Capgemini's career framework, it now uses both 'languages'. In a similar fashion this could be re-used in other countries.

The below is an illustration of the output of the pilot that made people realise the complementarities and the value add.

⁹¹ European Commission (2012) "e-Skills and IT Professionalism, Fostering IT Professionalism in Europe", Final Report

Employee	Capgemini Career Framework role	E-CF profile
Employee A	Service Delivery Lead	SERVICE DESK AGENT
Employee B	Software Engineer Lead	TECHNICAL SPECIALIST
Employee C	Software Engineer Lead	DIGITAL MEDIA SPECIALIST
Employee D	Software Engineer Lead	NETWORK SPECIALIST
Employee E	Senior Service Delivery Manager	SERVICE MANAGER

Future challenges

The general overview of the use cases has served to strengthen the agreement on the e-CF added value among all the potential users. Nevertheless, the practical implementation of the framework into the organisational settings has raised some issues that needs to be discussed further.

A list of the **main challenges** can be provided below.

- **A new concept:** there is a lack of understanding of basic terminology of the e-CF and low awareness and familiarity of e-CF structure, concepts and language; providing awareness of the e-CF is preliminary to the use of the framework of reference for competence management and improvement.
- **Unclear added value:** new incentives should be found to support its adoption and implementation within businesses. At present, job profile descriptions are usually based on qualifications while on the e-CF it is build upon competences. A shift in the current practices is needed.
- **Lack of transparency:** there are no universal indicators to assess the e-competences. On the contrary, evaluations are still subjective and dependant on personal judgment since self-assessment of competences by IT professionals are usually carried out as tick box exercise.
- **Need for a flexible approach:** not all the certification programmes and contents can perfectly match the competences described in the e-CF. Consequently, mapping education and training against the e-CF requires flexibility.
- **Sustainability:** if commercial exploitation drives adoption, it will be important that third parties provide commercially available solutions to enable an easier adoption by organisations. To a certain extend that is already taking place but could be facilitated in order to accelerate. In this it will be important to not only see e-CF as the solution, but the complete IT Professional Framework.

In the view of improving the e-CF implementation in the future, the agreed priority will be the identification of complementarities or overlaps with existing frameworks at national level leveraging on their interoperability. For instance, the e-CF will align with SFIA to complement it and to improve comparability at EU and global level, rather than replacing it. The formal recognition of the e-CF as an EU standard and alignment with national framework will ensure a greater impact of future versions.

ESCO: European Skills, Competences, Qualifications and Occupations

ESCO⁹² is the multilingual classification of European Skills, Competences, Qualifications and Occupations. ESCO is part of the Europe 2020 strategy. The Commission services launched the project in 2010 with an open stakeholder consultation. DG Employment, Social Affairs and Inclusion – supported by the European Centre for the Development of Vocational Training CEDEFOP – coordinates the development of ESCO. Stakeholders are closely involved in the development and dissemination of ESCO.

The ESCO classification identifies and categorises skills, competences, qualifications and occupations relevant for the EU labour market and education and training. It systematically shows the relationships between the different concepts. ESCO has been developed in an open IT format, is available for use free of charge by everyone and can be accessed via the ESCO portal.

The first version of ESCO was published on 23 October 2013. This release marks the beginning of the pilot and testing phase, including the ESCO mapping pilot. Until end of 2016 the classification will be completely revised.

ESCO includes occupations rather than job profiles (as is done in the e-CF) and for each occupation skills and competences are provided. It also links to qualifications in EQF.

4.1.2 Knowledge: Foundational IT Body of Knowledge

Having deep knowledge gets the job done, but having broad knowledge helps us understand what the job is in the first place⁹³.

Differently from skills (*know-how*) and their application (*competences*), knowledge constitutes the *know what* of the IT profession.⁹⁴ A multitude of Bodies of Knowledge exists in the IT field across the world. The global landscape is characterised by many Bodies of Knowledge developed by professional associations with the aim to define the core knowledge of IT professionals. Each one of them differs in its key features: the scope, the approach, the purpose, the model, the target and the origins. Thus, the landscape is very fragmented and there are many overlaps and gaps: some countries have a national IT Body of Knowledge adapted to their national context; others have carried out a standardization of the knowledge and skills in isolated fields of IT.⁹⁵ The main challenge addressed by this building block is the lack of a global or European Body of Knowledge encompassing and addressing all the aspects of IT. Furthermore, the lack of an authoritative source within the EU that defines and organises the core knowledge of the IT discipline, is a major issue. The analysis of several key Bodies of Knowledge existing in the global landscape (e.g. those developed by the IEE⁹⁶, ACS⁹⁷, IPA⁹⁸ and ACM⁹⁹), has inspired the development of the EU Foundational IT Body of Knowledge.¹⁰⁰

History

First version of the *European Foundational IT Body of Knowledge* (fBOK) was released in February 2015¹⁰¹. The approach taken to develop the foundational IT Body of Knowledge was outcome-based since the IT profession was observed from what the IT professional was expected to know in the practice depending on the IT domain,

⁹² Information collected from https://ec.europa.eu/esco/portal/escopedia/European_Skills%252C_Competerences%252C_Qualifications_and_Occupations_%2528ESCO%2529

⁹³ Gavin Payne <https://blogs.technet.microsoft.com/uktechnet/2015/05/28/thinking-wider-as-well-as-deeper-maturing-an-it-professionals-knowledge/>

⁹⁴ Ibid.

⁹⁵ European Commission (2014). E-skills for IT Professionalism. Brochure.

⁹⁶ Institute of Electrical and Electronics Engineers (IEEE).

⁹⁷ Australian Computer Society (ACS).

⁹⁸ Information technology Promotion Agency (IPA).

⁹⁹ Association of Computing Machinery (ACM).

¹⁰⁰ Ibid.

¹⁰¹ European Commission (2015): "The European Foundational IT Body of Knowledge", Version 1.0 Final Report

the sector, the size of the business and the national specificities. The attention paid to the outcomes allowed to identify a set of knowledge areas useful for individuals, academy and industry. Such knowledge areas would have been used in the design of curricula and educational programmes.

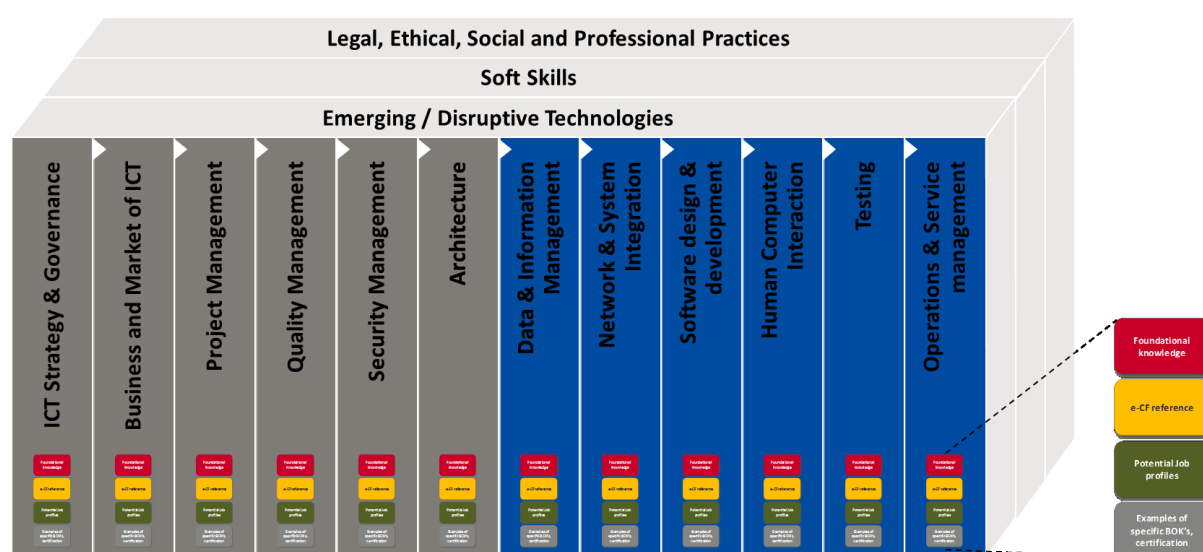
The European *Foundational IT Body of Knowledge* is intended to capture the general core knowledge areas. It has been defined “the base-level knowledge required of all IT professionals and acts as the first point of reference for anyone interested in working in IT” (CEPIS, 2012). From this perspective, the *foundational BOK* refers to the core IT knowledge shared by all the different IT sub-domains and which any IT professional should master even before approaching a career in the sector. To be an efficient IT professional, the user will need to know a relevant part of the BOK especially at the entry-level of his career. Clearly, in practice the IT professional will not need to know the whole BOK but just those areas that are relevant for the selected industry. An appropriate BOK encompasses the documented and agreed set of concepts which often inform course syllabi and serve as a basis for proficiency standards against which industry certifications and higher education qualifications can be issued.

Current state of the play

The Foundational IT Body of Knowledge is the accepted ontology in the field and an essential building block for the promotion of IT professionalism in the EU Digital Single Market. Built on a comprehensive repository of concepts, terms and definitions, the foundational BOK aims to constitute a **‘go-to’ reference** for IT in Europe and the fundamental basis to set standards and certifications.

As per the structure, the Foundational IT BOK encompasses a spectrum of IT foundational knowledge areas ranging from strategy to technology. This spectrum is further detailed into sub-domains and specific knowledge areas developed through a definition, the foundational knowledge required, a list of competences, job profiles, references to the e-CF and examples of specific BOK, certifications and training possibilities. These can be obtained through formal or higher education. The spectrum indicates that there is no definite hierarchical order in the presented areas.

Figure 19: Structure of the European Foundational IT Body of Knowledge



Furthermore, the Foundational IT Body of Knowledge has been represented ideally as an ‘inverted T-model’ where the horizontal axis shows the spectrum of the knowledge areas within the IT domain, while the vertical axis encompasses the specific knowledge and skills an individual has to acquire to specialise in a single

domain.¹⁰² In contrast with the “I” model, the mainstreamed T-Shaped metaphor (Guest, 1991), adds further complexity to the previous model combining the vertical axis of functional/disciplinary skills into a specific IT domain, with horizontal axis referring to the ability of applying knowledge to different situations and to collaborate across different disciplines.

Taking the IT foundational Body of Knowledge into account as starting point, several specific Bodies of knowledge, certifications and advanced training courses have been developed as examples of IT specialisation paths. The foundational BOK finds the common DNA to offer a guide to the breadth of IT knowledge that any professional might acquire.

Including legal, ethical, social and professional practices but also soft skills, the foundational BOK supports the maturing of the IT Profession towards multi-disciplinarily. In fact, the nature of jobs is changing and thus, it is no more sufficient for an IT professional to have a technical expertise. The IT job market requires “multidisciplinary IT professionals” or *dual thinkers*, indicating those who integrate the technical with soft skills and have a good understanding of business or managerial knowledge. Successful IT professionals will be oriented towards team building, collaboration, negotiation and e-leadership (EC, 2015).

Value for users

The ambition guiding the development of the Foundational IT BOK is not to provide an exhaustive repository of the conceptual universe surrounding the IT Profession but rather, to offer an instrument to guide students and individuals willing to enter the IT profession and to orient them in their future career choices. More generally, the target audience of the Foundational IT BOK includes anyone interested in working in the IT field and in understanding how to approach a career. Similarly, people experiencing career shifts from other professions, can use this reference to improve their awareness of the IT domain.

The value of the foundational IT BOK stems from the possibility to be adopted by many potential users a ‘go-to’ point of reference for their own mission. Few examples of different uses of the BOK for some categories of stakeholders can be listed:

- Education providers: use the BOK as source of inspiration for curricula design and development;
- Professional Associations: promote the BOK to their members as the basis for certifications;
- HR Departments: use the BOK to improve the recruiting and people development processes.

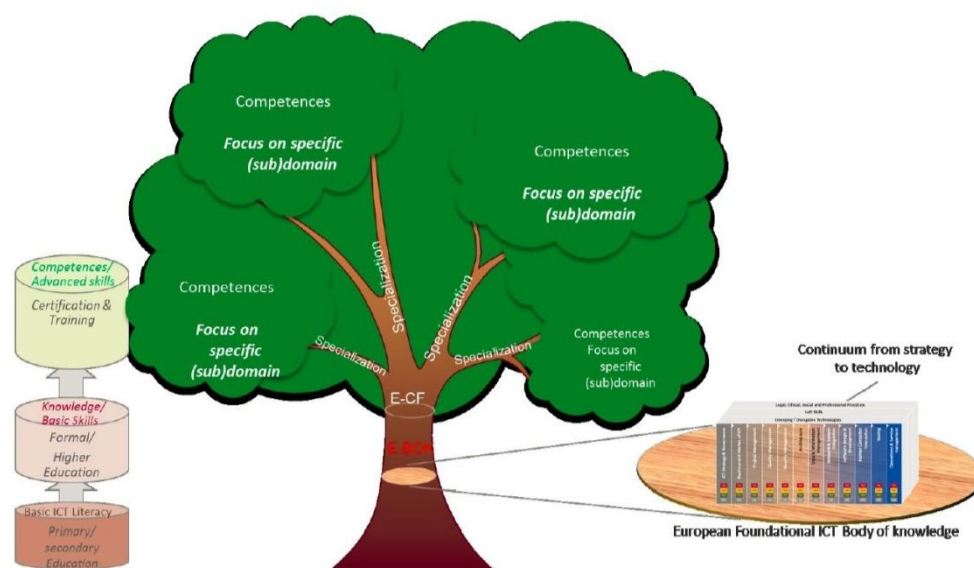
The foundational IT BOK should be considered as part of the European framework for IT professionalism together with the e-CF and the European IT Profile Family Tree. Over the last decade, the rise of IT in all the industry sectors as well as in the society, has determined a rapid increase of stakeholders’ expectations and requirements about IT professionalism.

Due to the complexity of the field, the tree has been used as a metaphor to visualise the framework and to highlight the relationship with computer literacy, education, the e-CF and specialisation in the form of certification and training. The foundational knowledge addressed by the BOK is the level beyond IT literacy but coming before specialisation in any IT sub-domain. In the metaphor: the roots refer to the basic IT literacy - the knowledge and the ability to use computers and technology efficiently - tested by the European Computer Driving Licence (ECDL); the middle part of the trunk is the core knowledge of the IT profession including business and technical components; the upper part captures the specialised knowledge (or BOKs) gained

¹⁰² Further details on the structure of the Foundational IT Body of Knowledge could be found in the report prepared for the European Commission, *The European Foundational IT Body of Knowledge*, Version 1.0 (No 290/PP/ENT/CIP/13/C/N01C011). Available online here: http://ictprofessionalism.eu/wp-content/uploads/EU-Foundational-IT-Body-of-Knowledge_Brochure_final.pdf

through advanced master's programmes or management schools; the branches of the tree represent in-depth specialisation into niches domains.

Figure 20: Visualisation of the Foundational IT BOK in the context of lifelong learning



The tree metaphor suggests that the EU foundational BOK should be considered in the wider context of the IT Professionalism together with the e-CF and other integrated components to deliver more value to its users. Being an essential part of the overall framework for IT Professionalism, the IT Body of knowledge will contribute together with the e-CF to the maturing the profession and to the improvement of its perception into the wider public. Furthermore, the detection of a common DNA will boost the EU competitiveness in the near future. An in-depth analysis of the direct links and synergies existing among the different building blocks of the Framework will be provided later on in the report.¹⁰³

Future challenges

The use of the Foundational IT BOK to inform the syllabi and national curricula, is supposed to provide a sound basis which in turn, eases the communication and mutual understanding between all the potential users across Europe. This would be possible only if the foundational IT BOK is adopted in practice.

Based on inputs gathered from selected stakeholders thorough interviews and during the project's workshops, the EU Foundational IT Body of Knowledge v.01 is still relatively unknown and initiatives to further develop and communicate this model to the public is required to support its **practical use** among the IT professionals.

To achieve this, it will be necessary to establish an open collaborative network involving all the relevant stakeholders, including "champions" for the promotion. These could be professional associations representing the interests of IT professionals, but also other actors having a pivotal role in decision-making processes. Direct value add may come from the cooperation with international partners since many initiatives on the development of BOKs have been already launched across the globe (for instance in Japan, Canada, the US and Australia).

As regard the specific BOKs, there is a wide range of specific IT BOKs, setting standards and qualifications recognised at international level and which have been regulated in some countries via national legislation. To a

¹⁰³ See Paragraph 4.2

wider extent, some Member States have adopted national provisions regulating the use of each particular IT Body of Knowledge. These topic-specific BOKs will be the references for the European Foundation Body of Knowledge to gain insights on certain specific IT fields. It should be mentioned that many of these BOKs address IT professionals who have already entered the IT domain or are working in the field but want to specialise more. In fact, many State agencies and employers stipulate that possession of one or more Bodies of Knowledge is suitable to increase IT professionals' employability. From this perspective, the main challenge is to **align** the existing specific IT BOKs to the foundational one developed at EU level so as to contribute to its maturing in the future.

However, the EU IT foundational BOK has been built as a permissive and not an exhaustive model to adapt to the diversity of the IT domain. Given its flexibility, it constitutes a sound and robust point of reference able to adjust to future technological changes and knowledge developments in the IT profession. Therefore, its value in guiding and growing new generations of IT professionals is expected to be maintained in time.

4.1.3 Education and certification (quality labels)

In the context of a knowledge-based economy aiming to compete globally across various sectors, education represents a key factor to attain a stable and sustainable growth in Europe.

History

Europe 2020 strategy¹⁰⁴ set an ambitious schedule to build a smart, sustainable and inclusive growth. According to the 2013 Annual Growth Survey (AGS)¹⁰⁵, there was an urgent need to "tap the job potential of expanding sectors" such as, among the others, the IT through "future-oriented and reliable legal framework, the development of adequate skills and targeted public support".¹⁰⁶ An OECD survey over 17 EU member states, revealed that in 2013 there was a significant percentage of adults having not the basic IT skills (around 5%) and even more lacking any prior computer experience (9.3%).¹⁰⁷ Furthermore, it also revealed the existence of **short gaps** in the IT due to a misalignment between the stock of skills and the skills required in the labour market.¹⁰⁸ The promotion of e-skills frameworks via certifications, the establishment of multi-stakeholder partnerships (e.g. the Grand Coalition for Digital Jobs), and the investment in IT skills also through the strategic use of European structural funds¹⁰⁹ became key actions to tackle the digital skills gap and to solve the problem of thousands of unfilled IT-related vacancies across all the industry sectors.

As underlined by CEPIS, industry demanded IT professionals "the right skills in the right place at the right time".¹¹⁰ Since formal education was not able to meet that demand, new approaches had to be developed to address those mismatches, skills gaps and shortages and to support different educational paths.

Current state of play

Education is considered one of the cornerstones of, and key enablers for, the adoption of the EU framework on IT professionalism. The report emphasises the need to give equal recognition and importance to non-formal

104 European Commission (2012). Europe 2020. Retrieved from http://ec.europa.eu/europe2020/index_en.htm.

105 COM(2012) 750 final

106 The Commission spelled out ways to tap this potential in its Communication "Towards a job-rich recovery" (COM(2012)173) of 18 April 2012.

107 OECD Skills Outlook 2013, Survey of Adult skills

108 OECD Skills Outlook 2013, Survey of Adult skills

109 Communication: "Towards a Job rich recovery." COM(2012) 173 final, Strasbourg, April 2012.

110 Further information is available on the CEPIS website (<http://www.cepis.org/>).

and informal learning and to formal qualifications and certifications. Certifications, qualifications, non-formal learning and informal learning are mutually supportive components for the development of an IT professional's career since they attest to an individual's competences and skills. This is particularly important for the maturing of the IT profession. However, while formal education paths are well established, with recognised accreditation and validation methods, atypical educational paths still need public recognition.

Several initiatives have been carried out throughout EU, to recognise and validate IT professional career development based on formal education and training, certification by industry, non-formal and informal learning. These include:

- The European Qualifications Framework (EQF)
- The European Credit System for Vocational Education and Training (ECVET)
- Europass
- European Quality Assurance in Vocational Education and Training (EQAVET)
- Validation of non-formal and formal learning

Two important initiatives are highlighted in below: the Euro-Inf Quality Label by EQANIE, and the Quality Labels for Industry-based certification.

The Euro-Inf Quality Label (EQANIE)¹¹¹

The European Quality Assurance Network for Informatics Education (EQANIE) is a non-profit association seeking to enhance evaluation and quality assurance of informatics study programmes and education in Europe. It was founded on January 9th, 2009 in Düsseldorf, Germany. It has around a dozen institutional members from countries across Europe including CEPIS and several professional bodies (among them the Europe's two largest: German and the UK). Each institution nominates a representative to the General Assembly, the governing body of EQANIE. The General Assembly appoints members of an Executive Board, responsible for the management of EQANIE activities. The Executive Board appoints a Secretary General who supports these activities.

EQANIE develops criteria and procedures for the evaluation and quality assurance in informatics study programmes and education¹¹². Furthermore, it develops and maintains a system for the award of a European quality-label (Euro-Inf) for informatics degree programmes as well as its protection and continued further development. EQANIE provides information about events, activities and publications relevant to quality assurance in informatics education and lists study programmes that have been awarded the Euro-Inf quality label. It maintains contacts and relationships with other European and non-European organisations with similar goals. EQANIE also promotes the development of national and regional accreditation bodies and organises events, seminars, workshops and conferences in its field of activities.

The main objectives of EQANIE in the area of accreditation and quality assessment are:

- Improving the quality of educational programmes in informatics;
- Providing an appropriate "European label" for accredited educational programmes in informatics;
- Facilitating mutual transnational recognition of programmes by validation and certification;

¹¹¹ More information available online: <http://www.eqanie.eu/>

¹¹² For the latest standard, please see: <http://www.eqanie.eu/media/Euro-Inf%20Framework%20Standards%20and%20Accreditation%20Criteria%20V2015-10-12.pdf>

- Facilitating recognition by the competent authorities, in accord with the EU directives and other agreements;
- Increasing mobility of graduates as recommended by the Lisbon Strategy

Consistent with the framework of the Bologna process, accreditation distinguishes between first and second cycle study programmes; it covers informatics degree programmes offered by all types of Higher Education Institutions (HEI).

The **Euro-Inf Quality Label** is awarded to degree programmes at Bachelor's and Master's level that comply with the Euro-Inf Framework Standards and Accreditation Criteria.

The objectives of the Euro-Inf Quality Label are

- To enhance quality and transparency of educational programmes in informatics;
- To provide information on study programmes across Europe through an appropriate label for accredited educational programmes in informatics;
- To facilitate mutual transnational recognition of qualifications
- To increase the mobility of students

The quality of informatics degree programmes, according to EQANIE e.V., derives from a functioning qualification process, the interaction of its elements and the level of achievement of objectives – i.e. the attainment of the intended learning outcomes by the graduates of a programme.

Accreditation with EQANIE aims to review the logics and efficacy of a qualification process within a degree programme in the field of informatics. Central to the overall assessment is the effective attainment of the educational objectives set by the institution applying for the Euro-Inf Quality Label.

More than 250 labels have been awarded in 13 countries and HEIs are now aware about this label. Connecting results (e-CF, accreditation initiatives...) with Euro-Inf could help to land the project amongst universities.

What are the benefits of Euro-Inf?

The Euro-Inf system is internationally recognised and facilitates both academic and professional mobility.

Benefits for Higher Education Institutions:

- Additional certificate of quality
- Means of promotion: programme meets academic and professional standards
- Benchmarking against other programmes
- Reliable information on quality of Bachelor programme for admission to Master programmes
- Incentive for students to choose programme

Benefits for Students:

- Assurance that programme meets high international standards
- Easier access to Euro-Inf Master programmes
- Additional quality label recognised by employers Europe-wide
- International recognition of degree meeting professional standards

Benefits for Employers:

- Applicants knowledge and competences meet international standards
- Reliable information about quality of degree programme without knowing its details
- Not only academic standards checked but also relevance for the profession

Quality labels for industry-based certification

Certifications have become essential for IT professionals in all IT-related positions to prove their set of skills, competences and knowledge. Nevertheless, the extreme variety of the landscape of certifications requires the adoption of common references for better orienting IT professionals and recruiters. Quality labels can provide this insight. Based on the e-competence framework e-CF and a set of quality indicators (developed in the e-Skills Quality Label project, funded by the EC¹¹³) two kinds of Quality Labels – one for the programme or for the delivery of the programme-can be assigned to e-competence related training and certification programmes. In detail, programmes are mapped against the e-CF and included in the list of e-competence certificates.

Thus, the principle followed in developing the quality label is *a dual-channel structure* indicating that two key elements should be monitored and assessed as satisfactory, to give formal recognition:

- An education institution and its associated delivery process: European e-skills Education Institution Quality Award;
- An education programme and its content: European e-skills Education Programme Quality Award

Furthermore, a set of e-skills quality label criteria has also been proposed. This set includes mapping against the European e-Competence Framework as a major criterion for the quality label.¹¹⁴ The mapping of industry-based e-skills certifications against the European e-Competence Framework (e-CF) will make the label clearer for IT-professionals, consultants with specific e-skills, training providers, certification bodies, employment and recruitment agencies and the staffing industry.

Thus, a clear need for the full development of e-skills quality label and tools has emerged in Europe.

Value for users

There is a general consensus on the relevance of certifications to assess the set of competences/skills acquired by the IT professional. Academic institutions and their educators, students and staff benefit from digital curriculum and certifications for fundamental technology skills.

Common European instruments and principles are necessary in order to contribute to recognition and consistency of employment, education and training throughout Europe. Such provisions enable also the enhancement of mobility and transparency across Europe, inducing the development of multidisciplinary skills required in the analysed professional and learning pathways.

In regard to E-Competence Quality Labels, introduced above, they have a clear value for learners, employers, employment agencies, training providers since they allow to identify the skills needed in the market, make them available to recruiters and ensure the demand-supply matching. From this perspective, quality labels are expected to bring transparency to the IBTC market, and to ensure a higher quality of teaching and delivery.

¹¹³ Further information is available at <http://www.eskills-quality.eu/home/>

¹¹⁴ Empirica (2013). "Towards European e-Skills Quality Labels for IT Industry Training and Certifications". Study on behalf of the European Commission.

Future challenges

The IT market is still affected by **skills shortages** consisting higher demand than supply and consequently, more effort in education and skills policies is needed to make European workers more IT literate and competent.¹¹⁵

In this regard, it is important to mention recent research from ThinkYoung¹¹⁶ that observes that countries with low youth unemployment are those where VET and apprenticeships are more developed. This could be an important trigger for countries to take into account when developing (effective) education policies.

Despite the development of a unique framework on e-competences at EU level, there is still a wide universe of IT certificates which can be used by the IT professionals. The **lack of transparency** in IT certification world – defined also as a jungle – is still the hardest challenge to face in the future. Thus, more effort is needed.

The wide adoption of e-Competence Quality Labels could help solve this issue. Furthermore, the e-skills Landscape Service¹¹⁷ constitutes a prototype tool based on the European e-Competence Framework and on the CEN IT Profiles and the mapping of IT industry certificates, which can help to distinguish different types of training and certifications by reference to quality labels.

Trends in education: Innovative teaching methods

The changing face of the university lecture is a hot topic that has been discussed by students and lecturers alike for many years. With the rapid rise of the digital age and of innovation in teaching, where students are using smartphones, tablets and laptops as learning tools and there is a phenomenal wealth of information available online, is there still a place for the traditional lecture¹¹⁸? For students, it is not just what we teach, but the way we teach it. Millennials are constantly growing in ‘digital’ and the way they think and act must be aligned with the way they are taught.

In the words of the European Schoolnet,¹¹⁹ *“A trend is a shift or tendency within a system, for example schools, that is likely to grow in importance and influence how the system operates. Examples include economic developments, changes in society or in employment, or in attitudes and behaviour. Some trends are opportunities, others disruptive, a challenge or threat; some turn out to be a short-lived novelty (an innovation can develop into a trend, or die out), others slow-burning, even barely noticeable but seismic and enduring over the long term.”* Many trends are of course outside the control of schools, but others can be taken into account in school development planning and designing effective teaching and learning. A trend may emerge in one country but not another, another may be global. The European Schoolnet’s ‘Future Classroom Initiative’¹²⁰ explains very well what is happening from the different viewpoints of teachers, students and technology, and also includes various good practices such as the ‘Technology compass for education’¹²¹ (Kennisset, the Netherlands) and ‘Innovating Pedagogy 2014’¹²² (Open University UK).

One interesting and much debated concept is **Problem-based learning (PBL)** which is a student-centred pedagogy in which students learn about a subject through the experience of solving an open-ended

¹¹⁵ COM(2012) 173 final

¹¹⁶ Available online here: <http://www.skillsmismatch.thinkyoung.eu/#!2016/tzhf6>

¹¹⁷ See: www.e-skillslandscape.eu

¹¹⁸ Innovative teaching methods vs the traditional university lecture, BBC Active, available online here: <http://www.bbcactive.com/BBCActiveIdeasandResources/Innovativeteachingmethodsvsthetraditionaluni.aspx>

¹¹⁹ See: <http://www.eun.org/observatory/trends> and

¹²⁰ <http://www.eun.org/observatory/trends/trends-by-teachers-students>

¹²¹ <https://www.kennisset.nl/>

¹²² <http://www.open.ac.uk/blogs/innovating/>

problem¹²³. Students learn both thinking strategies and domain knowledge. The PBL format originated from the medical school of thought, and is now used in other schools of thought too. It was developed at the McMaster University Medical School in Canada in the 1960s and has since spread around the world. The goals of PBL are to help students develop flexible knowledge, effective problem solving skills, self-directed learning, effective collaboration skills and intrinsic motivation. Problem-based learning is a style of active learning.

Most teachers have done projects, but the majority do not use the defined set of methods associated with high-quality PBL¹²⁴. These methods include developing a focused question, using solid, well-crafted performance assessments, allowing for multiple solutions, enlisting community resources, and choosing engaging, meaningful themes for projects. PBL offers the best method we have presently for combining inquiry with accountability, and should be part of every teacher's repertoire.

It's true that some people are just naturally more creative than others. But creativity can be nurtured in everyone and all students can learn to use a process for effective innovation¹²⁵.

There are more trends in education; and this probably deserves a report on its own. For the purpose of this report we want to stress the importance of keeping teaching in line with expectations of students, and aligned with technology innovations as well as needs for technology skills.

Figure 21: Badge EcoSystem¹²⁶ and cartoon developed during 1st workshop on IT Professionalism

'Badging' – an emerging trend in education

Digital badging is one new practice worth examining for its potential benefits for teaching, learning assessment practices in both formal and informal learning settings¹²⁷. Digital badges have emerged as a way to document ongoing community engagement, professional development, and accomplishments. Badges recognise incremental learning in highly visible ways. They can support and enhance a career portfolio and may help illuminate a learning path¹²⁸. Those individuals who meet established criteria have an opportunity to earn digital badges in recognition of their engagement with the association. When you earn, display, and share badges, you help draw attention to your community involvement and professional development experiences. It is also a great way to attract young people.

¹²³ Hmelo-Silver, Cindy E. (2004). "Problem-Based Learning: What and How Do Students Learn?". Educational Psychology Review 16 (3): 235–266

¹²⁴ Markham, Thom, 10 Ways to teach innovation, April 2013, available online here: <http://ww2.kqed.org/mindshift/2013/04/01/10-ways-to-teach-innovation/>

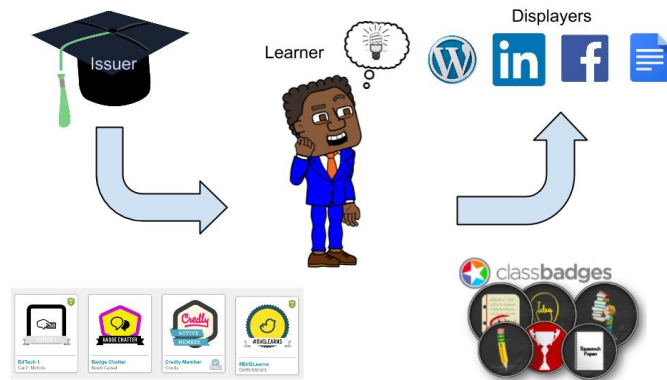
¹²⁵ Larmer, John, How Can We Teach and Assess Creativity and Innovation in PBL?, February 2014, available online here: http://bie.org/blog/how_can_we_teach_and_assess_creativity_and_innovation_in_pbl

¹²⁶ Retrieved from: <https://ict4kids.ca/teaching-and-learning/how-can-digital-badging-aid-learning/>

¹²⁷ From: <http://ict4kids.ca/teaching-and-learning/how-can-digital-badging-aid-learning/>

¹²⁸ From: <http://www.educause.edu/badging>

Badge EcoSystem



Potential benefits of digital badges are that they consist of a way to showcase the skills of learners beyond traditional structures like formal education offers. When lifelong learning becomes an essential ingredient of success and productive citizens, badging could offer a transparent way of measuring and recognising new learning. These badges could be linked directly and posted on websites such as LinkedIn and others to allow relevant stakeholders to see. A digital portfolio (i.e. blog, wiki, site etc.) can also provide a rich platform for dialogue and asynchronous communication between educators and learners through comments and messaging. In way this resembles the Irish CPD practice (see paragraph 3.3.4), that illustrates a unique pathway of learning.

There are also concerns with this trend, and as with all trends follow the Hype Cycle, substantial experiencing will help to overcome these barriers and might lead to productivity and value-add.

4.1.4 Ethics: towards European Ethical Guidelines

Ethics in the IT Profession regulates the boundaries of relationships with customers, colleagues and society.¹²⁹ The ethical principles can be embodied into different forms ranging from high-level documents specifying principles of individual behaviour to specific initiatives.

There is a formal distinction between Codes of Ethics and Codes of Conduct/Professional Practice (Berleur et al.2004):

- *Codes of Ethics* are static in nature since they comprise high level statements or guidelines on general and accepted principles governing the individual ethical conduct (e.g. honesty, integrity).
- *Codes of Practice/conducts* encompass specific and detailed statements dealing with “good practice” or the practical and technical execution of the individual work within an operational environment. Such codes relate to specific domains such as security, software engineering and are subject to evolving technological environments leading to sudden changes.

According to the distinction made by IFIP and CEPIS, the “*Code of Ethics*” generally mirrors the computer society’s vision and objectives in terms of its public mission and guidelines addressing the profession in

¹²⁹ CEPIS Professionalism Taskforce (2010), Characteristics and Benefits of Professionalism in IT, Version 0.1

general. Differently, the “*Code of Conduct*” focuses on the profession or professional practice also imposing enforcement rules which are binding on all the professionals and whose violation potentially leads to sanctioning processes. As underlined by the Institute of Engineering and Technology (IET) any profession is characterised by adherence to a shared Code of Ethics/Conduct that allows to pursue different purposes including self-regulation, responsibility and accountability or improved reputation of the IT profession (Berleur et al, 2004; Udas et al, 1996). Whilst the conduct codes focus on behaviour and aspirational values, the practice ones deal with processes and products which evolve rapidly.

History

An overview of past experiences is useful to both advocate the relevance of this component into the IT framework and to identify the state of the art for future intervention. Already at the very beginning of the 2000s, the development of an IT charter was conceived as a way to ensure reciprocity of conducts and to benefit the community rather than the few following the mainstream idea of “people coming first” (The real world of technology 1999).

The Council of European Professional Informatics Societies (CEPIS) Taskforce has been working on this building block to support the adoption of a cohesive approach and initiatives suggesting concrete actions to develop the framework for IT professionalism. As part of its lobbying activities on the UN and EU institutions, the CEPIS has advocated the inclusion of accountability and transparency requirements into the ethical codes as a key aspect. In regard to the content, codes adopt a holistic approach comprising high-level statements that aim to inspire the individual conduct, demand the use of good practices and expect a professional attitude.¹³⁰ The main goal of CEPIS activity is to provide practical tools not only to raise users’ awareness of the ethical issues in the IT field, but also to strengthen the experts’ capability in ensuring compliance with ethical norms.¹³¹ As an achievement of its lobbying role on the institutions, CEPIS has also found that the level of enforcement of these principles depends on the existing infringement measures.¹³²

Beyond Europe, other initiatives illustrate similar perspectives. Two cases can be illustrated:

- In Australia, the 2012 Government IT Young Professional of the Year Award, Christopher Giffard from the Department of Education, Employment and Workplace Relations, underlined in his speech the importance of standards and equal accessibility for all citizens to web content and information services (ACS, 2012)¹³³.
- In India, the Al-Ameen Movement has supported the education of young students to become IT professionals of tomorrow. Targeting the most modest part of society in the region of Bangalore, the education model focused on the integrated development of technical, moral, physical and spiritual issues besides formal education (AISS)¹³⁴

¹³⁰ Simon Rogerson, IT Codes of Ethics, PPT Presentation, CEPIS Ethics Conference 2015.

¹³¹ CEPIS website: www.cepis.org

¹³² EU IT Professionalism Final Report

¹³³ ACS, Australian Government IT Young Professional of the Year Award Winner, available at: <http://www.acs.org.au/news-and-media/news-and-media-releases/2012/2012-australian-government-it-young-professional-of-the-year-award-winner> (accessed February 2016).

¹³⁴ AISS, Al-Ameen Institute of Information Sciences, Principal's Message, available at http://aiis99-edu.org/principal_message.htm (accessed February 2016).

Current state of play

The ethic domain encompasses codes of Conduct covering integrity, confidentiality and competence; initiatives related to the accessibility of IT, the management of the safe use of IT or the promotion of forms of Green IT to minimise energy wastage; specific safeguarding actions against the spread of software piracy.

In the IT sector, professionals' commitment to ethics can be proved by adherence to a code of conduct or to specific thematic-oriented initiatives. Codes of conduct define the way professionals act and think and their role is to establish agreed standards against which individual practices are measured and tested (Software Engineering Code of Ethics & Professional Practice, 2002) Nevertheless, ethical guidelines or norms tend to be dependent on the national geographic context where they are produced and applied. In reality, they are typically linked to traditions and culture as well as to the degree of professional maturity. Therefore, adherence to codes which are not in line with a shared "cultural ethics" is likely to lead to dichotomies (Grodzinsky 2000). Each code belongs to a specific ethical environment where they can be applied, enforced or sanctioned and thus, they are not universally valid nor transferrable to other cultural contexts. As a consequence, a framework on the IT profession should adopt a high-level and high level perspective on ethical issues to maintain the potential to be applied to different codes, laws and guidelines across different geographic contexts.

A good overview of interesting examples are given by CEPIS¹³⁵, but also for instance CIPS in Canada¹³⁶, and also a Code of Conduct from the Dutch CIO Platform¹³⁷ and which covers the relationship between IT using industry and providers.

Value for users

Evidence gathered through *interviews* has showed that there is a general consensus on the existence of a core corpus of principles that should be respected in major professional societies. Ethical principles should inspire and inform any individual daily professional practice to keep the IT professionals accountable for their work.

Nevertheless, there are uncertainties on the type of principles to be included in such codes and on the role of the European Commission in developing them further. Except from a strict nucleus of principles common to all the professions, ethical norms are perceived as natural expression of a specific culture and society. Despite the agreed relevance of such principle for IT professionals, a strong criticism covers their binding nature and the level of enforcement it is possible to ensure in case of breaches.

Future challenges

A variety of codes is not only accepted but also safeguarded by involved stakeholders as not belonging to the domain of competence of the European Commission. IT professionals can belong to different organisations and consequently they could not know how to behave by adhering to one code or another (Oz, 1993).

In order to develop common guidelines for national Codes of Ethics, general core ethical values and on associated requirements for the specific professional conduct need to be listed and structured.

The first category can be applied to any profession society. A non-comprehensive list is presented hereby:

- Honesty
- Integrity

¹³⁵ See: <https://www.cepis.org/index.jsp?p=940&n=2849>

¹³⁶ See: http://www.cips.ca/?q=system/files/CIPS_COE_final_2007.pdf

¹³⁷ See: https://www.cio-platform.nl/l/library/download/urn:uuid:8e17063b-1ae5-40c7-b8b3-d09d03fe913a/ciopublicatie2016+cccegvendorrelations+code+of+conduct+-+eng.pdf?format=save_to_disk

- Transparency
- Confidentiality
- Objectivity
- Respectfulness
- Obedience to the law
- Loyalty

In sum, there are still strong ambiguities both in the identification and in the endorsement of the ethical principles in the IT domain. Nevertheless, like any other profession, there is a clear need for ethical guidelines within the IT profession in order to keep professionals accountable and responsible for their activities.

Past and current initiatives related to this building block have contributed to start the discussion on ethics in the IT field and to stimulate the public debate on codes, but there is still a barrage of **ethical challenges** to address. Participants to recent stakeholders' events on the ethical issues have raised some key points and dilemmas to be discussed further. A sample list of **future ethical challenges** has been included below.

- The theoretical attitude and adherence to codes are not usually part of the general skill set demanded for recruitment.¹³⁸ In fact, IT professionals may work at the same time for many organisations and the alignment with different organisational systems is based on the personal adherence to adopted codes. The lack of strict forms of censure or enforcement poses a threat on the effective application of shared ethical principles. The debate on ethical values for IT professionals has been politicised and reduced to a demand for a tick-box compliance rather an effective adherence (Rogerson 2014).¹³⁹ In sum, compliance is essentially *voluntary*.
- It is impossible to control or to stop different individuals from writing codes nor should they.¹⁴⁰ Plurality of sources is also a consequence of the fact that "the innovation journey is never over" (Floyd 2013).
- Despite the attention paid by education systems to the need to consider IT domain as ethically charged, the silo-mentality in delivering ethic concepts and norms has not favoured the development of a trans disciplinary approach which helps to recognise ethic related risks and challenges in different situational contexts to allow the individual judgment (Rogerson 2014).
- Future will be unknown. The gap between reality and what was predicted is usually huge and any attempt of forecasting leads to the paradox of a wide variety of technology futures which are likely to fail.¹⁴¹ The nature of computer technology, its 'logical malleability', leads to high levels of complexity, unreliability and uncertainty. In Computer Ethics, it is important to consider the moral frameworks and assumptions which influence the way we look at risk, accountability and responsibility.¹⁴² Therefore, it is important to train for *styles of thinking* since they are more likely to guide in future applications.¹⁴³

¹³⁸ EU IT Professionalism Final Report

¹³⁹ Rogerson, S. (2014) Preparing IT professionals of the future, *Mondo Digitale*, 13 (50).

¹⁴⁰ Kai K. Kimppa, Future Ethical Challenges and the Task of the Professional, PPT Presentation, CEPIS Ethics Conference 2015

¹⁴¹ Horner, D. (2007), Digital futures: promising ethics and the ethics of promising. *ACM SIGCAS Computers and Society*, 37, (2), pp.64 -77 [ISSN:0095-2737]

¹⁴² Horner, D. (2010) Moral luck and computer ethics: Gauguin in cyberspace *Ethics and Information Technology*, 12 (4). pp. 299-312.[ISSN 1388-1957]

¹⁴³ Ibid.

- Compliance requirements are effective only if there is the possibility to exclude a company from organisational membership or an individual for not following the accepted codes. To get anyone to implement and respect codes would require that ethical needs are attractive to both the corporations and the individuals (Kimppa 2015).

To address these challenges, it is important not to offer methods to solve specific problems but rather to indicate decisions support systems, sources of information and available codes to orientate behaviours. Practical tools that might be used to face the current challenges and to stimulate ethical behaviour have been proposed together with possible methods of application:

- Education: mandatory ethics and IT education at bachelor level IT professional studies but also through other activities(e.g. seminars on professional ethics, peer learning within companies and between computer society members, professional magazines, scientific journals or books);
- Ethics work groups to share common practices and to guide each other;
- Promotion of Ethics through Code of Conduct and not through ban of unethical behaviour;
- Introduction of ethics certification or accreditation with possibility of losing them.¹⁴⁴

To conclude with, the process to ensure virtuous action comprises many steps going from education & Training to design & governance which influence final conducts.

A non- exhaustive list of possible developments of this building block would include:

- Address in a univocal way the complex and multiple ethical issues related to IT EU professionals in the multi-stakeholder and international context, providing general guidelines to be implemented by national computing associations. The need for a set of guidelines stems from the plethora of possible applications of technology and from the risk to harm the society when recipients' needs are not duly taken into account;
- Fill the gap between ethics taught at university and the ethical issues faced in the workplace. It is uncertain whether IT professionals are prepared to face ethical challenges even if they have been educated to recognise and understand the main issues and types of challenges to be faced.
- Although we do not know the future, we can predict some uses of applications we are designing and thus, it is possible to adopt a preventive rather than reactive approach in the assessment of potential risks;
- Promoting IT social responsibility. Beyond legal compliance and fiscal requirements, the recognition of social responsibility requires a change in the adopted perspective and in moral individual action. For instance, by taking into account not only the stakeholders' interests but also their wellbeing and by ensuring that all the business processes are managed applying a social responsibility perspective. This approach would also mean being accountable for global common values and local cultural differences.¹⁴⁵ This would contribute to establish and maintain a safer and more reliable e-Business environment and information society regardless of organizational, social and cultural structures;
- Professional codes should not be an instrument of compliance but rather, an instrument of appliance in maturing ethical IT profession. This means that ethical values must be embedded in professional practices and thinking (Rogerson 2010)¹⁴⁶.

¹⁴⁴ Ibid.

¹⁴⁵ Rogerson, S., Aspects of Social Responsibility in the Information Society, in: DOUKIDIS, G.I., MYLONOPOULOS, N.A. & N. POULODI, A. (editors), Social and Economic Transformation in the Digital Era, IDEA Group Publishing, Chapter 3, pp 31-46, 2004

¹⁴⁶ Rogerson, S. (2010). A review of information ethics. Journal of Information and Management, Japan Society for Information and Management, Vol. 30, No. 3, pp. 6-18

- Raise the awareness of IT Professionals' responsibilities and obligations towards society. In fact, professionals must be conscious of their role as the custodians of the 'most powerful and flexible technology mankind has invented' (Rogerson 2010).¹⁴⁷

Finally – as key output of this project – CEPIS and stakeholders developed a first version of European Ethical Guidelines and presented these at the project conference on 6 December 2016. Chapter 6 includes the concrete output of this important activity that proves a major contribution to IT professionalism.

4.2 Creating synergies

Technology is changing very rapidly and consequently the society is changing very fast. Therefore, professionals who work with these technologies are required to keep up with ongoing developments. This general rule applies to all areas of expertise with no exception.

In this view, a unique framework at EU level to help professionals in a changing environment will be welcomed. Due to the speed of technological change, the framework should be future-oriented to align with new technologies. The components of this framework must be open to new developments but also stable enough to provide the framework with a sound basis to cope with future developments in the IT field.

In essence, creating synergies among the four building blocks also through a strict and wide cooperation of the wide network is crucial to maximise the potential value of each single component.

4.2.1 The European Framework for IT profession as a dynamic model

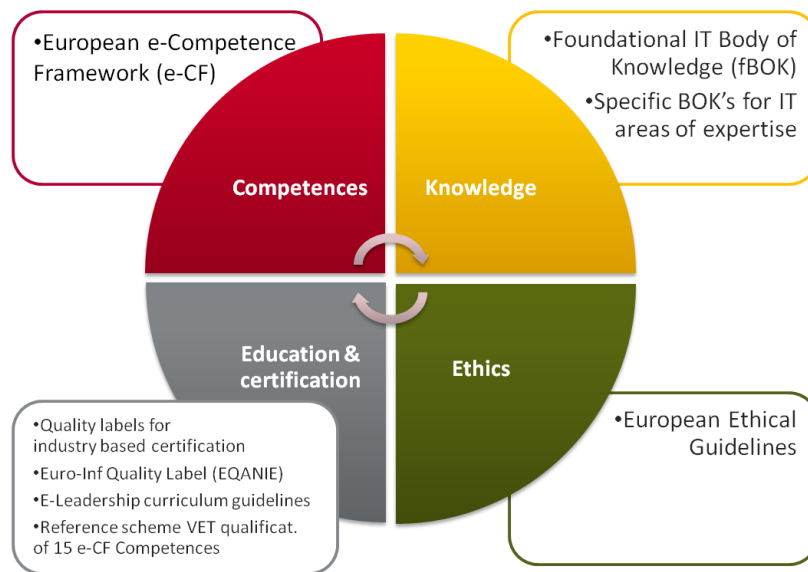
The EU European framework for IT professionalism is a **dynamic model** able to capture the constant evolution of the European Digital Single Market through its four blocks and to offer tailored services.

To attain this ambitious goal, the four building blocks must be open to the external world but also connected through both structural and functional links and relations that create synergies. The four building blocks do not work in isolation but they work together to deliver value to beneficiaries and final users of the framework. In essence, the framework is specifically designed to be more than the sum of its parts.

The figure below depicts the four building blocks and includes the key standards and instruments that are developed over the past years, and that can be applied in the context of IT Professionalism.

¹⁴⁷ Rogerson, S. (2014). Preparing IT professionals of the future, Mondo Digitale, 13 (50)re,

Figure 22: The four building blocks of the European framework for IT professionalism



4.2.2 Structural and functional relations within the Framework

As widely described in the report, the European Framework for IT Professionalism is based on four building blocks essential to mature the IT profession: Body of Knowledge, Competences, Education & Training and Professional Ethics. The main strength of the proposed framework is the combination of stable components with a high degree of flexibility allowing to adapt to rapid IT changes and emerging market requirements.

Looking at the four building blocks, different types of relations can be found:

Structural relationship: this kind of relation refers to existing links between building blocks within the structure of a building block itself. Some examples can be illustrated to better describe the structural relationships:

- *Link between the Foundational IT Body of knowledge, e-CF and Ethics:* Building on the existing frameworks, the EU framework establishes a clear correspondence between the knowledge areas of the Foundational Body of Knowledge and the e-CF. In detail, the European Foundational IT Body of Knowledge consists of different knowledge areas within the IT domain ranging from a strategic to a technological perspective. Each knowledge area provides reference to the e- Competence Framework and thus, to possible job profiles. It is worth noting this function of referencing is one of the key strengths of the model, as it allows any user and the wider public to understand what it comes next. In fact, base-level knowledge is required to start a career in the IT and to get a job. Then the acquirement of a specific knowledge in an IT sub-domain combined with sophisticated skills also including soft and managerial aspects will be necessary to develop competencies for professional and career progression.

In addition, the Foundational IT Body of Knowledge offers an overview of practices designed to ensure the highest level of ethical conduct, standards of practice and integrity in carrying out any IT professional activity.

- *Link between e-CF and Education, Qualification and Certification:* The European Union has developed several instruments to support the transparency and recognition of knowledge, skills and competences to make it easier to study and work anywhere in Europe. A variety of initiatives has been launched with a view to improve the overall transparency and equal recognition of skills and qualifications across Europe. One of the most relevant initiatives is the European Qualifications Framework (EQF), which helps to compare national qualifications systems, frameworks and their levels to make qualifications more readable and

understandable across different countries and systems in Europe. In detail, proficiency levels of each e-Competence are closely related to the EQF levels so that we have a direct correspondence between e-CF levels 1 to 5 and EQF levels 3 to 8.

Functional relationship: this kind of relation refers to the combined use of two or more building blocks for a common purpose/function. A relevant example is presented below.

- *The link between IT Certifications and e-CF:* When obtaining a new job or moving within and across borders, IT students and workers should get their skills and qualifications quickly and easily recognised. This is essential to attain higher skills levels and increase employability. Mapping certifications to competences pose a challenge as there is no widely agreed standard for assessing the requirements nor commonly agreed methods of testing candidates for these certificates. Therefore, the mapping of e-Skills certifications against the European e-Competence Framework is part of the Quality project launched by the European Commission DG Enterprise and Industry. To date, many IT certification vendors such as CompTIA, Microsoft, Cisco, Cert-IT, LPI, and EXIN have already started mapping their certifications against the e-CF proving the interest in finding common solutions in this field. Furthermore, the current mapping is not just an update of the previous positioning exercises, but it affects the IT-related roles in organizations for which the certificates may be relevant. To this end the e-competence ‘profile’ of the certifications has been compared to the European IT-Profiles (Draft CEN Workshop Agreement of the CEN IT Skills Workshop). This enables a new approach in positioning of the e-skills related certifications for students, professionals, organizations and training providers which can be used, for instance, in the self-assessment tool within the e-Skills Online Landscape Tool and Service.

With the ambition of providing a clear guide to enlighten mechanisms between the four building blocks and to support users to orientate in the IT professionalism, the framework will provide concrete solutions leading to strengthen, standardise as well as establishing relations between building blocks.

4.2.3 Examples of synergies the Framework offers

The European framework for IT professionalism has to be intended as a comprehensive guide to orient and support the IT professionals throughout the professional life cycle, from the early school years to career development, thanks to the integrated and joint effort of the four building blocks. Therefore, the components of the framework structure (Body of Knowledge, Competences, Education and Ethics) should not be considered in isolation but as parts of a whole, which interacts with the surrounding technological environment and evolves in time.

The term “synergies” has been used in this study to refer to the virtuous interactions that can be established between building blocks. Similarly, the concept of “synergetic” (Fuller, B. and Applewhite, E. J. 1982) well explains the “system of holistic thinking” with reference to:

- A dynamic state in which combined action is favoured over the difference of individual component actions;
- A behaviour of whole systems unpredicted by the behaviour of their parts taken separately, known as emergent behaviour;
- The cooperative action of two or more *stimuli*, resulting in a different or greater response than that of the individual *stimuli*.

From this perspective, the Framework generates synergies between the four building blocks and builds upon them to provide concrete solutions to the involved stakeholders. The ultimate goal is to guide users and stakeholders into the IT profession by promoting an effective and integrated usage of the framework components. The expected outcome is an increased advantage for users, further development and improvement of the building blocks, higher transparency in access to the four building blocks and related tools.

For the scope of the study, we relied upon relevant practices derived from the desk research and experts' interviews to explore the potential synergies between the building blocks at each step of the professional lifecycle.

A non-exhaustive list of cases is provided below to show the virtuous synergies between the building blocks.

a. How the Foundational BOK interacts with the Education & Training and the e-CF

The foundational Body of Knowledge encompasses the basic knowledge beyond the simple IT literacy and it is oriented towards programming and problem solving. From a synergetic perspective, the base-level knowledge included in the Foundational Body of Knowledge can be used to map and align existing foundational training courses and to design new courses based on a common framework aimed at developing core e-competences and skills.

Being the repository of the core concepts that any IT practitioner should master before approaching a career in the IT domain, the foundational BOK should constitute the basic reference to inform the main contents and structures of the education and training programmes. This would allow the IT practitioner to acquire a set of knowledge and skills at basic proficiency levels to successfully start a career in the IT domain.

Furthermore, close links exist between the foundational BOK and the e-CF since the structure of the body has been developed using different families of IT job profiles for the clustering of the knowledge domains. Moving from the structure to the practice, the adherence to the foundational BOK would create bridges with the e-CF and job profiles providing a clearer view of future career paths. The direct positive impact on the image of the IT profession will improve its perception within the wider public and thus its attractiveness.

This synergy does not only favour the IT professionals at the entry level of their career, but throughout the professional life cycle. In fact, a key feature of the EU framework on IT professionalism is the attention paid to the professional development of the practitioner targeting the existing skills shortages and gaps, which hinder the individual career progress. By adhering to a common foundational BOK, formal learning and certification programmes contribute to decrease the e-skills shortages and gaps experienced in the IT sector, with a consequent positive impact on the career paths and progress. Finally, all the expertise areas within the IT sector share a common base of core competences. By expanding the common competences shared by different IT profiles, a positive impact would also be experienced in the employers' mobility within the IT sector.

Example1. ITIL Foundation training courses and foundational BOK

An example of the link between the foundational is the training course ITIL Foundation where the knowledge items of the Foundational BOK have been used to structure the contents. The ITIL Foundation training courses and related certifications address: Service Lifecycle, Portfolio, Infrastructure, Knowledge Management and Process Management.

FOUNDATIONAL BOK		ITIL Foundation				
KNOWLEDGE AREAS	KNOWLEDGE ITEMS	Service lifecycle	Portfolio	Infrastructure	Knowledge management	Process management
ICT Strategy & Governance	■ The role of ICT within organisations and benefit realisation					
	■ Concept and theory of strategic planning					
	■ International standards for corporate governance of information technology (ISO 38500)					
	■ Foundations of ICT strategy design					
	■ IT decision-making processes					
Business and Market of ICT	■ Distribution and delivery models					
	■ Business Process Management					
Architecture	■ Technical architecture					
Testing	■ Life cycle testing					
Operations and Service Management	■ Basic concepts of service management (including the concept of service and service level agreement)					
	■ Service management processes (including design, transition, delivery and improvement of services)					

As illustrated above, the knowledge areas of the foundational BOK and items are strictly linked to the training contents. New ITIL Foundation training courses, like Security Foundation, Data Scientist Foundation have also been developed based on the Foundational BOK confirming the value of the approach taken¹⁴⁸.

b. How the e-CF interacts with the Education & Training and the Specific BOKs

While the Foundational IT Body of knowledge is the reference point for developing wide basic knowledge at entry level, there is a growing awareness of the advantages of approaching advanced education and training from a competence viewpoint. In these circumstances, the e-CF is a valuable tool, supporting the design of training programmes.

According to a competency-based approach to educational programmes, various forms of education should be aligned with different national and European frameworks, with particular emphasis on alignment with the European e-Competence Framework (e-CF).

In this aspect, education providers can provide visibility into the competences and proficiency levels developed through various education routes. Qualification providers may use the e-CF or the European IT Professional Profiles in different ways: for example they can improve their programmes to match the learning outcomes with the e-CF and to achieve corresponding certification requirements. Universities usually create degree programmes to comply with higher education accreditation rules and frameworks. Lately more and more have matched their programmes to the e-CF, particularly the outcomes, to enhance communication with industry and to meet labour market needs.

¹⁴⁸ Further details on the ITIL Training & Certification can be found on the website: <http://www.newhorizons.com/courses/itil-training.aspx>

Mapping of education courses to the e-CF help improving the transparency, relevance and comparability of courses in terms of developed e-competences and associated proficiency levels, and support more informed course selection decisions. The transparency and consistency of this mapping of courses to the e-CF are essential to its successful adoption.

In addition, given the general agreement on the need of validating non-formal and informal education, e-CF can be used as reference point for developing such processes.

Example2. e-CF and E&T: Develop training and reskilling material

One of the most pressing areas of improvement concerning education and training is promoting training/reskilling programmes: in order to ensure the full development of required competences for professionals who move from one profession to another in the IT field. A typical training course can be based on competences and skills. To design a training course it is useful to use the e-CF as reference point.

See below for an example of training courses based on Product Certifications Architecture of The Open Group

Training course	e-Competence
Archimate	A.5. Architecture Design B.6. System Engineering
Togaf 1	A.1. IS and Business Strategy Alignment A.5. Architecture Design A.7. Technology Trend Monitoring B.6. System Engineering
Togaf 2	A.1. IS and Business Strategy Alignment A.5. Architecture Design A.7. Technology Trend Monitoring B.6. System Engineering (with higher proficiency levels)

Example3. e-CF and E&T: Positioning IT Certifications against e-CF

Since 2004, the CEN initiative and project “IT Certification in Europe” has been working closely with industry stakeholders and IT vendors such as Cisco, Microsoft, LPI, EXIN, etc. as well as with IT Professionals associations as CompTIA, CEPIS, IEEE, etc. and other standardisation endeavours such as Learning Technologies under the umbrella of CEN. The new CEN Workshop Agreement (CWA) IT Certification in Europe proposes a methodology to position certifications against the European e-Competence Framework (e-CF). The aim of the working group is to exchange information about the current state of play as well as future trends and developments on the training and certification market.

In 2014, the Linux Professional Institute (LPI) received the e-Skills Quality Label by EXIN based on the e-CF, for its certification programme. LPI's certification programme has been used by a global affiliate network that has delivered more than 430, 000 certification exams worldwide. Above all, the use of the e-CF for positioning Certification programmes has added value to the LPI's certifications by increasing the international recognition of the certifications which in turns favours the horizontal mobility into the labour market and the attainment of better job positions. This is valid not only at the entry level of the labour market but also for career development and changes within the IT sector. In fact, holding a recognised certification providing an accurate measurement of knowledge is essential to proof the ownership of skills

required to perform a job, the flexibility to adapt to different tasks, the ability to solve troubleshoot problems and a higher reputation.

While the foundational BOK provides the core knowledge in the IT domain, the specific BOKs have a focus on a specific topic (i.e. Security Management, Service Management, Business Analysis, etc.). Following the same approach taken in the previous case, specific BOKs constitute the basis for education curricula and training courses to improve the individual competences and skills.

In a long term perspective, positioning educational curricula against specific body of Knowledge contributes building a bridge to the IT job career by defining a common reference for lifelong learning and for career changes. When coming from a non-IT sector, professionals are concerned with important issues: the unawareness/incomplete understanding about what IT is and what it can bring in terms of career opportunities, the lack of awareness of skills/competences required to different role profiles due to high specialization/segmentation of jobs. At this stage, strong synergies built between the specific Body of Knowledge and the education and qualification/Certification are essential to acquire the competences and sophisticated skills required by in a specific IT domain.

In sum, the European framework for IT professionalism has been envisioned and designed as a dynamic model able to evolve into different states to adapt to the surrounding environment and based upon fluid structural connections and functional interactions between its building blocks.

The next chapter will describe in more detail how the EU Framework, leveraging on synergies between the four building blocks, will provide a positive impact on different stakeholder groups.

5 Target audience and stakeholders

The European Framework for IT Professionalism is an international reference framework that can be adopted and applied by IT professionals, educational providers, employers, government users, social partners and organisations from both the public and private sector across Europe. With this aim in mind, a useful approach to this framework is to distinguish the **target audience** from the **potential users**, who will adopt and use it.

The **target audience** encompasses the individuals for whom the framework has been designed and developed. It primarily consists of IT professionals throughout their career as well as people willing to approach this profession. The **potential users** are all the stakeholders within the IT community who will use the framework as a point of reference to fulfil their mission and to meet their expectations.

The **IT community** as a whole comprises a universe of stakeholders characterised by different needs, interests and expectations within the IT domain and labour market. They are not just potential users of the framework on IT professionalism but co-editors contributing to its development and maintenance through the development of the toolsets and services to support its adoption. In reality, the successful implementation and uptake of the European framework for IT professionalism requires a **coordinated and joint effort** from all the interested parties of the IT ecosystem. Maturing and promoting the IT Professionalism needs time but the establishment of a collaborative network bringing about all relevant stakeholders, would be an enabler of success.

All relevant stakeholders active at a national, regional or local level can be clustered into groups and framed within a 'European dimension' where complementary to their current practices can be found. A solid strategy to promote IT Professionalism in the future will rely upon their fruitful interactions and synergies.

As well described by CEPIS in the final report about the IT profession in Europe¹⁴⁹, multiple stakeholders have to be considered as key users due to their twofold role as players and interested parties.

A list of the main stakeholders representing the framework's audience, together with their main value in relation to the IT profession, is introduced in the table below¹⁵⁰.

Figure 23: Key stakeholders and their principle needs

Stakeholders	Value Statement
IT professionals and managers	<ul style="list-style-type: none">▪ Improved public perception and image of IT professionals▪ International recognition of IT competences and knowledge, enhancing mobility and credibility▪ Improved clarity over IT career paths and competence requirements
Employer	<ul style="list-style-type: none">▪ Reduced cost, effort, and time to recruit, deploy, train and develop suitable IT resources, as well as improved capability to align IT resources with business requirements▪ Competent professional IT workforce, reflecting industry demand▪ Potential to facilitate outsourcing opportunities through consistent, agreed

¹⁴⁹ CEPIS (2012), e-Skills & IT Professionalism: Fostering the IT Profession in Europe, Final Report.

¹⁵⁰ A preliminary list of identified needs can be found in the Technical Proposal for this study, which has been expanded based on interviews performed with selected stakeholders.

	definitions of roles and competences
Education Provider	<ul style="list-style-type: none"> ▪ Increased market size opportunities resulting from improved transparency and comparability of educational offerings ▪ Improved demand for education to support life-long learning requirements ▪ Enhanced alignment with demand from industry
Local/National/European Government Entities	<ul style="list-style-type: none"> ▪ Enhanced visibility of supply and demand of IT 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	<ul style="list-style-type: none"> ▪ Opportunity to mature the IT profession and boost membership ▪ Stronger role in communicating/shaping emerging industry practices ▪ Promote interests of IT workers at organizational, national and international level (e.g. employment prospects, security)
Society	<ul style="list-style-type: none"> ▪ Reduce risks resulting from an increasingly IT enabled society ▪ Improved employment prospects

A wide variety of stakeholders may contribute to the integration of the framework on IT professionalism into organisational strategies and public policies. To achieve that, advantages for each stakeholder group must be evident. In reality, the framework is designed to answer multiple needs and to provide benefits and value to each single stakeholder group taking into account the different perspectives. The point is to understand how and to what extent the framework can support all the targeted stakeholders in addressing the main issues identified in the IT field.

5.1 Target audience: IT professionals as prime beneficiaries

The European framework for IT professionalism is intended as a guide to orient and support IT professionals throughout their professional life cycle, from early school years to career development and progress. It analysed various use cases to determine value-add of the framework: from people preparing to enter the IT Profession, to people that actually started a career in IT, to those further developing their career or some that will change their career – either within IT or from outside this profession. There are evident values for IT professionals that this framework contributes to:

- **International recognition of IT skills, competences and knowledge, which enhances both credibility as well as mobility opportunities of professionals.** The e-CF is a standard for e-competences used across (and even outside of) Europe. The Foundational IT Body of Knowledge has not yet obtained that status. Both however contribute to providing a common, universal ‘language’ when talking about IT professionals. It presents references for certifications and thus allows professionals to ‘proof’ their professionalism. Job matching tools based on this reference framework will also make it easier for professionals to match on vacancies in other countries.
- **Improved clarity over IT education and career paths as well as competence requirements.** The framework offers the opportunity to professionals to shape a path in various stages of a career, either through advancing to a next proficiency level within an area of expertise or by switching to another closely related area of expertise.

- **Improved image and public perception of IT jobs and IT professionals.** Suitable standards of competences and knowledge and behaviour, as defined by professional bodies, will lead to higher levels of professionalism, and consequently to improved perception about the profession in general.
- **Improved understanding of IT for IT-using professionals.** Besides mere digital user skills, the e-competences and knowledge areas also apply in jobs that are not core-IT, but do involve a significant IT element. It can serve as reference to identify sector-specific IT-competences and skills.

And finally, all these values strengthen the pride IT professionals take in their jobs and the work they do. They can organise themselves, either in generic associations and/or in specialist associations around an area of expertise. This can consequently trigger also other people's interest and possibly attract them to a career in IT.

The European framework for IT professionalism has to be intended as a guide to orient and support the wide category of IT professionals throughout their professional life cycle, from early school years to career development and progress. The EU framework on IT Professionalism is primarily designed for IT professionals, but also links to e-Leaders.

With this in mind, a brief description of the main issues detected throughout the IT professional's career path which might pose challenges together with the role played by the different stakeholders core, is preliminary to understand how the appropriate use of the framework can deliver value to the users and enact potential stakeholders' interactions.

In regard to the approach, the methodology of use cases¹⁵¹ has been adopted to simplify the complexity of the IT domain and to carry out an analysis of the framework's value taking into account the core issues and the stakeholders' expectations at each step of the IT Professional career. Several scenarios are described below.

a. Preparing to enter the IT profession

The lack of clear career paths and related opportunities in the field of IT has damaged the attractiveness of the IT profession among the youngest generations in Europe. The negative public image of the IT profession combined with a poor reputation - a 'nerdy' image of IT - is the main issue hampering a fresh flow of brilliant young talents into the IT world.¹⁵² Despite a growing e-skills demand, there has been a continuous decrease in computer science graduates since 2005 intensified by the exit of IT professionals from workforce. The decline in the number of school leavers studying IT related courses contributes to this lack of maturity within the IT profession and presents significant challenges for society as well as European competitiveness (Sherry, M. et al. 2013). It is however starting to move upwards again which is a positive sign policy efforts are paying off; the gap is still there though, and growing. Also people who have already chosen IT studies, share common concerns and unclear views of the career opportunities and future achievements they might attain based on their specific backgrounds. As pointed out during the 2nd workshop on IT professionalism, the complexity of the IT domain and the poor maturity of the profession do not allow to clearly establish links between curricula and possible IT positions. Furthermore, the existence of a variety of qualifications from different education providers which are not comparable, reduces the cross-border mobility of IT professionals. Across Europe and beyond, there currently is neither uniformity in qualifications/certificates, diplomas and titles provided nor uniformity in the adopted criteria and processes.

¹⁵¹ A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal. The use case should contain all system activities that have significance to the users. A use case can be thought of as a collection of possible scenarios related to a particular goal, indeed, the use case and goal are sometimes considered synonymous.

¹⁵² As an evidence of this phenomenon, 17% of students surveyed in a recent CompTIA survey, saw IT careers as "sitting in a backroom with little or no social contact" (CompTIA, 2012).

At this stage, the focus is on how the framework can be used to improve the IT Professional image, and thereby motivating more people to choose an IT career as well as to acquire the entry-level knowledge needed. As a matter of fact, a number of surveys (Didero, M., Husing, T. and Korte, W. 2009; CEPIS, 2011) suggest that many IT professionals do not study computing as the main aspect of their degree course. The individual willingness to pursue an IT career can also be affected by the lack of attractiveness of the educational programmes and the teaching methods adopted at primary and secondary school which are not in line with innovation and emerging technologies. A root cause of this is that teachers are not enough "IT smart".

With this in mind, the framework is expected to support the maturity of the IT profession and its **rebranding** through an improved image of the IT Professionals as those who combine a high level of technical expertise with managerial and soft skills. Clearer and more linear links would be established between the IT related curricula and IT positions or jobs depending on the acquired competences. Thanks to the introduction of quality labels used as guidance in the field of certifications, it would also be easier for IT students and graduates to orient themselves towards the best suited certifications to access the IT market and the best available opportunities.

b. Starting a career in IT

At the very entry level of the IT career, the main problem is the mismatch between demand and supply of IT professionals in the labour market caused by the lack of IT skilled graduates and workers. An important goal for the 21st century would be the need to strengthen skills related to/based on STEM: Science, Technology, Engineering and Mathematics (EC, 2012). This goal mainly involves fresh graduates willing to work as employees or as self-employed starting their own business in the IT field.

From this perspective, people starting a career in IT are concerned with some relevant issues including the value of certifications when looking for a job and their potential to assess individual competences. As anticipated in the previous case, the existence of a diverse set of IT competence frameworks and certifications makes it difficult to compare them and to choose the best suited option. The complexity also stems from the distinction between local IT competence frameworks (for instance, the SFIA in the UK and the AITTS system in Germany) and their co-existence with a European e-Competence Framework (e-CF). In addition, there is a wide diversity of certificates related to technical training offered by nearly every IT vendor combined with certificates existing in parallel to formal vocational and higher education (Empirica, 2014). Therefore, there is a "certification jungle" covering IT qualifications and surrounding IT skills frameworks.

Furthermore, a misalignment between education and market requirements arises from the fact that education provides foundational knowledge, while specific knowledge is required to obtain an IT job. Employers have found difficulties in filling vacancies because even highly-qualified candidates do not possess the right skills. The CEDEFOP's new European skills and jobs survey (2014), underlines that in order to overcome skill mismatches, more and better jobs that invest in people's skills will be needed. In fact, around 26% of the 50.000 interviewed adult employees stated that they did not possess the required skills needed to be proficient in their job. Usually, young people are seen as 'digital natives' due to their exposure to digital devices but this is not sufficient to guarantee their proficiency level at the workplace (Thomas, 2011; Helsper E. J. and Eynon, R. 2010).

Another important issue is the lack of transparency in the IT labour market and the unclear rules governing the recruiting process which forms a barrier to select the right employee in line with the company needs and business strategy. In reality, matching the IT qualifications with IT skill profiles at different levels is a hard but vital process (Petersen et al., 2004). However, this process is hindered by the existence of incomparable job profiles using different languages and key words to express the core skills required. For the sake of transparency, the wide variety of IT job profiles in the IT Business Process has been clustered into 6 main IT

Profile families encompassing 23 Profiles and yet, this simplification has not prevented the proliferation of other profiles (CEN Workshop IT Skills, 2013). This trend may be the result of the internal lack of understanding within companies of the core IT profession requirements and of a common language to describe the IT profiles.

From this perspective, the framework can provide a common language as a reference to properly define job roles and positions. Through the e-CF and related proficiency levels, it would be easier to map the curricula and consequently to identify the IT Professionals which better align with the companies' requirements thereby increasing the transparency of the selection and recruiting procedures. Finally, the use of the framework at the entry level for IT graduates and newcomers will significantly help to minimise mismatches with labour market demands as the vital driver for the competitiveness and long term prospects of European companies.

c. Changing career

Due to the quick dynamics and evolutions of the IT job market, IT professionals may experience unexpected career changes in their positions between sub-domains within the IT sector. The main problem encountered in this process is the assessment, re-use and re-cycle of the skills and competences acquired in the previous IT position valuing the past experience, while at the same time, building on the individual set through re-training/re-skilling programmes.

From the demand side, IT skills are subject to rapid technological changes due to short technological life-cycles. New profiles continuously emerge and external developments may cause skills obsolescence or skills shortage (European e-skills forum, 2004). IT professionals are confronted with a raising demand of new skills when applying for a new job and only a high degree of flexibility would allow them to easily adapt to new workplaces. Therefore, gaining flexibility of work and at the same time, receiving IT-focused training have been regarded as a priority for companies to boost competitiveness and for Europe to reach a competitiveness edge (Mueller & Scherer 2003, Reilly 1998). On the contrary, IT professionals with a narrow professional development and a specific expertise in a single area will be side-lined, especially in a field characterised by a high job mobility such then IT field (Schreinemakers, J.F. & Peereboom, L.S. 1999; Scholarios et al., 2008).

As in the previous cases, the existence of a diverse set of incomparable certifications is likely to negatively impact on fluid career changes. Indeed, the IT certification world remains non-transparent with thousands of different certificates, ranging from technical ones (offered by each single IT provider), to those offered by foundations in information management. Also in this scenario, the multitude of existing e-skills certification systems imposes not only the categorization, but also the choice of internationally agreed standards to improve transparency and to ensure equity across Europe.

When people coming from a non-IT background take on IT positions, career changes refer to job shifts from outside into the IT sector. In this case, the most relevant issue is the unawareness or rather incomplete understanding about what IT is and what it can bring in terms of career opportunities. Despite the relevance of IT for companies, there is little understanding of IT as a profession and to a wider extent, of the fact that IT professionals belong to learned or skilled professions (Weckert, J. et al. 2013).

From this perspective, the EU framework on IT professionalism supports the maturing of the IT profession improving its reputation among the newcomers in the IT sector and within its borders. To those willing to change their career coming from another sector, the four building blocks provide a guidance to make the proper choices among the available IT jobs, in line with the previous experiences and acquired skills. The use of the e-CF as self-assessment tool combined with the guidance on certifications would help new IT professionals to select the most suited training and development programmes to progress in their career paths.

d. Developing a career

The European framework for IT professionalism does not address exclusively the IT professional at the entry level of his career, but it is expected to support his long-life learning and professional development. In fact, regular upgrade in career development keeping skills/knowledge up to date is essential to attain higher proficiency levels and to cope with changes in the tech environment. Due to the extent to which the IT skills have spread to all the economic sectors, it is possible to distinguish emerging issues within and beyond the IT domain. IT professionals developing their career in the IT domain usually experience problems in personal branding. Above all, the poor attention paid towards the individual professional development usually leads to stagnation which in turns damages the individual employability. This is mainly due to the prevailing professionals' attitude, which is less focused on growth/development with a higher eagerness for technology. The underlying problem is that professionals in the IT framework usually develop specific IT skills but lack combined business and management skills required by companies (Gourova, 2003). To pave their career, IT professionals should be early-adopters of new technologies by supporting lifelong learning to cope with changes in the labour market. Furthermore, the lack of transparency and equity in professional quality recognition is a challenge for all the HR departments within companies, since the same proficiency levels are recognised differently by each company. This issue is extremely relevant in today's IT labour market, where recruitment processes are mainly cross-border.¹⁵³ In this sense, a common European framework for IT professionalism would guide employees in building a "round" profile avoiding skills imbalances (technical or personal).

Differently, for non-IT people who are required to use IT more extensively, the main issue is the lack of IT professionals. In fact, IT is becoming part of all jobs but frequently employees are not educated or skilled in IT. New IT skills are required for their current job and thus, re-skilling and training based on a common framework would be beneficial.

In conclusion it becomes evident that a common European framework for IT professionalism primarily serves the needs of the whole population of IT professionals; ranging from IT specialists to top managers also including those willing to work in the IT domain and to progress in their career path. The value-added synergies enacted by each component, would support IT professionals in addressing all the issues encountered along their career life cycle. Nevertheless, the successful implementation of the framework in favour of the IT professionals as ultimate beneficiaries, will strictly depend on its use by the core stakeholders. Specific insights on how this instrument can be adopted to deliver advantages and value to its users are presented below.

5.2 Stakeholders: the IT professionalism ecosystem

As previously mentioned, the European framework for IT professionalism does not exclusively address the IT professionals but also the wider IT community where many stakeholders interact. Despite the heterogeneity of stakeholders' interests and needs, the framework represents a flexible structure to serve all.

The unstable and endemic evolving nature of the IT environment does not allow to empirically assess the magnitude of the added value delivered by the use of a unique framework to each specific stakeholder group (e.g. HR managers, policy makers, procurement managers). Yet, a qualitative analysis of the potential benefits could be introduced. Above all, there currently is a general consensus among the stakeholders regarding the advantages deriving from the adoption of joint solutions at EU level to overcome the national fragmentation and to find a common ground for interaction. The European framework for IT professionalism is a potential tool to support the stakeholders in their individual roles and functions, since it offers a platform to share and build on best practices.

¹⁵³ Towards a European Quality label for IT industry training and certifications, Conference, 24 January 2013

Provided that each stakeholder may act as enabler for the concrete uptake of the framework, it is essential to understand how this value-driven framework might help each stakeholder to fulfil their mission.

Finding a value proposition would be important to ensure the continued engagement of stakeholders in the further development and uptake of the framework.

- **Education providers**

The root cause of current demand-supply mismatches and skills shortages lies in the inadequate education of IT graduates entering the IT market place. The approach taken in designing the European framework for IT professionalism values the life-long learning of the IT professional paying a constant attention to education and training as crucial components of its structure. Therefore, education providers play a pivotal role throughout the IT professional lifecycle orientating people's choices and individual careers.

Education and shared knowledge is the foundation of a profession. Continuous IT education and training – a life-long learning commitment – is crucial for every IT professional. Education is important throughout one's career: when preparing for a first job, when growing as a professional and when orienting on a next career move. The European framework for IT professionalism allows education providers to prepare students for a prosperous career by ensuring their curricula are in line with requirements as defined by the broader IT community. The benefits for education providers when using the framework are:

Increased market size opportunities resulting from improved transparency and comparability of educational offering. Using a common language such as the e-CF and the fBOK, and other related standard references as the Euro-Inf quality label, to map educational offerings to, will make it easier for students to understand and compare these offerings. This can also enhance mobility of students and therefore open up new opportunities for universities to attract students. It will also increase insight into the quality of curricula and the extent to which they cover the knowledge areas that are important to gain a proper understanding of the breadth of IT. The latter will then allow to further specialise in a specific area of expertise. Education providers can distinguish themselves on these specific areas while also covering the breadth of knowledge. Working according to European standards for e-Competences will be perceived as criteria for quality.

- **Bridging the gap between IT education and training providers and employers' needs.** A better understanding of the market requirements gained through the use of the framework could facilitate the alignment between the demand and supply side thereby supporting graduates' placements. The reference framework contributes to consistent knowledge building and – during a career – competence development. It also covers soft skills that are of major importance for IT professionals. It is quite generic and therefore leaves flexibility in educational offerings to adapt to knowledge that is essential for new technologies or new jobs that are increasingly in demand. This will make it easier for employees to settle in their new job. On the other hand, increased standardisation of educational offerings will also make it easier for professionals to build competences during their career in a consistent and transparent way. This increases their employability and also makes the hiring process for employers more transparent and thus easier.
- **Increased alignment of IT education providers of all kind supports life-long learning requirements.** The adherence to a common framework increases standardisation of education, at least as regards the generic parts of IT curricula. This will make it easier to align and build on various forms of learning in different stages of a career (primary/secondary school, university, vocational). It leads to sustainable careers as it empowers students/professionals to make informed decisions concerning their education. This will also benefit the education providers as it can reduce drop-outs and will increase results of motivated students. Regarding career developments: this framework would allow education providers to set up skilling and reskilling programmes in close cooperation with the industry. As a consequence, the role of the education

providers in enhancing students' employability would be strengthened and enable a better matching of demand and supply in the IT labour market.

- **Support in innovating curricula to keep up with new IT developments.** The fBOK consists of the base-level knowledge required by IT professionals, and it refers to specialist areas of knowledge for further specialisation (for instance into architecture or service management). These specific areas of expertise have curricula that allow professionals to grow into more senior positions (for instance various TOGAF certifications that apply in different stages of a career). The knowledge foundations that are responsible for these curricula and certifications (the Open Group in the case of TOGAF) are very up-to-date with developments in their area of expertise. As a consequence, trends and innovations in these areas of expertise will also feed into the Framework updates and can thus benefit education providers.

Above all, the framework may be applied to train teachers in primary and secondary schools using the foundational BOK and the e-CF as references to assess their gaps or shortages and choose IT-focused programmes. To cope with pervasive technologies in the Digital Single Market, teachers need to gain core IT skills and relevant knowledge in order to become "IT smart". In a virtuous circle, they will be able to transfer the foundational knowledge to the younger generations allowing them to attain high proficiency levels.

- **Policy makers and governmental bodies**

As underlined by the EU's long-term e-skills strategy, Europe is still a "patchwork of countries functioning under different regulatory systems" while the IT industry operates globally (EC, 2007). Whereas the European Union has been actively promoting digital (e-skills) and IT careers for more than a decade through different initiatives, national governments are recognising more and more the need to act upon this sector to boost national competitiveness and growth. To date, national governments are proceeding at different speeds but more is needed. It is worthy to underline that policy makers and governments have a pivotal role in the development of the EU framework for IT professionalism, as well as in the implementation of the building blocks at national level.

Recalling their mission, national governments set policy directions and adopt measures to stimulate macro-level changes in supply-demand dynamics affecting aspiring IT professionals. Therefore, they share the responsibility for maturing the IT profession in conjunction with the industry, the education providers and the IT community as a whole. In detail, the tri-partite engagement and collaboration involving Industry, education and government has been considered a driver for increased levels of IT professionalism (CEPIS, 2012).

The adoption of a comprehensive EU framework would bring advantages to this stakeholder category both at national and EU level. By adhering to a comprehensive and flexible framework at EU level, national policy makers will achieve a better understanding of the skills required by the industry gaining a precious source of information for national strategies and actions. In addition, governmental bodies play a key role in the design of curricula and study programmes and thus, the use of the framework would help them to integrate the right IT skills in teachers' study programmes. This would also result in a highly IT skilled workforce allowing countries to obtain a competitive advantage in the global market. In line with the activity of education providers, national policy makers can promote the recognition of common standard proficiency levels across companies to support cross-border mobility and cross-sector IT professionals. Finally, the use of an EU-wide approach would provide a common reference to national policy makers to assess ex-ante, monitoring and evaluating ex-post the impacts of strategies, policies, actions aimed at promoting IT skills and competence.

From a wider perspective, policy makers contribute to raise the awareness of the relevance of technology for a digital world. Therefore, the framework would further support them in the promotion of research activities and campaigns to improve the image of the IT workforce.

- **Professional associations**

The European framework for IT professionalism aims to further mature the IT profession, while at the same time generating an increased interest for a career in IT and increase Europe's digital talent pool. Representative bodies for informatics professionals play an important role in developing, promoting and sustaining the IT profession. Standardising is one means to further mature a profession. **Obtaining the status of a profession requires professional bodies to set suitable standards of knowledge, competences and codes of conduct.** Professionalism is absolutely fundamental to the effective practice of IT.

The European Union is unique. Each Member State has a different background composed of historical, cultural, economic and societal roots. There are different needs, different approaches and a different mentality. However, each Member States can benefit from applying European standards as regards IT professionalism, and the road towards that goal should take into account those differences. In this respect, national stakeholders and IT professional associations can play an important role in this regard.

It is important to realise that adhering to pan-European standards has significant impact on user-organisations. There is significant work to be done if an organisation wants to adopt a new competency framework: for the HR department in writing the career framework and curricula/training guidelines, for the IT department to possibly ask for IT knowledge and competencies in different wording than before, and for the IT professionals working for that organisation in developing their own IT profile and career. It takes more than installing a new template. It requires structured organisational change. Again, IT professional associations can offer support to each of these stakeholders separately and by bringing them together in communities that encourage further take-up and smoother implementation of the European framework for IT professionalism. Such communities can share good practice as well as key challenges that need to be overcome. The ITPE network (www.itprofessionalismeurope.org) launched by CEPIS in November 2016 is an excellent example of this.

The value for IT professional associations lies within: the opportunity to mature the IT profession and boost membership, a stronger role in communicating and shaping emerging industry practice, the promotion of IT professionals' interests at various levels, and the development of educational offerings or tools that could support IT professionals or stakeholder groups.

Depending on future developments IT professional associations should have a pivotal role in case (voluntary) registering and licensing IT professionals would be considered by the IT industry and other stakeholders. This would concern how the profession may be regulated and who is responsible for making sure that professionals are doing their jobs properly. In other professions that are regulated or licensed to practice, such as law or medicine, professional bodies set the standards and codes of conduct.

In close cooperation with governments, IT professional associations accredit certification providers promoting transparency and providing guidance to employers. To this aim, the establishment of a widely-accepted quality label based on the e-CF has been considered key to overcome the barrier of a complex IT certifications landscape as underlined on the occasion of workshops and international conferences related to the work of the "Grand Coalition for Digital Jobs"¹⁵⁴ and as recommended by the European Parliament and the Council in 2009 (155/01).¹⁵⁵ Therefore, the IT Professional Associations should stimulate employers to adopt the e-CF as reference in the definition of the job profiles and the possible career path, to improve the transparency in the IT labour market.

¹⁵⁴ A full list of events is available on the Grand Coalition for Digital Jobs webpage <<http://ec.europa.eu/digital-agenda/en/milestones-events>>.

¹⁵⁵ European Parliament and Council (2009), Recommendation on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training, 18/06/2009

Professional associations are also involved in the promotion of self-assessment processes to IT professionals and in the development of related tools to better channel them to the right IT position. Coupled with additional tools and services, self-assessment tools have also been conceived as essential for focused development and to provide up-to-date information (EC, 2013). In this regard, the skills and proficiency levels established by the framework provide the basis for any individual assessment besides certifications facilitating the tasks of the professional associations.

By aligning with the framework, professional associations across Europe may also update their codes of ethics/conduct and by sharing common criteria, guidelines and a core set of issues beyond diverse cultures in Europe. In doing so, further harmonisation will be achieved.

Finally, and in collaboration with governmental bodies, there is a clear need to promote the European framework for IT professionalism in the interest of the professionals it represents. This role could contribute to an enhanced visibility of supply and demand of IT skills, helping to provide a robust and granular basis for informed policy setting at local, national and European level.

▪ **Employers**

Employers have a complex mission in the IT labour market being responsible for the recruiting process of young graduates while paying attention to the dynamics of the market. Employers provide information on career opportunities and on the competences required for IT Professionals in the recruitment phase.

In fact, they aim at fostering the employability of IT professionals defined as “the extent to which employees have skills that the market and employers regard as attractive” (Scholarios, D. et al. 2005). Their support is essential in the design of master programmes as well as in the promotion of vocational training as different but strictly linked to formal education.

Any organisation would want its IT staff to be highly confident and performant in their practice, and to be recognised and accepted as real IT professionals. The European framework for IT professionalism helps employers all over Europe in providing a common language for IT professionals' development, while facilitating the geographical and professional mobility of employees and offering them guidance and tools to develop their careers. The benefits to organisations (and society!) include IT professionals having an adequate level of knowledge, providing a higher level of products and services, and abiding by the highest professional standards and codes of ethics¹⁵⁶.

Employers have a key mission in the IT labour market being responsible for the recruiting process and the up-skilling/re-skilling of IT professionals while paying attention to the dynamics of the market as a whole. The framework offers clear values for employers:

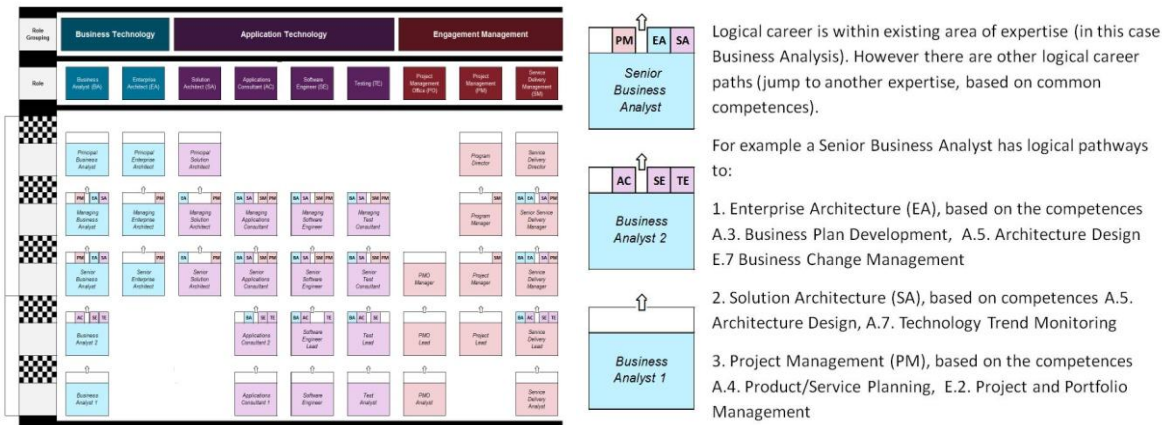
- **Reduced cost, effort, and time to recruit, deploy, train and develop suitable IT resources, as well as improved capability to align IT resources with business requirements.** When using the same reference framework, employers who hire IT resources and those who provide those resources can match more efficiently, and hence reduce time and costs involved.

The framework enables employers to build job profiles and curricula in a consistent way, and to develop transparent career paths, offering opportunities for further developing a career both within an area of expertise as well as in closely related areas of expertise. This could also improve retention.

¹⁵⁶ Ridge, J., Australian Computer Society, Available online here:
<http://press.anu.edu.au/apps/bookworm/view/Professionalism+in+the+Information+and+Communication+Technology+Industry/10791/ch02.xhtml>

Using the framework could provide insight into the extent that employees' competences support the business and strategic goals of the organisation. At the same time this will also facilitate the employer to develop training paths for its employees in line with that strategy, and ensure the training budget is spent effectively.

Figure 24: Illustration of advancing within or changing to another area of expertise



- **Highly competent IT workforce, reflecting industry demand.** Using pan-European standards such as e-CF, will lead the IT professionals to increase the quality of the workforce by providing higher level of products and services to demonstrate professional and ethical behavior. These components of the framework are a result of the multi-stakeholder process that reflects today's IT business needs.
- **It will also contribute to efficient collaboration between IT and HR departments.** They can have different interests and needs, **but they have to share a common language in terms of competences, knowledge and professional development to effectively recruit, select and manage IT workforce.**
- **Potential to facilitate cooperation with IT services companies and third parties through consistent, agreed definitions of roles and competences.** A common language will contribute to better understanding of employees and external resources involved in IT services activities, for instance for service managers. In similar fashion it can serve so-called 'stacked' products or services that involve various sub-contractors in various stages of the product cycle, or in for instance public-private partnerships. It will also make it easier to understand in the internal organisation how results were achieved and to transfer work to replacing resources.

The European framework for IT professionalism offers 'more with less': a common language in defining competences, knowledge, skills and behaviour that can be used across borders. It will improve professional development of employees – and thus their productivity – as well as open opportunities to reduce costs in recruitment, training and deployment.

▪ Certification Providers

Local, national, European and global IT qualification and certification providers are primarily concerned with the extreme variety of existing national based certifications. Starting from the entry level of the IT career, certification providers play a crucial role in providing sound evidence of the skills and competences acquired by IT graduates. Throughout the career life cycle, certification providers are responsible for offering services and products to support the professional's career development and to assess the individual competences and skills.

From this perspective, the framework allows to align competency frameworks and certifications through the mapping against the e-CF resulting in adopting a joint solution. In detail, the e-CF, as main component of the framework, supports the definition of jobs and qualifications, the improvement of training courses, career

paths, formal and non-formal learning paths. Certification providers would also benefit from a common guidance into the wide IT certification landscape mapping certifications to the Framework and thus, defining a general overview at EU-level.

5.3 Summary conclusions

The current state of play shows a strong disparity in the level of maturity and adoption of the four building blocks and, more in general, reflects the poor integration between them. As described at the beginning of the section, many initiatives have been launched so far to develop and promote the IT professionalism building blocks but most of them address a single building block, not the overall framework.

Now, a systematic approach is required to tackle main challenging and pressing issues concerning the IT profession.

In order to build on the four building blocks to develop the European framework for IT professionalism, it is essential to first understand the relationship between Body of Knowledge, Competences, Education and Training and Ethics in order to provide a sound basis for generating supportive synergies.

At this aim, managing the four building blocks in a more integrated and complementary way is the key success factor for developing the European Framework as a unique point of reference for all beneficiaries and users dealing with the IT profession. It could be used as a basis by IT professionals to orientate themselves with the IT professional lifecycle, from early school to career development, as well as Education providers, Professional Associations, Industry and Public sector, Policy makers in providing the right conditions to promote IT professionalism and ultimately increase European competitiveness.

Part C: implementing a European framework for IT professionalism



6 Implementation of the European framework for IT professionalism

"Begin with the end in mind"

– Einstein

"Begin with the end in mind" said Einstein, illustrating how important visualisation of the end goal is. It allows to better understand the long-term goal to which a project is contributing, for others to identify with that goal and possibly offer support, and – last but not least – it enables to break down the consequent steps that are required to reach that goal.

The European framework for IT professionalism aims to further mature the IT profession, while at the same time generating an increased interest for a career in IT. The previous chapter described these goals, and how the four building blocks work in synergy towards those goals. This chapter focuses on the implementation of the Framework. A well operationalised programme is a pre-requisite for effective implementation. The more clearly components are defined and validated, the more clearly implementation actions can be focused on bringing these 'to life' and sustaining and improving them in the context of practices, organisations and systems¹⁵⁷. So, what does 'implementation' exactly mean, and what does a successful implementation require?

This chapter presents the implementation activities that were initiated during this project, with the great support of many committed stakeholders. The support we encountered during this project for maturing the IT profession, and the engagement to reduce mismatches and get more people into work is overwhelming. It is also a prerequisite to any successful implementation and therefore leaves us confident that – also after the project ends – there will be continuation of the actions initiated under this project as well as follow up on other important ideas raised in the first phase of this project. Of course we also provide our recommendations on sustainability of the Framework, and how further implementation could be achieved – based on our views but also building on the lessons learned from the people involved in these implementation activities.

This chapter first looks into the objectives of implementing the European framework for IT professionalism, and defines key challenges that need to be taken into account in this regard. Second, the implementation activities are presented: the purpose, the results and the take-away from the activities are illustrated to facilitate the implementation in other countries. Third, we include guidelines to implementation based on the approach that was followed in this project to progress from generating solutions to selecting and running activities, and evaluating them.

6.1 The end goal and challenges regarding implementation

Implementing a Framework. Definitely a phrase that needs an explanation to reveal what it exactly means, and how this is approached. This paragraph first describes the end goal and ambition of the European Commission and stakeholders, and then zooms in to how this project contributes to that goal and which challenges need to be taken on to succeed. In the next paragraph, the project's practical approach to implementation is further elaborated.

¹⁵⁷ Fixsen, D. L., Naoom, S. F., Blase, Duda M. (2015), Implementation drivers: assessing best practices, National Implementation Science Network (NIRN), 2015. Available online at: <http://implementation.fpg.unc.edu/sites/implementation.fpg.unc.edu/files/NIRN-ImplementationDriversAssessingBestPractices.pdf>

6.2 Professionalism is fundamental to the effective practice of IT

Let's start with determining the end goal of the implementation of the Framework. There is a significant difference between a person being considered to be 'professional' in their approach to conducting business, whatever that business may be, and a person being part of a profession and therefore considered to be a professional. This difference has created enormous misunderstanding and confusion within the information and communications technology (IT) sector, and hampered its progress towards being recognised as a profession. Being part of a profession is a vocation requiring knowledge of some department of learning or science, for example, medicine, law, engineering, architecture, accountancy and, more recently, IT¹⁵⁸. **Standardising is a means to further mature a profession.** Obtaining the status of a profession requires professional bodies to set suitable standards of knowledge and codes of conduct. Professionalism is absolutely fundamental to the effective practice of IT. The ambition of the European Commission and stakeholders is therefore to develop the Framework into a standard, as is currently the case for the e-CF only. A standard that includes not only competences, but also knowledge, ethics, and education and certification. An international standard brings benefits for the economy and for society. It helps employers in providing a common language for professional development of IT professionals across Europe (and potentially beyond), while stimulating the mobility of employees and offering them tools to develop their careers. Any organisation would want its IT staff to be professional in their practice, and to be recognised and accepted as being professionals. The benefits to organisations and society include professionals having an adequate level of knowledge, providing a higher level of products and services, and abiding by professional standards and codes of ethics¹⁵⁹.

Long-term goals need to be properly embedded in strategy and policy, and engagement from stakeholder coalitions to ensure continuity and sustainability. In such an environment, initiatives like establishing and implementing a European framework for IT professionalism can flourish and progress. This is a condition-sine-qua-non which is very well set out at both European and national levels, and even beyond through collaboration with major economies like USA, Japan and Canada.

The common view is that the instruments available within the building blocks of the Framework will be further developed by the TC428, that is already fostering the e-CF, while other communities will play an important role in the further promotion of the Framework and stimulate take-up. The recently launched IT Professionalism Europe network, by CEPIS and with members amongst government, industry, certification, education, will play an important role in this regard. Further support is to be expected from the various national professionals associations, and the CEN Workshop on IT Skills.

6.2.1 Maturing the professional framework and the profession go hand in hand

The aforementioned ambition implies two requirements or sub-goals for implementation of the Framework:

- The building blocks of the Framework should be further developed and reach a level that allows them to be recognised as standards – similar to the path of the e-CF;
- The Framework itself should be adopted by (professional organisations in) countries in Europe, and used in practice.

¹⁵⁸ John Ridge, Australian Computer Society,
<http://press.anu.edu.au/apps/bookworm/view/Professionalism+in+the+Information+and+Communication+Technology+Industry/10791/ch02.xhtml>

¹⁵⁹ John Ridge, Australian Computer Society,
<http://press.anu.edu.au/apps/bookworm/view/Professionalism+in+the+Information+and+Communication+Technology+Industry/10791/ch02.xhtml>

This project was assigned to initiate the implementation of the Framework in at least three countries, during the last three months of the contract. To achieve successful take-up of the Framework across all European countries in the long-term, early-adopters are required on the short-term. Various organisations were triggered to start concrete actions that in the long-term lead to implementation of the framework. The focus in first instance were key stakeholders in those organisations who are convinced of the value add of this Framework, and who wanted to be the drivers of that change. Organisations that are willing to lead by example, and create a movement that others want to be part of too. These early-adopters can pave the way for others, and others can then learn from that experience.

Development of the contents of the building blocks itself was not a primary goal in this project, however through the course of this project it became evident that some of the actions not only consist of a first step towards implementation but at the same time generate considerations for improving the Framework and/or a specific building block. Some of the actions that we decided to take on are not primarily aimed towards implementation of the Framework in a country, but provide value for all countries/every organisation interested in the Framework. For instance the first version of the European Ethical Guidelines, or the initiated collaboration with the SFIA framework, are examples of these 'supra-national' implementation activities. Maturing the European framework for IT professionalism, and the profession itself by means of organisations adopting the Framework, go hand in hand.

Concluding, in the long-term the European Commission is aiming the Framework to be recognised as a standard that is used (implemented) by many European countries. Early adopters taking the first actions in that process of implementation will trigger others to follow, and eventually reach that long-term goal. This project, on the short-term, will identify these early adopters, select feasible actions that can be started during the course of this project. Commitment of these early adopters implies they will continue to push and monitor the actions initiated after this project has ended.

6.2.2 Uniting diversity: encouraging progress at different levels

Europe is unique. Each country has a different background composed of historical, cultural, economic and societal roots. There are different needs, different approaches and a different mentality. Each country can benefit from applying European standards and adhering to a European common language as regards IT professionalism, but the road towards that goal should take into account those differences.

Indeed, front runners can encourage others to follow. They can inspire and share lessons learned. This is particularly relevant for countries that are in need of advancing the most, and/or have interest in specific building block of the Framework. Early adopters also have an important role in using the instruments of the Framework in practice and feedback experiences and possible improvements.

But besides these early adopters, the instruments itself should also allow to be easily used by a diversity of countries and organisations in those countries. Any standard or instrument should allow for a certain flexibility in order to be of practical use to stakeholders. A too rigid approach would risk Europe-wide adoption. This is, for instance, why the Foundational IT Body of Knowledge applied a meta-model approach to describing the base level knowledge required from IT professionals. Such an approach allows stakeholders to customise in a certain way, and while it references sources of specific knowledge it is possible to add more detail or granularity to the use. The e-CF, being the most mature of the 4 building blocks, could act as a corner stone of the European framework for IT professionalism, as it is widely known and recognised for its added value. It could be the vehicle that carries the other instruments.

6.2.3 Changing routines: it is not just a new template

Another challenge to keep in mind while lining up for implementation, is the fact that adhering to these European standards has significant impact on user-organisations. Various stakeholders expressed this concern during the interviews and surveys. There is significant work to be done if an organisation wants to adopt a new competency framework: for the HR department in writing the career framework and curricula guidelines, for the IT department to possibly ask for knowledge and competencies in different wording than before, and for the IT professionals working for that organisation in developing their own profile and career. It takes more than installing a new template. It requires structured organisational change.

There are many definitions of implementation. Implementation can be defined as a “specified set of activities designed to put into practice an activity or programme of known dimension¹⁶⁰”. A synthesis of the research in the field describes implementation as “a mission-oriented process involving multiple decisions, actions, and corrections”¹⁶¹. A sound implementation strategy will avoid pitfalls of ‘implementation as usual’¹⁶², that could lead to the Framework being either adopted on paper, but without meaningful changes taking place at the practice level to support adoption and deliver new services, or fragmentation due to ineffective operating structures that do not provide the support necessary (or the wrong support). The key is to design for impact. New procedures and operating structures should directly support adoption of the Framework and its instruments.

Without repeating the many books that have been filled with approaches to change management, it at least involves thinking about political/executive sponsorship and commitment, gaining support amongst those affected by the change and involving the key persons (‘change angels’) to create ownership, assessing the impact, communication and possibly training or support activities during the implementation and after.

In terms of efficiently implementing the European framework for IT professionalism, it is hence necessary to think about ways to support this process within organisations. For this reason, we included practical guidelines that support designing the implementation process. Additionally, specific tools exist (such as AICA’s e-CFplus¹⁶³), and also practical guidelines that accompany specific instruments and standards of the Framework (for instance the user guide of e-CF¹⁶⁴).

Besides guidelines, in order to convince organisations to use the Framework, it should be very clear ‘what is in it for them’. In other words, describing a business case to why this change will sort effect in the long term.

6.2.4 Optimising effectiveness: balancing between enforcement and voluntarism

John Ridge, the former president of the Australian Computer Society, tackled this issue very clearly¹⁶⁵: ‘It would be plausible to think that organisations, as a way of guaranteeing professionalism, would seek to employ IT professionals who are part of the profession and members of a professional body. **One problem is that**

¹⁶⁰ Fixsen, D. L., Naoom, S. F., Blase, K., Friedman, R. M., & Wallace, F. (2005). Implementation research: A synthesis of the literature. Page 5. National Implementation Research Network, University of South Florida, Louis de la Parta Florida Mental Health Institute Available online at <http://nirn.fmhi.usf.edu/resources/publications/Monograph/>

¹⁶¹ Fixsen, D. L., & Blase, K. A. (2006). “What works” for implementing “what works” to achieve consumer benefits. National Implementation Research Network, University of South Florida, Louis de la Parte Florida Mental Health Institute

¹⁶² Metz, A. J.R., Base, K., Bowie, L. (2007), Implementing Evidence-based practices: six drivers of success’. Available online at: http://incredibleyears.com/wp-content/uploads/Child-Trends_6-Success-Drivers_10-07.pdf

¹⁶³ Online available here: <http://www.aicanet.it/e-cfplus>

¹⁶⁴ Online available here: http://ecompetences.eu/wp-content/uploads/2014/02/User-guide-for-the-application-of-the-e-CF-3.0_CEN_CWA_16234-2_2014.pdf

¹⁶⁵ John Ridge, Australian Computer Society, <http://press.anu.edu.au/apps/bookworm/view/Professionalism+in+the+Information+and+Communication+Technology+Industry/10791/ch02.xhtml>

membership of a professional body is not a prerequisite for IT professionals to practice, unlike other professions such as law or accounting. In most of these professions, membership of a professional body is inextricably linked to the ability to practice, either in reality or by common perception and, in some cases, the loss of that professional membership results in the loss of the right to practice. The absence of this professional obligation in IT can result in professionals employing haphazard levels of knowledge, with inadequate understanding of codes of ethics and professional practice.’

There are examples, like in Malaysia, where government efforts to implement a mandatory registration top-down almost ended in a revolution. It ignored the needs and wishes from the many IT professionals who didn’t share the need for this initiative. There is a wide range of IT professionals, ranging from those who have university degrees and minimum level of experience, to people with industry certifications, to professionals who gained their skills and experience on-the-job. It shows how sensitive taking steps in this regard can be, and that it should be planned for carefully. Professional bodies can play a role in establishing criteria to distinguish professionals from professionals. The Dutch VRI for instance, together with the NGI (both professional associations), opts for a bottom-up approach and is aiming to open a voluntary registration of IT professionals, offering transparency in competencies and promoting a code of conduct (and liaised disciplinary rules). Here, the challenge is to fill that register and to trigger organisations to require their IT professionals to be part of it.

Both examples represent different approaches to providing transparency in IT professionals’ competencies and further maturing the IT profession. The implementation of a Professional Framework cannot be made mandatory. Successfully achieving the end-goal of maturing the profession would require take-up on a large scale though. This requires commitment of all stakeholders involved, and their willingness to act. It also requires them to consider – after adopting the Framework - how to ensure a broad reach amongst IT professionals. This is particularly relevant for the professional bodies.

6.3 Overview of implementation activities at national level

This section focuses on the initiatives that were initiated during the course of this project, and that contribute significantly to both the development of specific building blocks of the Framework, as well as to the take-up of the Framework in Europe and possibly beyond. The service contract expected the project to initiate at least three concrete activities. However, considering the momentum this project gained and the interest from various organisations in the end we could report seven activities.

Four concrete implementation actions were initiated by Spain, Italy (two) and Ireland (one). Their actions match very well with the criteria set in advance (simple, demand-driven, pragmatic, scalable, and sustainable) and stakeholders involved in the project showed strong commitment by taking action from the start.

6.3.1 Implementation in Spain

Rationale & approach

The *Consejo General de Colegios Profesionales de Ingeniería Informática* (CCII) indicated early in the project to be interested to explore implementation of the European framework for IT professionalism in Spain.

Since 2014, CCII is already involved in activities around the e-CF, and the organisation also sees the value of the broader scope of the European framework for IT professionalism, and specially the least-developed fields as Ethics and Certifications and implementing Quality Labels.

According to the CCII, the Framework fills a much needed gap in the IT sector in general. The action plan that CCII developed had the objective to be well-received by its users and stakeholders. Besides the development

of a roadmap that includes a list of prioritised actions, it also created a stakeholder map with 75 experts related to each of the building blocks of the Framework. CCII then went public with this initiative during the Digital Enterprise Show 2016 (24th May in Madrid) to further promote the Framework with an 'open registration call'¹⁶⁶ to engage an even larger audience of stakeholders and in particular industry actors.

After that CCII organised several promotion actions across Spain about IT Professional Framework implementation.

Related to the Competence building block, CCII collaborated with AENOR, the *Spanish standardisation national entity*, and jointly they initiated:

- Leading the Spanish contribution to the EN 16234-1.
- Promoting a Spanish translation of European Standard EN 16234-1. As a key basis for its real use and assimilation by Spanish companies and society, especially outside of IT sectors; human resources, labor unions, trade unions, etc.
- Promoting besides AENOR a national presentation action of the Spanish translation of European Standard EN 16234-1. In Madrid on 13th December 2016.

In the field of professional ethics, the most relevant actions are:

- National Commission on Ethics v.1.0. (Mars 2016) Final version delayed until Framework proposal about professional ethics guidelines.
- Evolution from diverse regional and partial deontological codes, to one single national deontological code (Delayed until Framework proposal about professional ethics guidelines.)
- Participation in monographic Workshop about professional ethics guidelines that took place on 15th September 2016 in Brussels. See section 6.3.1. *Development of European ethical guidelines* of this report.

Besides that CCII has developed various other actions that support the development and implementation of the European Framework for IT Professionalism, such as:

- Participation in general Workshop 4th February 2016. Brussels.
- Framework Implementation Action Plan v1.0 (May 2016)
- Collaborating in CEN EN 16234 elaboration and evolution (2015, 2016, 2017...)
- Participation in Workshop about professional ethics. 15th September 2016. Brussels
- Implementation of ICT Certifications Map pilot. November 2016-January 2017. (See below)
- Participation in High Level Conference. 6th December 2016. Brussels

The participatory strategy of CCII for the implementation of the European Framework for IT Professionalism in Spain was a key milestone in a national workshop, on 13th December in Madrid International Lab, with the title "Workshop participativo: Implementación en España del Marco Profesional TIC Europeo (European ICT Professionalism Framework in Spain)". The workshop had the aim to:

- Provide information on the initiative in Europe and in Spain;
- Present the actions undertaken in Spain to implement the European ICT Professionalism Framework in 2016;

¹⁶⁶ See: <http://www.ccii.es/registroframework>

- Initiate a debate with Spanish stakeholders in order to obtain their contributions in defining an action plan for 2017.



The event was done with the support of eSkills-For-Jobs, and IT stakeholders and companies like AMETIC, CODDII, CONCITI, Capgemini Consulting, IDC, EY and Madrid City Council.

As a result of the workshop, CCII collected a set of 19 action proposals and a priority evaluation that provide the focus of the 2017 roadmap for implementation actions around the European framework for IT professionalism in Spain¹⁶⁷. The roadmap can be found in Annex D of this report. The challenge of starting such initiatives is always the sustainability. In the case of Spain this is handled with care: there is a roadmap, a broad stakeholder and expert network, and a committed coordinator to push forward.

One activity in particular we would like to highlight here: the development of an Open IT Certification Map.

The general goal is to improve the knowledge, comprehension, utilisation, and value of IT Certifications for individuals (specialisation, career development, etc.) and also for organisations (IT companies, companies using ICT, professional associations, certification offices, recruitment companies, public administrations, etc.).

IT education and training has nowadays an extensive, diversified and complex scenario. Certifications, qualifications, non-formal learning and informal learning are mutually supportive components of a professional's career development, but in this context there is a chaotic use of designations, descriptions and terms like "certification", "accreditation", "diploma", specialist, expert or master, among others, with a special issue about the use and abuse of the term "certification". There are also different "types" of IT education and training depending of the "teaching agent": universities, academies, suppliers, professional organisations, trade unions, employer association, accreditation and assessment bodies, etc.

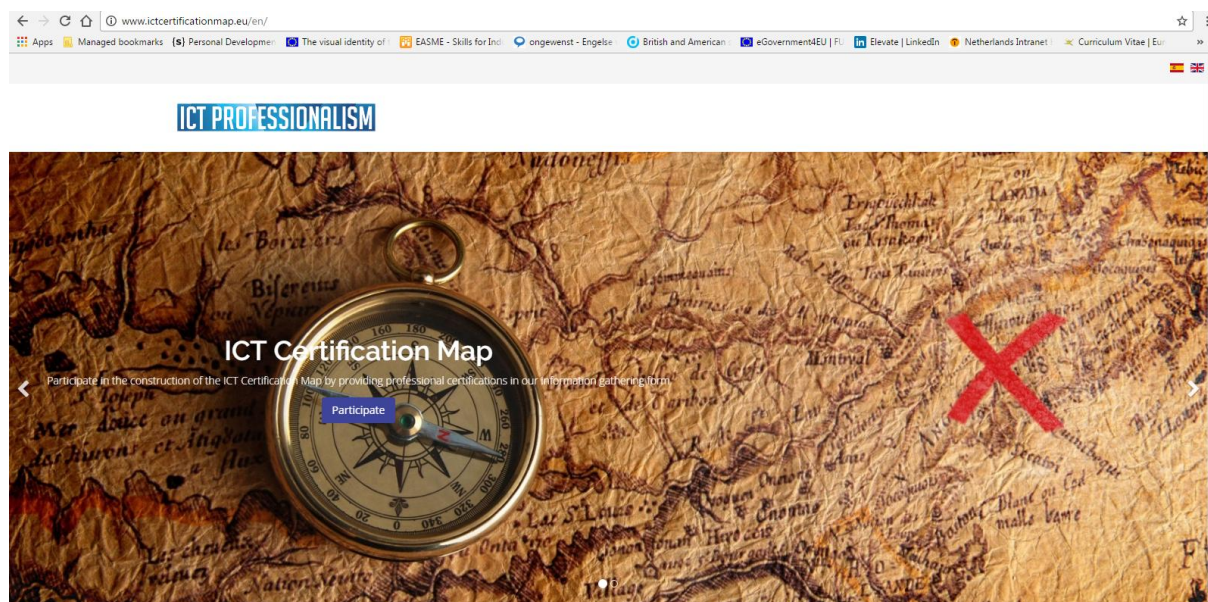
The specific goal is to implement a "visualisation" tool (a map) of IT certifications based on the construction of an IT certifications database. An Open Data approach is adopted, so that the evolution and use will be public and open for all interested parties. The map is being built based on contributions from professionals in the sector and companies, certification offices, and other stakeholders concerned with IT certifications. The map will especially include the most widespread, valued, and relevant certifications, both for professionals, and for the sector.

¹⁶⁷ Presentations from this workshop, and more info can be found online here:
<http://www.cci.es/305-whorkshop-implementacion-espana-marco-profesional-tic-europeo>
<http://ccii.es/noticias/311-resumen-del-workshop-implementacion-en-espana-del-marco-profesional-tic-europeo-european-ict-professionalism-framework-in-spain-madrid-13-diciembre>

Results of the IT Certification Map

In the current pilot approach CCII has implemented a Spanish and English basic web page and survey for data collection, available in <http://www.ictcertificationmap.eu/>.

Figure 25: Landing page for the IT Certification Map



In this first phase of the IT Certification Map, the **Fondazione Politecnico di Milano** is co-operating with the extension to other countries, and **Fundación CTIC** is helping with the start of the pilot in Spain.

The map will be built incrementally: **the first version of the IT Certification Map will be developed as a pilot project in Spain, including professional certifications mainly**. Other certifications, such as user certifications, will be the scope for future versions. The project team developed a survey amongst Spanish professionals and stakeholders to receive information about certifications. The survey was closed on the 15th of January 2017. Following that, from February 2017, a database will be built with all the collected data and published using Open Data standards. There are also plans to build the visualisation tool and repeat the survey in other European countries.

In words of Mr. José García Fanjul, CCII Board member and coordinator of the project, *“This initiative will provide a very interesting tool for professionals, companies, certification organizations, universities and the whole sector and society in the field of a better knowledge, use and value of the certification ecosystem”*

6.3.2 Implementation in Italy (1)

Rationale & approach

The current scenario of IT professionalism in Italy shows positive trends in terms of employability and compensation in a broad range of sectors. These results demonstrate the value of successful initiatives carried out by different stakeholders' groups working together to boost IT professionalism. Since Italy adopted the e-CF as a National standard in 2013 (UNI 11506:2013), much progress has been made turning Italy into a pioneer in Europe and providing “good practices” which can be used as reference by other countries.

However, as highlighted in recent studies, many issues have still to be addressed, especially in relation to skill shortage. Security Management is one of the most crucial domains, requiring high qualifications to meet

market needs. The lack of skilled talent experienced in Security Management is putting organizations at risk and leaving businesses across industries vulnerable to attacks.

Given the increasing value of Security Management, the C.I.N.I. (Consorzio Interuniversitario Nazionale per l'Informatica) has launched an initiative under this IT Professionalism project that aims at mapping existing Italian bachelor and/or master level University curricula with respect to the field of IT Security Management, using knowledge and competences frameworks published by International bodies. Currently, the survey uses definitions from the "The European Foundational IT Body of Knowledge v1.0" (<http://www.ictbok.eu/proposedFramework.html>), fBoK in the following, and the "European Competence Framework e-CF 3.0" (<http://www.ecompetences.eu/it/>).

The initiative is a joint effort of two C.I.N.I. National Laboratories: CFC (digital Competences, Formal training and Certification and Cyber Security). In a short-term perspective, the assessment provides a first understanding of the existing Italian Educational offering on IT Security and its alignment to the adopted European framework for IT professionalism. In a long term perspective, the initiative will be extended to other IT domains in order to further improve the current University curricula and to build a bridge to the workplace environment, in cooperation with industries.

The approach adopted for the assessment mainly consists of a web-based survey addressed to those who are responsible for the IT Security curricula design in overall 20 Engineering/Informatics Universities. Several meetings and communication actions have been planned to launch the initiative and to ensure the stakeholders' engagement. The survey was carried out from the end of October to the end of November 2016, with a good participation of stakeholders.

The survey is split into six sections:

Section 1: description of the course/institution

The section collected data on the curriculum being assessed, including details of the Institution offering it, global and specific effort of the subject matter of the survey, lab requirements (if any), project work (if any). The assessment was carried out on any curriculum, provided it had "some" offering in the IT security domain. For the purpose of the survey, a "curriculum" was any track, either a formally approved one, or part thereof, even if it was not labeled "Security".

Section 2: short description of the European Foundational ICT BoK (fBOK)

The section briefly described the fBOK and provided insights on the "Security Management" knowledge area.

Figure 26: The Knowledge area of 'Security management' within the European Foundational IT Body of Knowledge



Section 3: assessment of the fBoK vs Curriculum

The section specifically assessed the curriculum against the 'Security Management' knowledge area of that BoK. The aim was to understand the correspondence between the description of that knowledge area and the curriculum contents provided by different institutions in the field of IT Security.

Section 4: short description of e-CF

The section briefly described the European Competence Framework 3.0 as reference for designing curricula.

Section 5: assessment of fBoK vs e-CF vs Curriculum

The section provided the list of e-competences that, according to the fBoK, pertained to the Security Management knowledge area in order to assess each competence with respect to the curriculum.

Section 6: final consideration of possible curriculum re-designs

In the last section, participants were asked to consider the process of DESIGN and UPDATING of curricula in view of the frameworks outlined in the survey. Suggestions and constructive criticism on the frameworks themselves, with reference to "security" domain were also encouraged to further develop and improve them, together with the curricula.

Results of the assessment of the Knowledge Building block on "security management"

The initiative undertaken by the C.I.N.I. in Italy, represents the first step towards an improved transparency and comparability of educational offering in the field of IT. Despite being focused just on the knowledge area of security management, the survey has provided a valuable example for Education providers of how to assess and improve their training offering with respect to recognized frameworks and international standards.

Assessing the University curricula against the European Foundational IT Body of Knowledge (fBoK) and the e-CF 3.0 has contributed to a better understanding of the current educational offering in Italy and provided inputs for further improvements. At the same time, the comparison between knowledge areas, competences and educational contents, has allowed to carry out a critical analysis of the European frameworks and their application in curricula design and development.. The survey collected 13 consistent tracks with a strong focus in ICT/Security in universities (bachelor 1, master 7, PhD 1, post-degree 4). That provided a sound set of tracks on which to test the environment. Main findings and evidences from the survey show that:

- Several knowledge areas included in the fBok do not find correspondence in the assessed educational curricula. Based on the opinions of University professors, there are some knowledge areas in which the effort made by Universities is weak if not completely absent. These include, for instance, computer forensics, business continuity management and especially human behaviour/psychology. Efforts in Italy should be enhanced.
- The EU Foundational Bok, as well as the e-CF, are generally considered useful tools to design new curricula on IT Security and to update the existing ones. This result is meaningful especially in regard to the e-CF, since many educational providers find difficult to design curricula based on competences rather than on knowledge.
- Despite the progress made, the granularity of knowledge items and definitions both in the fBok and e-CF is too coarse to be used to design curricula. In order to gain relevance for the Academia, the foundational specs should be based on a richer syllabus.
- fBok cannot be deployed in the same way by different Institutions in formal education. Business schools take poor advantages from the use of the fBok while the IT post master-level degrees can take the highest benefits. In fact, the application of the fBok would allow them to better tailor the outcomes for a well-defined career path (business-driven).

6.3.3 Implementation in Italy (2)

Rationale & approach

There was another initiative concerning the European framework for IT professionalism launched in Italy, by the Fondazione Politecnico di Milano. The Fondazione Politecnico participated as an external expert in the implementation activities of the project on IT Professionalism. In 2015 FPM launched the e-CF Alliance project, an Erasmus+ funded project, aimed at providing a common reference scheme for qualifications and certifications that ensures traceability, continuity, coherence and joint recognition of e-competences. The e-CF Alliance aims to set a stable platform to foster IT professionalism at European and international level. The initial object is the development of recognized and joint IT VET programmes and certifications. This project decided to use the building blocks of the Framework where possible to deliver their study. The common reference scheme hence builds on the e-CF but also the fBOK.

The European framework for IT professionalism is an important step forward in the view of the FPM. Organisations and professionals mainly know and recognize the e-CF. This implementation initiative contributes to a broader recognition of the framework and starts to analyse, at local level, the building block of Training and Certification where so many different experiences exist. For this reason, according to the FPM, building a map of certifications is a very useful step to identify what is needed to further develop the Framework as a way to provide a coherent and complete view of the profession. However, even more important is having the IT associations onboard that will guarantee that the work on the Framework will not finish with the end of the project that built it.

Results: Support to the IT Certification map through e-CF Alliance

FPM supported the implementation of the EU Framework for the IT profession, by providing specific competences, resources and expertise in the field of IT Certification and Qualification map. The overall contribution of FPM in this field is strongly connected with one of the most relevant actions for the implementation of the EU framework in Spain; for that reason some of the activities have been delivered in cooperation with the Spanish stakeholders involved in the project, the Consejo General de Colegios Profesionales de Ingeniería Informática - CCII.

The key role of FPM in supporting the implementation of the European framework for IT professionalism included three main activities:

1. Understanding the state of play of the Certification map

In 2015 FPM launched the e-CF Alliance project, an Erasmus+ funded project, aimed at providing a common reference scheme for qualifications and certifications that ensures traceability, continuity, coherence and joint recognition of e-competences.

The study is built on the state-of-the-art of IT Certification in Europe, which take valuable advantage from EU reports and analyses on e-skills. The general picture of IT Certification coming from those studies still shows a general confusion and misunderstanding concerning the Certification system.

The working group of CEN (European Committee for Standardization) IT Skills Workshop together with representatives of IT industry, VET institutions and universities between 2008 and 2009 described the e-certification market in Europe in the context of e-Competence Framework. The project provided recommendations for strengthening the operations in the market like referring to e-CF when it comes to certification of e-skills, good practices for collaboration between different type of certification institutions (vendor based, VET centers, universities), potential connection between training and education providers. The experts in the project stated that “certification should not be seen as being in competition with traditional education. A new understanding of the market structure sees education, training, certification, and experience as mutually supporting components of lifelong learning and professionalism”.

To date, a variety of initiatives have been launched with a view to simplifying the transparency and recognition of skills and qualifications across Europe. However, the common vision still considers the complex scenario of qualifications and certifications as a “jungle”, with poor information, lack of clarity and often disconnected from national education systems.

Recognized European Frameworks such as the European Qualifications Framework (EQF), ECTS for higher education and ECVET for vocational education and training provide a sound reference for IT Qualifications but are not sufficient to reduce the chaotic scenario of Certifications.

The Spanish Certification map is a first key step to improve the knowledge, comprehension, utilization, and value of IT Certifications for both individuals and organizations. The specific goal of this initiative is to provide a web tool to map IT certifications in Spain.

The first version of the Certification map is mainly addressed to Spanish professionals in the IT sector and companies, certification providers and other stakeholders involved in the IT certification system in Spain. Given the great value of this initiative, FPM is supporting the extension of the Certification map in Italy and other Countries will be involved in the next future to incrementally improve the relevance of results.

To date, the tool adopted for the Spanish Certification map has been translated in Italian and implemented by FPM. First results are expected to be collected and elaborated in the next months.

The tool is accessible at <https://ec.europa.eu/eusurvey/runner/ICTcertificationMap-ITA>

2. Aligning Spanish Certification map to the reference scheme for vocational qualifications and certification

Once the Spanish Certification map will provide the expected results, FPM will be able to provide a significant support by aligning the certification map to the valuable and robust reference scheme of the e-CF Alliance.

The e-CF Alliance aims to set a stable platform to foster IT professionalism at European and international level. The initial object is the development of recognized and joint IT VET programmes and certifications. To this purpose a common reference scheme for joint qualifications and assessment has been developed, answering the skill requirements coming out of the new digital technologies.

This scheme:

- is compliant with the e-CF 3.0 and has been developed for 15 selected e-competences
- includes prior learning recognition (non-formal, informal learning)
- defines assessment and quality assurance indicators
- provides ECVET- and VETQI-based criteria for competence certifications and qualifications

The quality assurance of the e-CF Alliance scheme will guarantee VET mutual comparability and harmonisation of e-skills curricula at EU level to enable IT skilled professionals' and workers' mobility among countries.

Moreover the scheme (the e-CF Alliance Scheme) provides the basis for:

- The design of learning units for e-competences (per proficiency level)
- The development of learning/training content for these units
- The development of certification for each e-competence

The main building block of the e-CF Alliance reference scheme is a set of so called e-Competence Certification Profiles. Each profile can be considered as a concise description aimed at:

- Outlining a role, curriculum, person, certificate in terms of results, outcomes, content etc.
- Containing a mapping to the e-CF

As shown in the following picture, the e-Competence Certification Profile will provide a sound and standardized reference scheme to map IT Certifications against the e-CF.

3. Link IT Certifications to educational and training programs

Looking to a wider perspective, the overall Education, Training and Qualification system, which constitutes one of the key building blocks of the IT professionalism, should benefit from the Certification map. At this aim, a strong link between IT Certifications and Educational and training programs has to be built and further improved.

Educational institutes, training organization and Certification providers usually don't develop their curricula/certifications from a (single) competence perspective. Either they take a subject as their starting point or they focus on the role people want to take on after the certification.

The e-CF Alliance Scheme specifies the learning outcomes per e-competence (subdivided per proficiency level) as a basis for teaching units that can (and will normally) be combined into modules of a curriculum. Such modules will, in the case of vocational Education and Certification paths, be developed according to the need for a certain type of professionals in the labour market.

Defining learning outcomes is hard or even impossible, without providing some additional context indicating where the competence is required and applied. To this end the e-Competence Qualification Profile contains some examples of the roles in which the competence is needed.

Each e-competence also presumes some general knowledge and understanding of the kind of situations in which we find this competence applied, e.g. a general understanding of ICT, some knowledge of related competences and the ability to communicate with colleagues with different competences.

The European Foundational Body of Knowledge provides a definition of such general knowledge. Reference to the Knowledge Areas in this BoK as prerequisite knowledge will reduce the amount of overlap in the development of competence specific learning units.

The high granularity thus obtained will enable training providers to extend the existing school education to help people obtain higher levels of competence by developing their own combinations of learning units with as less as possible repetition and overlap with the competence and understanding people already have acquired. This could make lifelong learning more attractive and effective

The Qualification Profiles will enable the comparison of the learning outcomes of existing training and courses with the competences defined in the e-CF.

The e-Competence Qualification Profiles also enable to link the defined content and learning outcomes to other European standardisation initiatives like the Foundational Body of Knowledge, Professional Profiles of the CEN Workshop on IT Skills and ESCO, the European classification of Skills, Competences, Qualifications and Occupations.

4. Communication

In order to facilitate the communication and dissemination of the e-CF Alliance project as a best-practice in terms of collaboration between projects funded by different DGs, FPM participated to the Conference for the Launch of the European IT Professional Framework, which took place in Brussels on the 6 December 2016.

During the Conference, FPM presented the e-CF Alliance project into the panel session dedicated to the Implementation of the European IT Professional Framework, together with other frontrunners.

Other actions aimed at engaging stakeholders and experts at national and international levels have been put in place to encourage cooperation and synergies between different initiatives and contributions. Among the others, main communication actions include:

- Meetings with Spanish stakeholders involved in the Spanish certification map
- Meetings/workshop with e-CF Alliance project team
- Stakeholder engagement for the implementation of an Italian certification map

6.3.4 Implementation in Ireland

Rationale & approach

The ICS in general is a great ambassador for the European framework for IT professionalism, and basically an adopter '*avant la lettre*'.

ICS is establishing a National Coalition as part of the launch of the Digital Skills and Jobs Coalition on the 1st of December. As part of this the ICS is looking at specific activities which promote professionalism such as developing an industry-supported graduate development programme and seeking to pilot eCF implementation in one or more Irish organisations.

Annex D1.3 includes the action plan for implementation of the Framework in Ireland.

The ICS was very keen on supporting the Framework in many ways, for instance through promoting a survey that was addressed to all IT professionals at their National Day for the IT professional. This event has set an example and is followed up in 2017 by other countries. This Day for the IT Professional is scaling up to a pan-European level.

Results

Inspired by the work of the Council of European Professional Informatics Societies (CEPIS) in particular the landmark study prepared for the European Commission ‘eSkills and ICS Professionalism: Fostering the IT Profession in Europe’, the ICS CPD system has been developed based on research and lengthy consultation with members of the ICS CIO Advisory board, academics and other stakeholders, focusing on what IT professionals need from CPD and what Ireland’s innovative economy needs from IT professionals. This comprehensive input has resulted in a system, that is currently being introduced to 93 organisations with over 2, 000 individuals. The system allows individuals and management track activities as well as engagement with six professional societies in the fields of IT architecture, data protection, IT service management, business analysis, and health informatics.

The system also recognises contribution activities such as mentoring and volunteering in the wider community, reflecting feedback from industry experts on the need for a rounded professional.

The system is currently being updated to include competences from the European e-Competence Framework (e-CF) to allow a clearly-defined structure for both measuring and encouraging professional development that is recognised on a European platform. The development plans also include the integration of a competence framework for soft skills which will result in a system that supports professional development in a range of domains.

The new pathway is the result of long consultations with industry experts, academics and other stakeholders about what IT professionals need from CPD, and what Ireland’s innovative economy needs from IT professionals. The CPD is presented as a unique journey with clear benefits for both professionals and organisations as well as for the profession as a whole. It distinguishes between IT students, IT professionals, and IT leaders to look at their different needs. Finally, it also includes the opportunity to track ‘contributions’ of the professional (e.g. signing up to the ICS code of conduct, research & publishing or volunteering).

According to ICS: ‘In order to bridge the digital skills gap and fill the predicted hundreds of thousands of IT vacancies across Europe, it is essential to have a well-structured, comprehensive CPD system in place, to encourage professionals to keep up-to-date with technological changes and to adapt their skills as the IT domain broadens and changes.

The use of a transnational, e-CF integrated CPD system would advance worker mobility and employee hire across Europe. Many IT professionals qualifications such as PRINCE2, ITIL, TOGAF are universally acknowledged and therefore could be adopted into such a system. ICS is currently working with various training providers to support their recognition within the system, giving users further opportunities for CPD recognition.

European Commission endorsement of such a system, would allow the message for the need for CPD to be communicated to a wider audience, increasing engagement and up-skilling possibilities.

It would be good to have partners from across Europe who have already implemented the e-CF, to pilot the CPD system, so that feedback can be obtained on how the CPD system supported competence development.’

6.4 Overview of implementation activities at supra-national level

Three implementation actions can be characterised as ‘supra-national’ as they do not cover a specific country but benefit a wide audience. These activities also primarily aim to further develop the Framework itself. These actions are:

1. Development of a European Ethical Guidelines v1.0, with support of many stakeholders including CEPIS, and various national professional associations;
 2. Initial collaboration document, and an initial mapping, of e-CF and SFIA – towards a global uniform language, increasing mobility for professionals and employers;
 3. Adoption of the European framework for IT professionalism by the ASL-BISL foundation – one of the Services Libraries, or specific Body of Knowledge. With the aim of aligning the Framework with the services that this specific knowledge foundation offers. And also as a first step in convincing other foundations (ITIL etc.) to follow the same path – and hence creating uniformity and a common language for each role in IT;
- These initiatives are further described in the following paragraphs.

6.4.1 Development of European ethical guidelines

Rationale & approach

Ethics is one of the four core components of the European IT Professional Framework. While within the other building blocks models or instruments already exist to support the broader Skills-stakeholder environment – such as the e-Competence Framework – this is not the case for the Ethics building block.

Already early in the project, multiple stakeholders indicated the importance of these Ethical Guidelines. Together with CEPIS a workshop was organised, where the design principles and approach to these Guidelines were shared with experts in the field (with great support from a variety of experts and organisations such as CCII). Building on the feedback, and an additional review round, this eventually lead to the presentation of a first version of these European Ethical Guidelines at the Conference on Fostering IT Professionalism (on 6 December 2016).

Various countries and organisations have a code of ethics but a common European guideline on ethics to refer to is missing. It would complete the European framework for IT professionalism and could be used by organisations lacking a code to build one, while at the same time promoting social responsibility in IT. There is no clear common understanding of the word ‘ethics’, but in general it is about the way the tasks are performed and the relationships established with employees. In order to be successful, it should be easily understood by everybody from any sector. The suggestion was made to refer the European Ethical Guidelines to avoid possibly existing negative connotations that ‘Code’ or ‘Charter’ could have.

From the workshops and interviews it became clear that an individual’s attitude to his or her work is of importance. This goes beyond a code or guidelines. The point is to provide professionals with a structure which allows them to take correct decisions and actions in different circumstances. There is a distinction between responsibility and attitude.

Furthermore, it is necessary to underline the clear distinction between societal ethics and self-confidentiality of the professional. IT Professionals are not always independent professionals but they work within organizational structures which also influence their conducts. Therefore, the nature of the organisation as well as the assessment of the organisational culture and its ‘ethical maturity’, are preliminary to any evaluation of the individual dimension.

Composing this first version brings the opportunity to communicate about it, and create awareness with private sector and professionals as regards an ethical attitude towards their work. It was mentioned during one of the workshops that the next generation expects to get things for free – and this is not how it works. Both computing curricula in schools and universities, as well as broader communication campaigns could address this attitude and contribute to changing it on the longer term.

Another element that is of importance is to ensure that, in the words of professor Rogerson¹⁶⁸ ‘a Code accounts for global common values and local cultural differences’. This is especially relevant as the European Ethical Guidelines should be in line with existing national and organisational codes. It should allow for a certain flexibility for ‘adopters’ to enrich or specify it depending on whether it is meant to serve within a specific IT domain/occupation or in a broader context of IT professionals. The European Ethical Guidelines could also develop a reference function, as for specific fields, specific norms are practiced. One of these fields likely is the security domain, where development of ethics training and a set of principles around security and the ethical conduct for security will be a mechanism to assist education of the IT industry as well as a platform to open the debate with society¹⁶⁹.

Creating European Ethical Guidelines as part of the European framework for IT professionalism should hence take into account how these elements can be incorporated. It can be successful only if well embedded in the other building blocks of the Framework.

Results

This activity was taken up by the **CEPIS’ Taskforce on Ethics**, and with the aim to support the further development of the European IT professional framework, a first version of European Ethical Guidelines as well as concrete recommendations on the adoption and the use of the guidelines in practice is now released.

These guidelines set out basic principles which are expected from Statements of Professional Ethics for the IT Profession in Europe. They are intended to be applied to both the direct actions of the professional and to the indirect actions i.e. the automated actions of the technologies implemented by the professional.

Observance to a Statement of Professional Ethics that is compliant with these principles confers an obligation to satisfy these principles or, failing that, to explain why at the earliest possible opportunity.

The creation of compliant statements of Professional Ethics brings with them the need to promote a practice of continuous compliance and periodic re-evaluation, in strong preference to a practice of periodic compliance via audit. This way, such statements become the basis for ensuring that the highest levels of Professional Ethics are obtained.

The creation of a European framework for IT professionalism, and with it a framework for IT Professional Ethics, creates a need to provide suitable supports. Such supports are intended to include:

- Promoting the highest levels of Professional Ethics, in industry, among Professionals and professionals, and to society and the public.
- Assistance for the professional in trying to address problematic areas, including “safe spaces” where ethical issues can be discussed

¹⁶⁸ Rogerson, S., Aspects of Social Responsibility in the Information Society, in: Doukidis, G.I., Mylonopoulos, N.A. & N. Pouloudi, A. (editors), Social and Economic Transformation in the Digital Era, IDEA Group Publishing, Chapter 3, pp 31-46, 2004

¹⁶⁹ IP3, GIC 2020 Skills Assessment, produced by GIC Directors 2015. Available online here: <http://ipthre.org/wp-content/uploads/GIC-2020-Skills-Assessment-August-2015.pdf>

- Educational support to prepare professionals to address ethical areas within their professional environments
- Case studies and other educational resources to help develop professionals' expertise in considerations of Professional Ethics.

The framework acknowledges that there are limitations. Professionals, no matter how expert, nor how highly trained, are nevertheless human beings working in human environments; "to err is human". Ethics itself is not static; it evolves to reflect changes in cultural norms and technological challenges; this evolution itself drives the need for continuing education and development for professionals in Professional Ethics, as well as for professionals to contribute appropriately to the discussions that are involved in that evolution.

This report recommends that procurers of IT services and systems should require that the relevant implementing professionals have an explicit, validated statement of adherence to a code of ethics/conduct/practice that is compliant with these European guidelines.

There are four general principles of professional and ethical conduct which forms the basis for any statement on Professional Ethics. These principles recognise that activities of a professional nature impose specific duties on professionals; these are to serve:

- the interests of the public and of society
- the employer or client
- the informatics profession
- the professional practitioner.

These duties imply particular requirements that need to be observed by professional informatics professionals, and which need to be incorporated into any compliant Statement of Professional Ethics along with appropriate guidance.

Sometimes these principles may find themselves at odds. It is the skill of the IT Professional to apply expert judgement in achieving the most appropriate balance, or to advise where an appropriate balance cannot be found.

We are delighted that CEPIS has shown the commitment to lead this action and came forward with a first version of the European Ethical Guidelines. The complete document is included in Annex F.

6.4.2 Mapping of e-CF and SFIA

Rationale & approach

Both e-CF and Skills Framework for the Information Age (SFIA) are highly valued, well recognised international frameworks that describe skills and competence for the IT profession. This project marked an important step towards closer alignment of two major IT competency models that have similar goals in providing a common language to describe the requirements of IT professionals, and hence meeting private and public needs. The ambition of both the SFIA Foundation and the European Commission is to bring these frameworks closer together. Discussions have been taking place around how best the SFIA and e-CF should complement each other and interoperate.

During a constructive workshop with key experts of both frameworks a first discussion developed and lead to a concrete outcome that carried support of all involved. All participants agreed on the first actions to be taken:

- Establishing a working group consisting of several experts of SFIA and e-CF who, based on existing mappings, will determine how both frameworks should be connected to each other. It would lead to proposing one mapping as preferential. Representatives from CEPIS, BCS, AICA, CEN, Open Group and IFIP/IP3 volunteered.
- This working group should take into account how the frameworks are used in practice. This would provide important input to further design a roadmap and ensure careful communication towards users.

It would make life easier for global organizations that now map their career frameworks to both models. James de Raeve, vice-president certification of the Open Group, said that the Open Group has to sustain two mapping which is time consuming and costly¹⁷⁰. He also made clear that at the moment there are various mappings, of different quality, and it is unclear which one to use. Everyone using both frameworks at the moment would benefit by providing clarity in this regard. He also referred to the fact that both frameworks do not have to compete – but are in certain areas complementary. SFIA describes skills in 7 proficiency levels, where the e-CF describes e-Competency proficiency levels as opposed to skills levels. The e-CF on the other hand focuses on competences rather than skills, and could enrich the SFIA model. The challenge is to make them fit together. An example of this could lie in the professional certification.

In working towards a common solution, it is important to ensure a smooth transition to allow users to adapt to changes coming from updates in SFIA and e-CF. One of the early users of e-CF clearly stated that ‘a rapid major change is not preferential as it would require the organisation to consequently adapt too’.

An example of how e-CF and SFIA are used together to create a National Skills Framework in Tunisia

Benefits from the evolution of the two Frameworks could be naturally achieved at global level, as the Tunisian experience shows. In the past three years, one of the most important challenges in Tunisia was to create skilled IT jobs and foster the employability rate of the sector. In fact, according to the Offshore Strategy 2020, Tunisia’s market share in the IT has the potential to double in a decade which may allow it to create around 150.000 jobs. However, despite the favourable ranking of Tunisia in terms of attractiveness, the country is still affected by the lack of alignment between job market and Education in the IT field. Considering this gap, the World Bank Group, in cooperation with the Tunisian IT Federation, has launched an initiative which aims at setting up an IT Observatory and a Qualification framework. To this end, a first assessment of international Frameworks (e-CF; SFIA) together with existing standards in Tunisia, was carried out to design the Qualification and Competence Framework of the IT sector. Both the e-CF and SFIA Framework have been mapped to gather the most valuable elements, in line with the Tunisian context and the design principles. The final result is a National Framework made of **46** technical competences, **13** Soft Skills and **5** proficiency levels. In addition to this, starting from a list of 157 jobs, **25** job profiles have been described following the European job profile family tree.

Results

The first task is to identify how the current versions of the framework are aligned to each other. A proposed mapping methodology is drafted and shared with experts from both frameworks. This mapping methodology was also used to produce a draft mapping for discussion among the group. This exercise covered SFIA version 6.0 and e-CF version 3.0. Both of which are the current versions available. Until now the two frameworks have followed independent development paths. They are constructed using different architectures such as levels, definitions and levels of detail. The process for mapping the two together is therefore not straightforward and relies on an amount of interpretation. The final agreed mapping is to be published on both the SFIA and e-CF websites and used as the basis for describing the relationship between the two frameworks.

¹⁷⁰ Existing mappings by the Open Group are available from the bookstore, free of charge, at: <https://www2.opengroup.org/ogsys/jsp/publications/mainPage.jsp>

The process for developing the next versions of SFIA and e-CF are (by chance) at the early stages of discussion. It was agreed that the key to closer alignment at this stage is in the definition of the levels. This does not necessarily mean that the frameworks change their respective numbers of levels but that there could be closer alignment in how they are defined. This should be considered further in the next iteration of each framework. Closer alignment, including development timeframes and content maintenance could then evolve over time so that process causes minimal disruption the respective user bases.

The 3rd project workshop consisted of a meeting of this working group, and included preparatory working document that was initiated by the **BCS, The Chartered Institute for IT**. This document was further reviewed and is included in the annex G of this report. The original working document also included a mapping of e-CF and SFIA, which will be further reviewed once the TC428 initiates the activities concerning the update to e-CF 4.0.

6.4.3 Adoption of the European framework for IT professionalism by ASL BiSL foundation

Rationale & approach

The European IT Professional Framework includes instruments like the e-CF and Foundational IT Body of Knowledge that are reference models. The fBOK for instance describes elementary knowledge in all areas of the IT profession, and then refers to other specific bodies of knowledge for further specialisation. These specific bodies of knowledge are usually kept up to date with the latest accepted insights and trends by specific knowledge foundations or services libraries.

A very important step is to achieve uniformity and consistency between the Framework and its components and other related sources of knowledge and competences. This project initiated the alignment between one of these knowledge foundations (**the ASL BiSL foundation**) and the IT professional framework, with the aim of encouraging other foundations that represent many of the other knowledge areas (of for instance project management, architecture, testing etc.) to follow the same path – and hence creating even more uniformity and a common language across the IT profession as such.

The support of ASL BiSL Foundation as an early adopter could accelerate take-up of the Framework by other Knowledge Foundations while at the same time further maturing and developing it.

Results

Introducing the ASL BiSL foundation and its work

ASL BiSL Foundation has managed key ideas of the Application Services Library (ASL®) and Business Information Services Library (BiSL®) for several years, and is now developing them further. In doing so, it is seeking to bring business and IT closer together. The supply of information – perhaps by its very nature – needs to take place via an integrated chain. The Foundation is relatively young, as it is covering one of the new domains in IT, and is expanding its presence and knowledge and experience in this field further into Europe and other parts of the world (Canada, USA, Japan, China, and Russia). It is now introduced in 30 countries.

Business Information Management is an organisational capability that helps enterprises to realise short-term and long-term business goals by obtaining access to, and ensuring effective use of, valuable information and IT¹⁷¹. Information systems and related applications have a long shelf life. Constant modifications are making these systems increasingly complicated and expensive to manage and renew. Control of IT processes is crucial.

¹⁷¹ Smalley, M, The making of the Business Information Management Manifesto, White paper, 22 February 2016, .Available online via: http://aslbiisfoundation.org/?wpfb_dl=1147

ASL BiSL Foundation is a meeting place for professionals with a common interest. The Foundation encourages the improvement of working methods and the exchange of best practices. The experience of others helps to improve management processes within each organisation. And each organisation's own experience helps other companies. The result should be an improvement in the quality of the overall service provided industry-wide.

The value add for the European framework for IT professionalism

The European IT Professional Framework includes instruments like the e-CF and Foundational IT Body of Knowledge that are reference models. The fBOK for instance describes elementary knowledge in all areas of the IT profession, and then refers to other specific bodies of knowledge for further specialisation. For instance, application design and development is a key part of the knowledge area of Software design and development. ASL is a specific body of knowledge that covers this topic extensively¹⁷². In August 2015 an international standard for application management based on ASL is published: the ISO 16350. This proves the international recognition of ASL's body of knowledge. For a next version 2.0 of the fBOK however it is essential that specific Knowledge Foundations such as ASL BiSL Foundation – but also others like ITIL, Prince, IPMA and the like – review the current version and map it to their own specific body of knowledge, with the purpose of a) improving both bodies and b) aligning them. At the same time, it is important for the ASL BiSL Foundation to work according to internationally accepted standards and terminology.

Concrete actions that ASL BiSL Foundation took up to align with the European framework for IT professionalism

Already at the first meeting concerning possible collaboration, the Foundation responded very positively. Follow-up sessions resulted in the following possible actions:

- Selecting e-CF competences to complete profiles of the Application Manager and the Business Information Manager – that are typically roles ASL BiSL Foundation distinguishes. This would lead to profiles that are in line with the Framework and could be used for upcoming updates of e-CF.
- Mapping of the BiSL Foundation certification and ASL Foundation certification to the fBOK.
- Provide feedback and recommendations for version 2.0 of the fBOK.
- Based on current training programs, certification from ASL BiSL Foundation, and the existing curriculum for AM/BIM within Capgemini, it is possible to describe the typical career path of both profiles.
- Exploration of how the to-be-developed European Ethical Guidelines could be applied within the ASL BiSL Foundation and its community – perhaps through the IT Manifesto that was designed by the Foundation last year.

The report-out on the actions already completed can be found in Annex H.

6.5 Lessons learned from the implementation

In the context of this project, the main goal of the implementation is to propose concrete solutions to bring clear added value at EU and international level by ensuring a broad support for a successful longer term implementation of the European framework for IT professionalism. With this goal in mind, outputs and results provided by the different initiatives in Spain, Italy and Ireland, together with the other specific initiatives,

¹⁷² Pols, Remko van der, ASL®2, Framework for application management, Van Haren Publishing 2012. See more information on <http://aslbisfoundation.org/2009-asl-2/>

represent the most visible benefits of the implementation actions as they support concrete actions and innovative approaches for strengthening the IT profession.

However, if we consider the implementation as a continuous process for the development, usage and further improvement of the Framework, lessons learned, coming from the initiatives, are even more relevant and valuable than concrete results. Indeed, if results are specific of the action that produced them, lessons learned, for nature, can be applied to different context and actions, as they put in evidence the principles, which can be actively taken into account for future initiatives.

In order to facilitate the implementation of the IT Framework in other countries and support stakeholders in launching similar initiatives we report, in this section, the key lessons learned from implementation, which are common to the involved frontrunners.

Lessons learned 1: Main benefits provided for users and stakeholders

Stakeholders involved in the implementation actions agree on several benefits they achieved, independently from the specific goals of the initiative.

- At a general level, implementation actions contribute to spread the framework, providing a better understanding of its purpose and components. Lack of awareness about the nature and usage of the Framework is one of the main barriers to the adoption of the Framework itself.
- At a more specific level, implementation actions encouraged a deeper assessment of single building blocks. The result of this effort is a clear map of the state of play at local level.
- Based on this initial understanding, stakeholders could more easily identify what is needed to further develop the framework as a way to provide a coherent and complete view of the profession.
- Thanks to the strong link between the four building blocks, benefits coming from a single initiative can positively affect different building blocks and different target groups.

Lessons learned 2: Key success factors of the initiative and the potential barriers

- According to the involved stakeholders, a key success factor is the credibility of those who launch the initiative. There are many players managing projects and tools concerning the IT profession. It is very important the IT Professional Framework and any related initiative is perceived as “public” and “official”, promoted by the European Commission, in order to ensure the real support of IT professionals and other stakeholders involved. A reliable and non-profit IT professional entity at national level, trusted by national government and stakeholders is a key success element to promote and consolidate initiatives in the IT Professionalism scope
- Another key success factor is related to the object of the implementation: looking at the different initiatives, sharing a European set of definitions and standards is perceived as a plus, in most cases. Indeed, one of the main issues concerning the IT professionalism is the high level of terminological confusion and undesirable effects it causes.
- Finally, a key success factor to be considered concerns the methodological approach of implementation: all initiatives have been developed based on research and lengthy consultation with members of different stakeholders group, focusing on what IT professionals need. Stakeholders engagement and a participatory approach are required to ensure high commitment at all levels.
- As a consequence of the previous point, another key success factor is the relevancy of the action. No initiative produces successful results if it is not able to keep the attention of its target. All implementation actions carried out in the three selected countries met the real needs and interest of their target by providing pragmatic solutions

Lessons learned 3: Recommendations to further scale up the initiative

- It is very important that authoritative IT association in different country recognize the Framework and adopt it. The first practical action, after adoption, should be trying to answer the question: “what is the state of play in my Country?”
- At this aim, the first recommendation is to start deeply understanding the IT Framework itself. It is very important to adopt this common view before starting to implement. It is time to start reducing the complexity and variety and to work on the same direction, even at national level.
- In general, a gradual approach to implementation is suggested. Adopting and testing the Framework on specific a context ensure higher flexibility and allow more rapid changes and improvement, if required.
- Monitoring the results of implementation hints to a correct mix of suggestions/actions that leverage from the four "building blocks".
- Organizational and financial resources are required for setting up and promote implementation. In the absence of a sufficient budget needed to roll-out initiatives at national level, promotion through allied initiatives is suggested.

More generic recommendations and guidelines to implementation will be described in the next section.

6.6 Guidelines to implementation

The approach that was taken in this project to initiate implementation of the Framework in several countries is quite similar to the process to start implementation in a country. The essence of this process is engaging and managing a complex stakeholder environment in order to achieve sustainable results.

We distinguish the following steps:

1. **Framing the assignment.** The important question to answer in the first phase is who the stakeholders are and what the aim of bringing them together is. The focus in this phase is on ambitions, values and commitment. During this project the challenge is clear: to work towards implementation of the European framework for IT professionalism. Therefore, it is important to engage a broad range of stakeholders that are directly or indirectly involved in this field. All types of stakeholders need to be represented to look at this subject from different angles. The differences in interests and expectations should be openly discussed and aligned to formulate a common goal. The output of this phase should be commitment from stakeholders on the common goal, objectives and general approach.
2. **Focusing the direction of efforts.** The second phase is focused around prioritisation together with the stakeholders involved. Together it should be decided which activities should be performed first to reach the common goal that is formulated during the first phase. It is also aimed at creating a plan where the required people are linked to specific activities of the project. Other people or resources that might be needed will be identified. The communication between stakeholders and from the project team to the stakeholders is also an important subject to discuss. At the end of the second phase it should be clear to every stakeholder what the approach will be to roll out implementation of the Framework, their roles during the next phases of the project and what it requires from the participating organisation in terms of time and efforts. Basically: a roadmap and action plan.
3. **Mobilisation of the implementing teams.** The third phase is less theoretical, but more practical. The activities as discussed during the previous phases need to be executed by the people assigned to those actions. The European framework for IT professionalism will be tested by doing so, and this could lead to constructive feedback and recommendations for improving or further developing (building blocks of) the

Framework. The implementation activity in Italy for instance illustrates this. The project team will need to be actively engaging the teams/experts that are responsible for the defined actions. Sharing success stories early in the process will stimulate commitment.

4. **Sustaining the implementation.** This final step consists of continuous monitoring and knowledge sharing in order to further develop the implementation actions, and is specifically aimed at securing the outputs and removing barriers for a sustainable result. It consists of dissemination and promotion, but also of evaluation and sharing of lessons learned. It could also provide recommendations for further follow up, and hence the start of a new cycle.

The above can only work as long as there is a central coordinator or project team to manage this process carefully. Key feedback from for instance CCII in Spain concluded that successful implementation requires a strong, 'neutral' and dedicated organisation to ignite the process and trigger action along the way.

Some further explanation of elements in these steps are described in the following paragraphs – which include lessons learned and captures from this project.

6.6.1 Framing the assignment

The important question to answer in the first phase is who the stakeholders are and what the aim of bringing them together is. The focus in this phase is on ambitions, values and commitment.

Mapping and involving the different stakeholders from the start of an initiative will prevent difficulties or misunderstandings later on. It is important that all stakeholders get an opportunity to collaborate on the design of the activities within the initiate and are offered space for their own vision, ideas and views.

The formulation of the scope of the initiative, mapping all the different stakeholders and the creation of a support base and commitment with the stakeholders are preconditions for a successful start of the initiative. Stakeholders should be intensively involved in the first phase of the activities to get them on board for the execution phase as well.

Logically speaking, a stakeholder mapping to identify which groups to involve is the first step. The next step is to prioritize the different stakeholders by plotting the analysis on a stakeholder map. This will provide the input to determine a stakeholder engagement strategy. Various instruments could be used here to attract and engage stakeholders (conferences, workshops, seminars etc).

In general, there are four steps to stakeholder mapping:

1. *Identify stakeholder groups*

Identify the complete set of internal and external stakeholder groups. Clarify the objectives of the project, identify the required changes and resources and list the key stakeholders.

2. *Evaluate importance*

Determine the criticality of the alignment of each stakeholder group by evaluating the potential impact on the project's success. Identify the power base of each stakeholder (primary target, secondary, tertiary) and estimate the impact of each stakeholder on the project's success.

3. *Evaluate relationships*

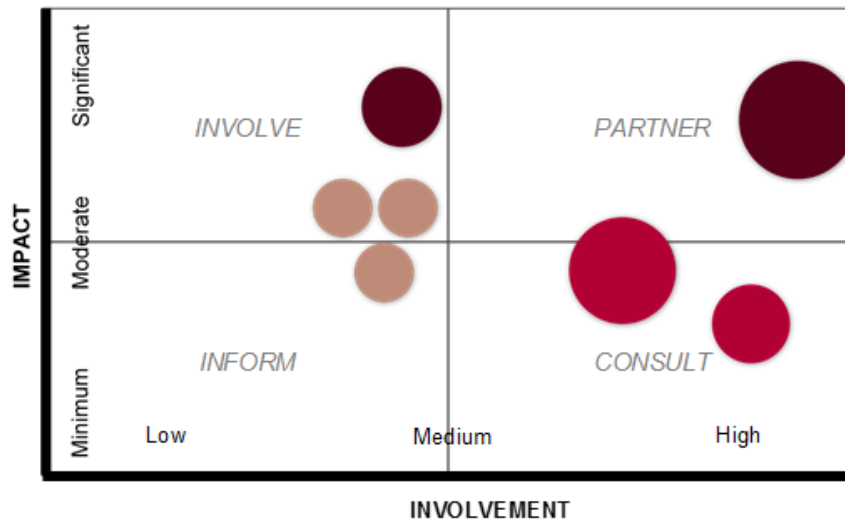
Understand the relationships between the stakeholder groups. Assess the relationships between the identified stakeholder groups.

4. *Evaluate level of involvement and alignment*

To what degree are stakeholders aligned and involved with the change programme. Evaluate level of alignment and hot buttons. Evaluate level of involvement.

These evaluations can then be plotted on a stakeholder map of which an example is shown below.

Figure 27: Example of a stakeholder mapping



During this project the challenge is clear: to work towards implementation of the European framework for IT professionalism. Therefore, it is important to engage a broad range of stakeholders that are directly or indirectly involved in this field. All types of stakeholders need to be represented to look at this subject from different angles. The differences in interests and expectations should be openly discussed and aligned to formulate a common goal.

The detailed objectives need to be agreed upon by the stakeholders: they should be SMART - Specific, Measurable, Attainable, Relevant and Time-bound. Goals need to be specifically defined so when the communication strategy is being developed, there is a consistent message put forward by the study. Similar to defining the goals, defining the means of communication needs to be agreed upon before the initial plan is being created. This will ensure that everybody is on the same page and moving in the same direction. Moreover, objectives can be easily monitored and evaluated if they are detailed clearly and action-centric.

To make the efforts tangible, the communication strategy needs to be complemented by an Action Plan that details the target groups addressed by the various communication channels.

The output of this phase should be commitment from stakeholders on the common goal, objectives and general approach.

6.6.2 Focusing the direction of efforts

This phase is focused on the prioritisation of actions with the stakeholders involved. Together it should be decided which activities should be performed first to reach the common goal that is formulated during the first phase. It is also aimed at creating a plan where the required people are linked to specific activities of the project. Other people or resources that might be needed will be identified. The communication between stakeholders and from the project team to the stakeholders is also an important subject to discuss. At the end of the second phase it should be clear to every stakeholder what the approach will be to roll out

implementation of the Framework, their roles during the next phases of the project and what it requires from the participating organisation in terms of time and efforts. Basically: a roadmap and action plan.

Generate potential solutions for implementation

This step aims at generating a long list of potential solutions, and then prioritising actions. The focus here is on identifying a significant number of potential solutions to be considered. In this stage there are no bad or impossible ideas, as should be the case in a proper brainstorming phase. The only requirement is that a solution addresses one or more of the four building blocks, or the Framework as a whole.

The process of generating potential solutions started early on in this project and has seen an extensive list of solutions that can be considered. This long list is included in Annex I.

Select solutions for implementation

After identification of concrete solutions on the four building blocks, these solutions could be evaluated against requirements in terms of being simple, demand-driven, pragmatic, scalable and sustainable.

- **Simple**

The balance of simplicity and complexity is relevant in all business and technology fields. John Maeda, professor at MIT University, defines: "Simplicity is about subtracting the obvious, and adding the meaningful".

For the scope of this work, the level of complexity of the solutions to be chosen and implemented will be balanced with the actual goals to be achieved and gaps to be filled, without overloading and oversizing the scope of each of them. The pursued simplicity of the solutions will receive added value and further enhancement through the interactions and synergies developed across and through the building blocks of the European framework for IT professionalism.

- **Demand-driven**

In manufacturing, a demand-driven network is a method of supply chain management which involves building supply chains in response to demand signals.

In the context of the European framework for IT professionalism, it becomes a fundamental requirement for individuating and choosing potential solutions. A proactive response is required for aligning the solutions to the IT dynamic marketplace, in terms of managing, selecting and shaping a mix of initiatives, activities, channels and stakeholders. Furthermore, deviations caused by internal or external events must be taken into account, based on the analysis of multiple scenarios and multiple demand forecasts.

One of the main outcomes of a demand-driven approach is the skills matching between the supply and demand of IT professionals. Examples of efficient good practices already implemented are: German Dual Apprenticeship System, UK Apprenticeship Vacancy Matching, and the EURES Job Portal tool.

- **Pragmatic**

In order to achieve the scopes of the tender, the solutions presented will be analysed and evaluated from a practical point of view, focusing on concrete results and consequences on the real-world scenario. Theoretical approaches and analyses are already in place for several topics, our goal will be also the conversion and enhancement of such initiatives in order to achieve the related practical expected outcomes.

- **Scalable**

The concept of scalability can be related to all technological and business fields. It is defined as the ability of a system, network, or process to be able to handle growing volumes in a capable manner.

In our approach to the development of the European framework for IT professionalism, the analysed solutions must fulfil this requirement in order to be adapted to the multi-layer and multi-dimensional context. In fact, the implementation of the proposed programmes must be consistent, efficient and effective both at national and international level.

- Sustainable

The concept of sustainability is derived from the Latin '*sustinere*' (i.e.: to hold). Sustain can mean "maintain", "support", or "endure".

Here sustainability is intended as the set of strategies that make it possible to use available resources to their best advantage. The use of resources should be both efficient and responsible, and likely to provide long-term benefits. The solutions proposed for the development and implementation of the European framework for IT professionalism will be justified from an economic point of view through different methodologies and networks of financing. One key objective will be the identification of areas in which resources are not being utilised in the most efficient manner, in order to take steps to correct the situation. At the same time, future scenarios will also be evaluated due to the dynamic nature of the sector, in order to ensure long-term sustainability and potential future developments of the framework. The strategy will include a cross-sector coordination, involving key stakeholders at national and European level.

Of course there is a need to discuss these solutions with the aimed countries where the implementation can start. That is why we involved many stakeholders from these countries at an early stage of the project (via interviews and workshops) as they are the best able to estimate what is/is not feasible, and to match the activities to their own (strategic and implementation) agenda's. Their commitment is pivotal to ensure continuity after this project ends.

Commitment: a clear mandate to operate required.

Most critical criteria is that implementation will require political will and commitment for the national stakeholders, which is a process that can take some time. For this reason it is advisable to start the implementation with the organisations that are very clear on this. This step should also see to plan for the resources required.

6.6.3 Mobilising and sustaining implementation

When mobilising and sustaining the implementation activities it is important to understand the progress being made, and to be able to communicate and steer.

Continuous monitoring and knowledge sharing to define clear and measurable goals collectively to ensure acceptance and understanding of the KPIs. KPI's are an actionable scorecard that keeps your strategy on track. They enable you to manage, control and achieve desired business results. The KPIs have to credible, measurable and relevant metrics to measure achievements against a set of objectives over time. KPI's imply causality between the goal, the actions taken and the expected impact. So we're after statistics that reliably reveal cause and effect. These have two defining characteristics: They are persistent, showing that the outcome of a given action at one time will be similar to the outcome of the same action at another time; and they are predictive—that is, there is a causal relationship between the action, the statistic measures and the desired outcome.

Building on the above, KPIs need to be credible, measurable, relevant, and easy to understand and positioned into time. A five step approach could be followed.

- Step 1: Define your goal: be specific, look at how this goal can be achieved. For e.g. to increase awareness around the project and engage beyond the usual supporters
- Step 2: Define your performance metrics: identify measurements that are important in achieving your objective. For e.g. To have 120 participants attending the event in Luxembourg. Or for e.g. to have 3 countries live per use case by the end of the project, with at least 3 countries live per use case in the first wave.
- Step 3: Define your frequency: determine periodicity and timing of measurements to show progress overtime in achieving your objectives.
- Step 4: Conduct measurements: collect the data required within your metrics.
- Step 5: Assess progress: explore causality between actions and realization, identify room for improvement.

7 Recommendations

The conference on IT Professionalism on 6 December 2016 in Brussels (<http://ictprofessionalism.eu>) confirmed the importance and the relevance of the European framework for IT professionalism, as well as the general need to take action to further mature the IT profession and reduce the skills gap.

The work on this IT professionalism framework will hence not stop here, with this brochure. It will continue. It will be fostered by relevant communities such as the European standardisation Committee (CEN TC 428 on digital competences and ICT professionalism and the CEN Workshop on ICT Skills) as well as the Digital Skills and Jobs Coalition launched by the European Commission on 1 December 2016 as well as the European e-Skills Association and the IT Professionalism Europe (ITPE) network etc.

It will also be further promoted by the organisations in countries where implementation took off during the course of our work in 2016: Spain, Ireland and Italy. In the coming years the framework will be implemented by other Member States and several countries outside of the EU have shown strong interest. These developments offer a great opportunity for the future of the IT profession.

The European Commission will further support IT Professionalism in the coming years and strengthen the synergy between IT professionalism and the successful digitisation of organisations (industry, SME's, public administrations etc.).

The strong collaboration between all stakeholders involved will enable successful development and implementation of the IT Professionalism Framework in Europe and beyond.

With the aim of achieving this, we also recommend the following:

On continuously improving the European framework for IT professionalism:

- Encourage an open dialogue with users of the Framework, and with non-users, to ensure lessons learned are captured and consolidated, and followed up quickly in a transparent manner. A single point of access would be the place to initiate a community and store feedback.
- More concrete implementation actions, by more countries than currently on board, are required. Building on the revitalising of the Grand Coalition, new pledges would ideally be in line with and contribute to the Framework.
- Following the example of ASL-BISL Foundation, triggering other knowledge foundations to take-up the Framework would also help to further mature it. These foundations hold the most up to date specialist knowledge and set-up certification for these areas of knowledge. They could support further development over time – for instance regarding the Foundational Body of Knowledge, job profiles or specific ethical guidelines – and ensure these standards and instruments stay up-to-date.
- Building on the Ethical Guidelines, further explore establishing a voluntary register at European level where professionals can acknowledge the guidelines in order to increase transparency and accountability¹⁷³.

¹⁷³ We understand the sensitivities in this recommendation and would like to express that the recommendation is about exploring options to increase understanding of pro's and con's and current tendencies in EU countries (and globally). At least in the Netherlands such register is initiated, in other countries we've heard similar ideas.

On ensuring coordination between ongoing activities and sustainability:

- For the instruments that are part of the Framework and are published as standards (e-CF), the responsibility for updates lies with the CEN TC 428. The instruments that are part of the Framework but not (yet) published as standards (Foundational IT Body of Knowledge) will be fostered by the CEN Workshop and also by other communities such as the ITPE network. These communities will also have to align with developments taking place in other fields, such e-Leadership and KETs.
- Pivotal to its further development, there is a need to remain responsive to what's happening in practice and to be able to update the Framework when needed. All building blocks of the framework will need further development (into standards, or towards updates of the standard) and this requires diligent coordination. We believe this network should have a dedicated coordinator acting as an engine.
- A central coordinator of the responsible communities could also be made responsible for ensuring coherent and consistent communication towards stakeholders (education, professionals, young people etc.).

On sustaining collaboration with other parts of the world:

- Extend international collaboration to ensure further alignment of the Framework with parallel developments in other parts of the world (notably with Canada, USA and Japan, but also others) - at least to exchange knowledge and experiences, but possibly also to further align and map existing standards/frameworks and to come to joint statistics on the key indicators that indicate state of play. An International Sounding Board for IT professionalism could be established as a network of international – and committed – experts in the field.

On promotion of the European framework for IT professionalism:

- Appoint a clear owner that is responsible for the continuous promotion of the Framework with the aim of creating higher levels of awareness amongst stakeholders and increase take-up in practice.
- Set up one single point of access to all information, instruments, tools and policies concerning skills required in the Digital Economy. Not just IT professionalism related content and tools, but unlocking also materials concerning e-Leadership and KETs. Again, this requires to indicate a clear owner. In our view this could either be the Commission (or a delegated partner) or the European representation of IT professionals (i.e. CEPIS). A well-known platform or observatory would stimulate further promotion.
- A European Day for the IT professional could support the above actions; ideally it would be a Global Day for the IT professional that would run from Japan through all time zones to the United States.

Appendix A: Demand and Supply Skills Model

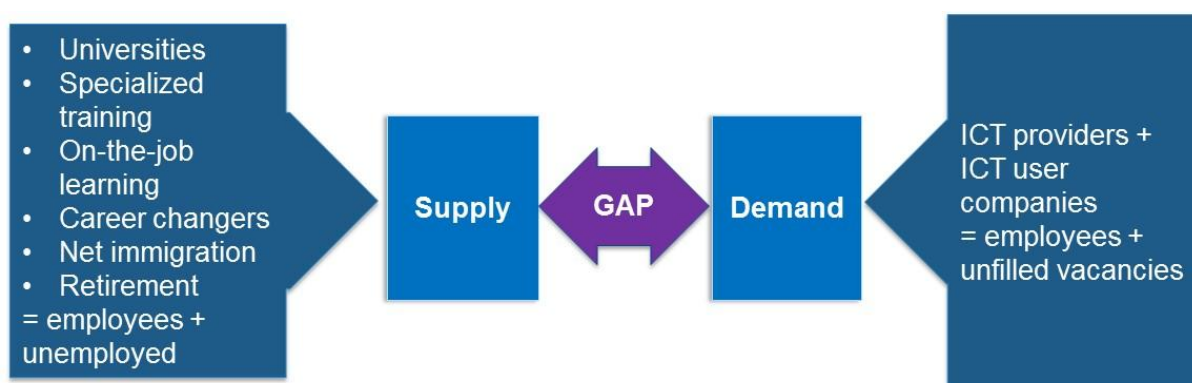
The demand and supply skills model applied in this project is result of the extensive work done by IDC and empirica, since 2009 to develop a consistent methodology for sizing and forecasting IT skills. This section provides an overview of the dynamics of the model in developing the data.

A.1.1 Methodological Approach

The forecast model is based on the following steps:

- **Development of baseline data for the year 2015**, which is the starting point for the forecast model. It is based on existing, consolidated data and presents the demand and supply of IT professionals (and their resulting balance) for the three main EU countries (France, Germany and the United Kingdom) and for the EU28. In addition, the model was extended also to Japan, Canada and the USA. The baseline data for is the starting point for the forecast model. The baseline model structure is based on the following equations:
 - Demand = **realised demand + excess demand**.
 - Supply = **realised supply + excess supply**.
- **Applying the forecast model**, estimating the correlation between the demand and supply of IT professionals for the period 2016-2020, including the main inflow and outflows parameters:
 - **Forecast of supply**: new market entrants come from computer science graduates entering the labour market as well as other graduates who possess the IT skills demanded. Also, career changers originally coming from a non-IT background may enter but also re-entrants who had been out of the labour market previously. Finally, immigrants may be a source of additional supply in the market. In addition, exits from supply can also include career changers, emigrants, and retirements.
 - **Forecast of demand**: the development of the demand forecast takes into account expected economic growth, estimates of future IT spending, impact of “IT delivery models” such as offshoring and cloud, and wage levels.

The following figure shows a simplified outline of the IT workers demand and supply model.



Source: IDC and empirica, 2016

A.2 IT Core Skills Definition

Since the start of the IT industry in the 1960s, the usage of IT has spread dramatically and the technologies that are adopted have developed in rapid speed. IT has changed from being mainframe centric, insular environments to spreading across organisations with access to computing power for employees in different

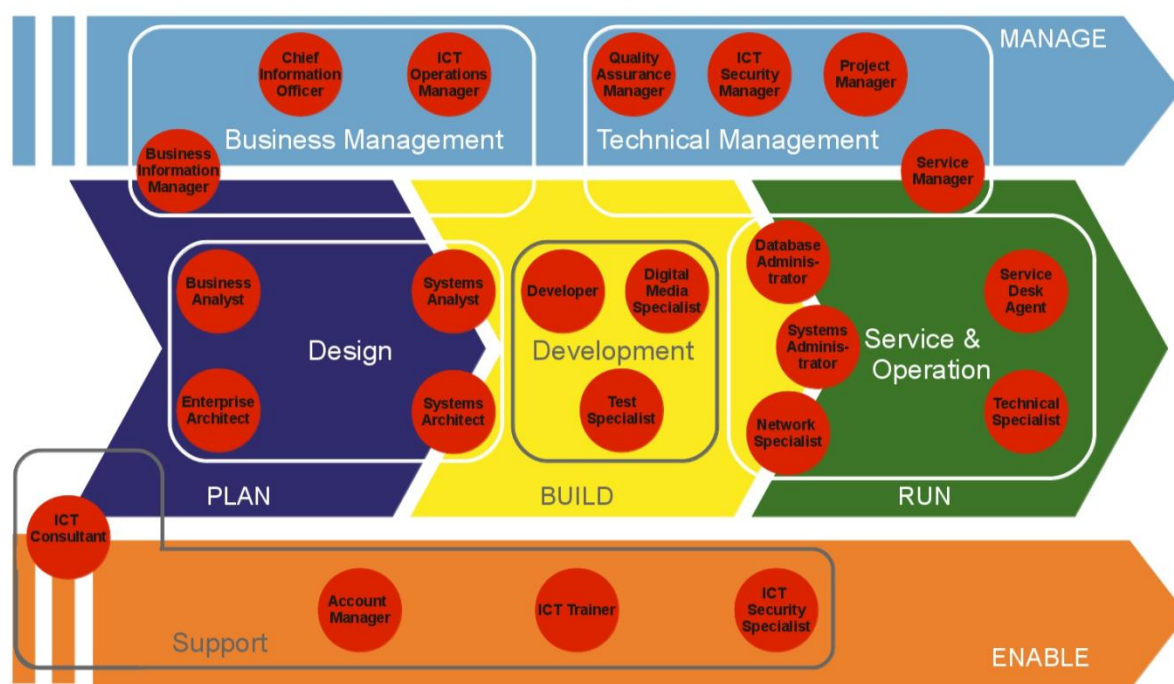
departments in the business in the client server era, to being highly connected internally and externally with mobile devices bringing agility and flexibility in the usage of IT – and even with millions of connected devices feeding data into

However, despite the changes in technology the fundamental activities and types of skills needed to design, implement, support and operate an IT environment have remained relatively stable.

Creating a standard set of definitions of skills that can be used as the IT industry introduces new technologies and terminologies are paramount for the continuation of tracking the employment levels for IT skills and for establishing a solid reference framework against which new skills sets and capabilities can be developed. These skill sets will then reflect the changing technologies available in the market – but they will belong to the specific categories of skills needed to undertake the activities that make IT environments work.

Against this background, IDC and empirica define Core IT skills as follows.

Core IT skills are the skills needed to design, implement, support and run an IS environment and its related applications which secure the functioning of the core business activities. **The understanding of the core IT profession in this regard rests on that part of the Information System which is necessary for the core value chain.** The CEN IT job profile mapping can be taken as a background:



Source: CEN Job profiles (<ftp://ftp.cen.eu/CEN/Sectors/List/IT/CWAs/CWA%2016458.pdf>)

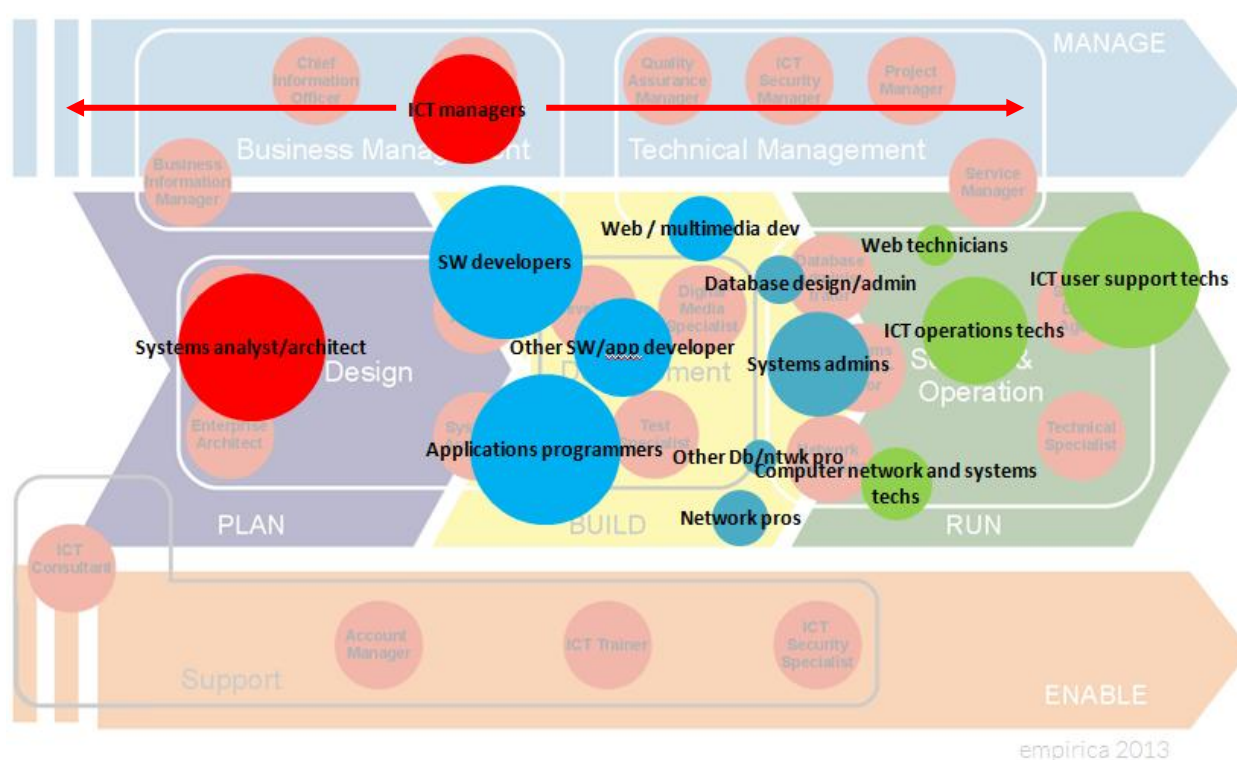
The core IT functions in this sense are the segments Plan, Build and Run, whereas “Enable” roles are seen as supporting (enabling) the core function. The section “Manage” acts as a supervising and guiding role ensures the alignment of business and IS, hence should also be included in the core definition.

Specifically, based on ISCO-08, core IT skills include the following occupational codes:

- 1330: IT service managers
- 2511 Systems analysts

- 2512 Software developers
- 2513 Web and multimedia developers
- 2514 Application programmers
- 2519 Software and multimedia developers and analysts not elsewhere classified
- 2521 Database designers and administrators
- 2522 Systems administrators
- 2523 Computer network professionals
- 2529 Database and network professionals not elsewhere classified
- 3511 IT operations technicians
- 3512 IT user support technicians
- 3513 Computer network and systems technicians
- 3514 Web technicians.

These can be mapped across the CEN Job Profile Scheme as follows



Source: empirica

These occupations will include the skills that demand a certain educational level to perform the role – typically with a tertiary degree as a base.

Specifically, the occupations listed above include those jobs which can be seen as at the heart of the disruptions and digital transformations we witness recently. For instance

- All software and app engineers, programmers and developers, across platforms (251)

- Big data roles, the IT parts of it – i.e. machine learning, algorithms, data storage and processing (especially 2511, 2521, 2529, 2522)
- Cloud and distributed computing (252, 3511, 3513)
- Security skills which are cross cutting and play a huge role in all of the above jobs (but specifically also in (1330, 2511, 3511 – 3514).

A.3 Exclusions and exceptions

For the core IT skills, IDC and empirica have excluded the following ISCO codes which are part of the broader IT workforce definition of Eurostat. However, some of these are included in the either broad or very broad definition of the IT workforce:

- *2152 Electronic engineers* and *2153 Telecommunication engineers* are computer and telecoms hardware engineers who are often responsible for the design of hardware, production and installation. They are more found on the supply side of IT and as such are not central to a profession view which focuses on IT as a business function.
- 3114 Electronics engineering technicians and 3521 Broadcasting and audio-visual technicians and 3522 Telecommunications engineering technicians are computer and telecoms hardware technicians who are often responsible for the installation and maintenance of hardware and equipment. They are not central to a profession view which focuses on IT as a business function.
- *2166 Graphics and multimedia designers* – these occupations are often employed to create **content** that can be dispersed or displayed via IT but they are not core to function of an IT environment.
- *2434 IT sales professionals* are professionals who sell, at wholesale level, complex IT hardware, software and services mostly to business clients. As high level sales representatives, they need to be tech savvy to a significant degree but do not necessarily need the professional knowledge of a core IT professional.
- 7421 Electronics mechanics and services –majority of people in this occupation will be involved in activities that are not directly related to IT systems. Although electronics, such as semi-conductors, are at the heart of IT, these occupations also include for example televisions, mobile phone handset, digital radios, manufacturing robotics, airplane control systems, etc.
- 7422 IT installers and servicers – although involved in activities related to IT - with a task complexity level in their work which is typically expected of installers and servicers are not so high as to justify inclusion in the core of the profession. For example, many people in this category would be self-taught– or provide simple swap and replace tasks.

A.3.1 Extending the Supply and Demand Model outside Europe.

For the project at hand, the extension of the supply and demand model to Japan, the USA and Canada was a key component. However, the availability of statistical data varies outside the European Union. This section describes briefly the approach taken to populate the model and validate the model output while keeping the integrity of the approach.

A.3.2 Japan

Most of the data for populating the model was readily available. For the rest, data, including employment by ISCO codes, student enrolment data etc. was supplied by the IPA, which was also interviewed as a stakeholder for this study. The outcome of the model was then verified and supported by IPA and by IDC Japan.

A.3.3 Canada

A large part of the data for populating the model was readily available. However, Canada does not report occupation by ISCO codes but rather by National Occupational Classification for Statistics (NOC-S) codes. These are not at the same level of granularity. However, the Canadian Information and Communications Technology Council, which was also interviewed as a stakeholder of this study has developed a detailed province by province study on the IT skills gap, published in 2015. This data was used to calibrate the base model. For the forecast, a similar approach as the EU model was taken with relevant comparable statistics available. In addition, IDC Canada has undertaken several studies on IT skills and verified and supported the model outcome.

A.3.4 USA

Developing the supply and demand model for the USA was under similar constraints as for Canada. However, the USA uses Standard Occupational Classification codes, which are not dissimilar to ISCO-08 and can therefore relatively easily be matched. In addition, IDC US has undertaken several studies on IT skills over the years, which provided guidance to ensure the baseline model results were in line. For the forecast, a similar approach as the EU model was taken with relevant comparable statistics available. IDC US verified and supported the model outcome.

Appendix B: Expert interviews

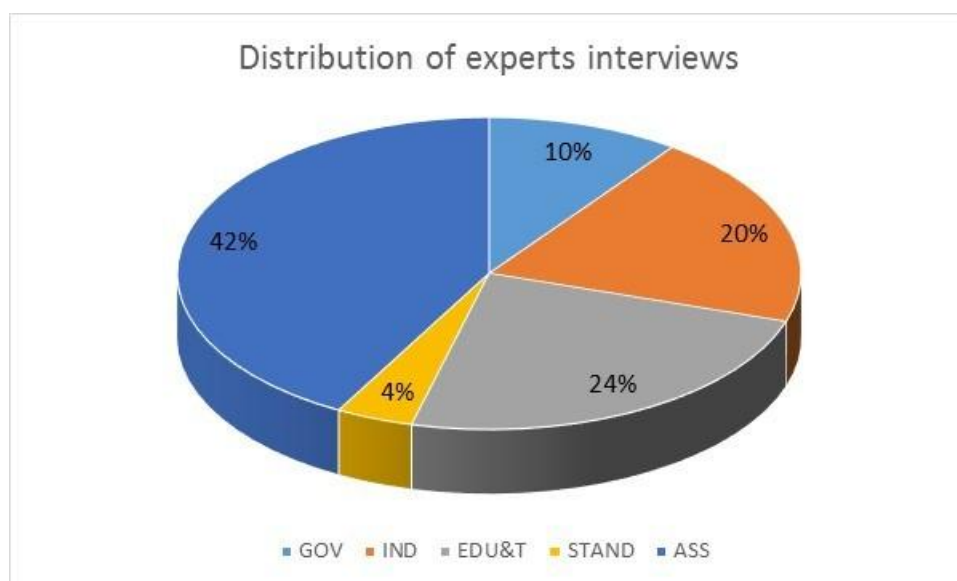
B.1 Objective and methodology of interviews

During the first phase of the project, a series of detailed interviews have been carried out to collect high-quality data and information from experts as regards their view on the value of a European framework for IT professionalism and its current state of the four building blocks. The objective of the interviews was to:

- Provide insights on the main supply-demand trends of IT professionals' main drivers and barriers influencing the development of IT professionalism in the interviewee's country
- Provide inputs on the most recent evolution of IT industry training and certification activities, both formal and informal (existing offer, capability to respond to demand, quality of the offer, identity and type of IT vendors or other organisations providing certifications and training)
- Visibility of, and opinions about, existing online self-assessment tools for the certification of IT competences, their rate of success and level of take-up, including possible sources of information;
- Information about, and opinions on, the most recent policies and initiatives for IT professionalism, with a specific focus on each of the 4 building blocks of the EU Framework
- Indications about actual/upcoming good practices of implementation of IT professionalism activities falling within, or comparable to, the 4 building blocks of the EU Framework
- Interviews have been conducted by interviewers fully aligned on the survey topic and instructed on the objectives, on the expectations and next steps.

The interviews have been streamlined in a standard interview guideline to ensure consistency of approach across countries and comparability of findings. Guideline provides a road-map to conduct the interview by setting the basic questions that need to be answered. The format used for the interviews was a semi-structured format which allows the respondent to express him / herself freely, rather than being confined to a strict template. Semi-structured interviews make it possible for interviewees to elaborate on certain questions and for interviewers to ask additional clarification questions. This does justice to the explorative character of the interviews.

Based on the list of stakeholders, 50 experts were selected and invited to attend the interviews. The main target group involved in interviews included **Government, Education/Training/Certification, Industry, Standard bodies and professional Associations** that are able to provide key insights on the four building blocks.



B.2 Structure and contents of the interviews

To the end of capturing experts' views on the current state of play of the four building blocks and relevant input to develop the European framework for IT professionalism, some key topics have been investigated in order to meet final objectives. Main topics included:

- Insights into IT innovation trends,
- Body of knowledge,
- Competences,
- Education/Training/Certification paths,
- Ethics,
- Policies and initiatives at national and international level for the promotion of the IT profession.

B.3 IT innovation trends

Main purpose of this section was to gather feelings about digital transformation, fast technological changes and their impacts on IT professionalism. Experts were stimulated to discuss about the strong influence the combined diffusion of Big Data, Cloud Computing, Mobile technologies, Social media and the Internet of Things (IoT) will have on the EU economy in the next years to 2020.

B.3.1 Emerging technologies and Digital transformation

Globally, the common perception of interviewees is that Digital transformation is a global key trend both for big companies and SMEs.

In **Denmark**, one of the most mature Countries in the terms of digitalization, the two groups that are following new trends are the public sector and the large companies, while SMEs are lagging behind. The strongest trends are in cloud, social and mobility. IoT is mostly the remit of large companies. Big Data is in the explorative stage in most organizations but there are a lot of activities and interest.

Also in the **US**, digital transformation is a highly relevant trend, as evidenced by the appearance of research that draws upon organizational examples of effective and ineffective implementations of the associated practices. It is evolving at an extremely rapid pace. The trend is important for larger companies as it is an essential part of their strategy to survive in competitive and global market. It is specifically more important and vital for SMEs if we consider that many new start-ups are simply the product of the digital transformation.

The same position is underlined by **Sweden**, where many SMEs have been created following the wave of digitalization. In essence, digital evolution is an opportunity for SMEs creation and transformation.

The digital transformation is a dominant trend in **Germany**, and there is high recognition at policy level about the relevance of this trend. In some branches this trend is very fast; it is the case of automotive, financial services, industry machines, IoT (which accelerate a lot this trend).

From a global perspective, the use of social media and the diffusion of big data, Cloud Computing and other technologies, are having a profound effect on everything we experience. A lot of companies are adapting to these trends by reviewing business strategies, processes and systems. But they need to foster the types of skills that enable digitalization.

B.3.2 Demand of new e-skills

As a result of the rapid pace of change, interviewees agree that there will undoubtedly be a shortages in both required skills and in qualified candidates.

In **Canada**, new education programmes are required to make skills up to date and increase attractiveness of IT profession. Nevertheless, the main point is that businesses and industries often have difficulty attracting the right skills, largely because of salary policies. They often have to secure resources as consultants because they can't hire staff with advanced professional qualifications: this is especially the case of SMEs, but not only. Firms should build capacity of such skills within their organizations by investing in training.

In **Japan**, supply-demand gap by technology is not fully captured. The highest risk, in this regard, is a loss of business opportunities by the skills shortage that cannot be predicted at the moment. For this reason, there is a strong need to identify and clarify the information in this field to take an action.

In **Europe**, according to Professional associations such as ACM Europe and IT Forum, there are significant challenges with Big Data, Data mining, Data analysis, and Machine Learning due to a lack of resources – in particular for the higher levels of IT education, such as computer scientists, SAP specialists, developers etc. Many of these issues feature basic education: emerging technologies have been incorporated in Computing / Informatics courses only recently. So it will take 4 to 5 years before we have Computing graduates with a formal education in many of these technologies. At the same time, the demand for professionals with these skills is already increasing fast. There is a clear need for more innovative curricula that provides a sound education in Computing / Informatics and prepares graduates to be responsive to and interested in these and other novel technologies. As mentioned by Fabrizio Gagliardi, Chair ACM Europe, *“The quality of education in general in Europe is high, but the quality of education in Informatics could be higher. There is considerable potential for Europe to become leading in terms of Informatics and that is important. Suitable incentives and support could assist in developing that potential and this could help to attract and retain suitably skilled people and help with collaborate across Europe.”*

From an industry perspective, companies like Bitkom and The Tech Partnership, the skills gap can definitely damage the competitiveness of the European industry. In a global environment, companies with better access to skills will be more competitive. European competitiveness could be damaged because of skills gap. This is true for both IT industry and users. There is high need for basic understanding of software development and

big data, but it is more and more important to be able to use and understand how to use all these ICTs within all industries. Projects within all industries are going to become complex and generic IT skills will be more and more demanded by the users. This does not really mean that such trends are going to generate a demand for new IT skills. Users will need traditional IT skills, but all users will. On the other side, e-leadership skills and big data competences will be the more relevant.

B.3.3 Gender Gap

One of the most relevant phenomenon concerning the IT professionalism is the dramatically increase of gender gap.

There is a wide consensus, among experts from different countries and sectors, about the huge need to improve women involvement in IT careers through focused initiatives. Several good practices in this regard include Testimonials in schools who bring their success stories, Promotion and Communication campaigns aimed at putting in evidence the opportunities of working in IT.

Professional and scientific societies, such as ACM and IEEE, have very successful initiatives that have the benefit of supporting the entire IT community and forging linkages to educational institutions. The IEEE Computer Society in collaboration with Intel offers an annual Prize to the best female led software development team in the Game Sig College Competition. This is designed to encourage more females to take a leadership role in the profession. However, the common feeling is that there are a lot of competing initiatives without a central coordination that ensure effective and concrete results. Unless the issue is addressed, IT sector is missing out on the skills and attributes that women can bring to the profession.

B.4 Body of Knowledge

Questions in this section aimed at discussing the value, challenges and further development of the Body of knowledge, intended as the accepted ontology for a specific domain, a considerable repository for the professional knowledge as used by various professionals. The interview with experts covered both specific BoKs that consist of pertinent specialist knowledge in specific domain and foundational BoKs that encompass common IT knowledge across various specific domains.

B.4.1 Main issues and next steps

As regards to this building block, the most pressing issues according to interviewees concern:

- How to increase awareness of the Bok and promote it
- How and when the Bok must be updated: technology changes very fast and Bok needs to be aligned accordingly
- How to make it possible for everyone to easily use the Bok: currently, the level of granularity is quite difficult to be clearly understood
- How to increase the collaboration between stakeholders in order to further mature the Foundational Bok and promote it in different contexts

In an evolutionary perspective, experts suggest several key actions for further developing the Body of knowledge and increase its value:

- Strengthen relationship with IT competences and roles, making clear the existing connections.
- Encourage education providers to use BoKs

- Encourage Libraries/Foundations (e.g. ITIL, BiSL) to align their foundational modules with the Foundational BOK (libraries/foundations of specific knowledge) (e.g. BiSL proposal)
- Create (more) foundational training modules and certify them (e.g. EXIN proposal)
- Determine the targeted audience and decide how they can use the BOK. Ideally provide career changers or students with roadmap to get into jobs and advance a career. Help them determine what do they already know and what actions can they take to develop to a certain level in IT

B.4.2 Relevant initiatives and good practices

Main input from experts' interviews show that the level of awareness and usage of the Body of Knowledge can vary significantly among sectors and countries.

In some cases, such as IEEE educational programmes, curricula have been developed based on the Software Engineering Body of Knowledge (SWEBOK). The IEEE CS SWEBOK is now available in wiki format to facilitate access, the process of receiving comments and feedback from industry professionals and academics.

In the same way, the Education Board of ACM develops curricula and their CS 2013 and SE 2014 are recent examples of very good practice. These are in use, not just by universities and colleges, but also by ICCP, for instance, for continuing professional development activities.

In other cases, the lack of a clear understanding of how to use the Bok and what target address brings to a limited adoption of the Bok itself. Nevertheless, there is a general agreement on the potential value of the Bok as the base for certifications in specific areas of expertise or explain IT to non-IT professionals.

B.5 Competences

An understanding of the capability and competency needs of individuals working in various roles is essential for organizations to effectively recruit and develop suitable employees. Understanding the core areas of expertise required by various roles and maintaining appropriate levels of competences through commitment to continuous professional development is necessary to building any profession.

The adoption of the e-CF among organizations, IT professionals and educational providers will facilitate the use of a common language for describing e-competences in Europe. In doing so, IT professionals will be able to describe themselves in terms of a set of e-competences, employers will be able to recruit for roles defined in terms of e-competences, and educators will be able to develop offerings to target gaps in e-competences."

B.5.1 Main issues and next steps

Developing the e-CF many different stakeholders have been involved to gather their interests and expectations and to design a commonly agreed framework. However, some barriers can be identified as regard the adoption of the e-CF.

From an industry point of view the main barriers as regard IT competences concern the lack of consistency and standardization: for instance job titles not always correspond to the same profiles and this is a big issue especially in recruiting IT resources. In this regard, according to the IEEE Computer Society, the most pressing issue is properly identifying the exact competences and skill levels an individual has to develop for a specific role. In addition, practical measures are needed to assess competences and skill levels of IT professionals. According to CompTIA, one of the challenges from SFIA or e-CF is to navigate through these frameworks as they are quite complex, difficult to understand and cumbersome to use. You can boil down the number of core roles within IT to a lot less than what SFIA or e-CF will have you think. Until there is a defined core set of roles,

you will always have organisations trying to expand the roles and call them something else. There are huge similarities and the complexities need to be taken out. A similar feeling has been explained by Prof Marco Ferretti from CINI: The e-CF is a comprehensive scheme which encompasses different professional profiles. This has determined a conflict on the sub-provision, since although there has been consensus and recognition of the validity of the framework, the main stakeholders have claimed the possibility to define specific professional profiles.

According to CEPIS, the e-CF was not designed as an exhaustive list of competences to meet their specific needs; they should be enriched by professional associations/ industries. Another issue concern the co-existence of different frameworks that can generate confusion: for instance, the use of e-CF and ESCO should be clearly communicated. ESCO is obligatory for public tenders (and serves a broader cause). How would this conflict with e-CF? Added value of e-CF because it has become a recognised standard (EN 16234-1, European Norm about IT Profession Competences by the European Committee for Standardisation – CEN, in the scope of CEN PC 428 e-Competences and IT Professionalism) so it is a more permanent standard¹⁷⁴. Finally, e-CF is not open for use: the national standardization bodies will ‘sell’ the e-CF. Each national standardization body will ‘sell’ the e-CF in their language after translating (this translation process will take 6-12 months) and develop tools based on the e-CF.

To further develop the building block, different initiatives can be promoted according to experts:

- A multiple stakeholder commitment is required to promote adoption/implementation of the e-CF: public sector should lead by example, education should start to make visible how they deal with e-CF in their curricula, and industry should look at e-CF as a reference for HR recruiting and for developing career paths.
- A clear link to qualification and certification has to be defined in order to increase consistency in competence recognition
- A simple and flexible user interface is needed in order to reduce complexity and facilitate a wider adoption of the framework.
- A set of EU guidelines have to be developed, that clearly explain how to adopt the framework and define what kind of convergence between different frameworks. This could stimulate other parts of the world to do the same.
- Specific initiatives should be put in place in order to monitor successful projects and the usage of e-CF
- Beginning the fieldwork to updating process of EN 16234-1, European Norm about IT Profession Competences, including new IT matters and trends.

B.5.2 Relevant initiatives and good practices

Current state of play of this building block shows a good maturity level of the e-CF. The framework is widely known and recognised as a standard, providing sound reference and common language to define the set of core competences for a wide range of IT profiles. Nevertheless, there are still few good practices in place that are commonly known, as the most part of experts interviewees have reported. Main successful initiatives gathered through interviews include:

¹⁷⁴ This can also become true for ESCO . For the exchange mechanism in EURES, ESCO could even become a de jure standard through the Implementing Act according to art. 19 of the EURES Regulation. Also the current proposal of the Commission on a reform of Europass mentions that the Commission would continue to manage the ESCO classification as an open standard. In case the co-legislators adopt this, it would be another guarantee enshrined in law for ESCO to be a more permanent standard.

- Success stories providing evidence of the full adoption of the e-CF within the organization: Airbus adopted the e-CF to map employees' profiles and design career paths. Sintel has proposed consortiums to refer to the adopted standards in the renewal of contracts. Dutch education providers are very active in this field and using e-CF in practice (HBO-I, LOI, Saxion, HU) – trying to find answers as to HOW to get from a certain level in e-CF to the next.
- Supportive initiatives aimed at developing e-CF driven tools to enable the framework and help final users: CEPIS e-Competence Benchmark and AICA e-CF plus are good example of such tools.
- Collaborative initiatives to consolidate e-CF at national and international level: EuroCIO is involved in establishing a European governance of the e-CF; national levels need European guidance to put it into effect. We need to establish a user community.
- Initiatives aimed at investigate and promote further convergence of existing frameworks: BCS and the European Commission are working together to map e-CF and SFIA. There will be a conversion available.

Besides these initiatives, many stakeholders suggest a wide variety of practices around alternative competency framework, most of them developed in house. An example is given by The Open Group experience. The Open Group developed its own competence framework with over 7, 000 people certified, working for over 160 organisations. The framework defines skills and experience that a professional should be able to demonstrate.

Similar initiatives and good practices may be found in many organisations.

B.6 Education & Training

Certifications, qualifications, non-formal learning and informal learning are mutually supportive components of a professional's career development and they attest to an individual's competences and skills. To date, a variety of initiatives have been launched with a view to simplifying the transparency and recognition of skills and qualifications across Europe (i.e. EQF, ECTS, ECVET, European inventory on validation of non-formal and informal learning). Vocational education and training (VET) for young people and adults is also an essential part of the Europe 2020 strategy.

Nevertheless, IT education and training has nowadays a very extensive, diversified and complex scenario (chaotic use of designations, descriptions and terms) and challenges become more and more pressing.

In this section, interviewees have been asked to provide their views about key areas of improvement, good solutions and further development concerning Education and training with the aim of definitely reduce one of the main issues in IT professionalism: the mismatch between skills/knowledge of students/graduates and industry needs.

B.6.1 Main issues and next steps

Looking at the general complexity of the scenario, ACM sustains that the different approaches to professionalism that have been adopted by EU, IP3 and IFIP, BCS, and others does not help; indeed it creates confusion.

Complexity reflects also geographical differences: there is a great variance across Europe with regard to IT education and skills. According to recent studies, UK, Finland, NL, Germany are doing better in terms of IT education than many other countries, but even here there is room for improvement. If one of the priorities at European level is to attract students and professionals from outside, Europe needs to be more open for non-Europeans to access education. Without global mobility, compatibility of IT people is lower than the inflow of expected IT professionals.

European CIO supports this position by suggesting an increase standardization of Educational programmes to help mobility: it is fundamental that studies and diploma from EU countries are valid and recognised in each country of the EU.

Among the IT Professionals there is a sectoral vision that needs to be changed in the future. In fact, the demand of IT professionals is likely to arise from different contexts; consequently, more flexibility is required.

Another key issue concerns the low attractiveness of current educational programmes: ACM considers the combination of MOOCs with traditional education as a key challenge in the coming 3 years.

From an industry perspective, misalignment between the education system and the demand of IT professionals is still the biggest issue to be tackled and a clear understanding of industries need would be beneficial both for firms and for students. At high level, industry requirements can be summarised in two abilities: on the one side, as mentioned by UST Global, young people entering the IT career should have the motivation to learn, be flexible and open minded. Technicalities can be learned after, through specialization or advanced training. On the other side, students are asked to demonstrate 'up to date knowledge'. Technological developments will speed up in the near future and alignment between education and industry is becoming increasingly important. As IMEC said, *"We speak about Big Data for a while, but the education for this still need to be designed"*.

Looking deeper into educational programmes several stakeholders encourage the development of an e-leadership programme which combines business and IT. Besides I think studies about programmes, languages are too much theoretical. Education should be more focused on applying programmes: IT for health, for lawyers, etc. This kind of approach should be part of the education programmes.

Finally, two additional input can be listed among the areas of improvement:

- Firstly, the need to develop consistent reskilling programmes: in order to ensure professionals who move from a profession to another one in the IT field with the development of required competences
- Secondly, the need to develop a recognition system, especially for non-formal education, based on a common language to identify contents/topics

B.6.2 Relevant initiatives and good practices

Globally, strong effort is required to promote greater exchange of information among professional organisations, industry and countries. There is a need for a collaborative approach to IT professionalism in general and, more in specific, to educational programmes.

To this end, relevant solutions can be put in evidence in order to inspire similar initiatives across European countries.

Many good practices show great effort in providing high quality educational offerings addressed to IT professionals. Several examples come from Orange Digital Academy - a collaborative platform for the on line training where experts work together to develop contents – or the ACM Learning Centre for instance.

The Irish Computer Society (ICS) is also very active in education and training: among the other we can mention the Graduate development programme, Techweek, Coding competitions, Leadership development programme, Continuous professional development (CPD).

CompTIA's curricula is based on what the industry is telling us is needed.

In Spain, Universities collaborate with industries for the design of post graduate Master programmes. They are also experimenting new tools to complement traditional education such as MOOCs, Blended learning, FLIP teaching. Furthermore CCII is designing a Spanish IT Certification Map as a tool to analyse and improve the current chaotic scenario and use of designations, descriptions and terms in this field (“certification”, “accreditation”, specialist, expert, master, etc. with a special issue about the use and abuse of “certification” term.

Within Canada there is an initiative to expand the BTM (Business Technology Management) programmes, accredit them and certify graduates.

BTM was introduced in 2009 at the undergraduate level in response to the feedback that new IT graduates didn't have the skills needed by businesses. Working together with academic institutions, industry and sector associations, ITAC Talent defined a set of learning outcomes and competency standards required by industry, drawing heavily on relevant international standards for similar programmes.

BTM is an innovative educational solution that opens academic and career opportunities for post-secondary business students. It equips graduates with the right technical and business skills to enter the workplace. BTM programmes prepare professionals who have the knowledge, skills and competencies to lead and support the effective, competitive use of information technologies.

Since its development in 2009, BTM has impacted thousands of graduates and is currently offered at 19 post-secondary institutions across Canada. BTM applications are rising by an average of 24% per year. (Source - <http://itactalent.ca/talent-initiatives/btm/>)

B.7 Ethics

A defining aspect of any profession involves adhering to professional ethical conduct. The need for professional ethics and adherence to established Codes of Ethics/Conduct, which specify principles of individual's behaviour within various professions, societies and organizations, is paramount to maturing any profession and to garnering positive public perception. To date no overarching European Code of Ethics is available but national codes exist which are developed by professional Associations at national level. Consequences of the lack of a code of ethics are dramatic: industry association in Denmark have not defined a code of conduct – and there have been several scandals (such as SKAT - tax authorities- and the job centres).

In this section, discussion with experts went around evolution of Ethics as a mean to further mature the IT profession as well as current initiatives and good practices in this regard.

B.7.1 Evolution of Ethics

Given the diverse cultures across Europe, a single common ethical code is unrealistic. However, alignment against a core set of ethical issues specified in a meta-framework of ethical issues, will help inform the nature and content of a Framework.

According to William Agresti - Johns Hopkins Carey Business School - given the advances in technology, we need to refresh the IT ethics scenarios so that they convey realistic and contemporary dilemmas faced by IT professionals.

To support this process of continuous update and alignment, all IT curriculum should include learning outcomes related to professional practice, social responsibility and ethics, as CIPS and IPA Japan agree.

According to BCS, ethics is a critical component of the IT professionalism and should be developed from the early stages of school. People building IT systems should be equipped with the right skills but also with the

right ethical background. Especially in certain key areas such as the public sector: for instance, asking for adhering to a code of ethics in procurement processes would make industry need to follow.

As CEPIS puts in evidence, many professional associations have a list of ethics. However, the main question is: what do you do when someone is not complying with the code of ethics? This is a struggle. In an evolutionary perspective, we should get employers involved in the implementation of the building blocks.

Similarly, Irish Computer Society, which developed a curricula including Ethics component, underlines the same issue: what if someone does not apply? A possible answer comes from UK, where disciplinary board can decide that someone cannot do his/her profession anymore.

B.7.2 Relevant initiatives and good practices

Relevant initiatives and good practices are in place concerning Ethics issues that have been collected through interviews.

Ethics is of considerable importance to ACM, which constantly review its codes and include Ethical issues in ACM curricula. ACM has a Code of Ethics and Professional Conduct as well as a Software Engineering Code of Ethics and Professional Practice (the most recent version being v5.2). People should be educated on ethics, and on the related legal issues. Codes of ethics should certainly feature within any IT BoK (such as the Foundational IT Body of Knowledge). Education is more important than certification when it comes to ethics.

The ASL BISL Foundation has released a Manifesto in December 2015 which we would like to align with the European standard. CIPS has a requirement for all certified members to complete an ethics exam. In addition, there is now a working group in place to update this ethics exam based on the feedback to date.

EQANIE standard is being revised and will include legal and ethical aspects.

In Spain, CCII was set up in 2010 by a specific agreement of the Spanish Parliament. Among its duties CCII has:

- Representation of the Spanish informatics engineering professionals on the national and international level;
- Organisation and regulation of the professional practice;
- Ensuring proper standards and promoting an ethical practice and contribution of informatics engineering to general interest;
- Disciplinary proceedings / notification of sanctions or disqualification proceedings for the professional practice;
- Deontological control of the professional and its values in good practice, etc.

In Italy, the provision UNI11506 (point 7) deals with ethic and deontological aspects and thus, they have already been regulated in Italy. This is valid for Italy but there is also an ongoing discussion at EU level. Furthermore, the Appendix A includes, among the others, provisions on the privacy, non-competition and non-conflict of interest.

In UK, Legal social professional and Ethics are integrated in the education. The integration of ethics in education is built in the regulations: education will not get funding if ethics and security are not included in the educational programmes. BCS support education in applying ethics and security in training courses. Nevertheless the major issue concerns the fact that employers do not demand it; they rather focus on skills rather than licences. There is no competitive advantage for all companies to have licenced people. However, clearly there is an opportunity to initiate this.

B.8 Conclusions

In summary, interviews carried out with the selected experts provided relevant insights into the IT professionalism, with specific focus on the four building blocks and digital trends.

Main findings will contribute to increase the value of a European framework for IT professionalism and will serve as a compass to orient future implementation.

Inspired by existing initiatives and good practices we will be able to design the required solutions aimed at promoting the IT professionalism in Europe. Doing this, some priorities gathered from experts will be surely taken into account:

- The e-CF is a useful instrument for companies and consortiums to characterise their employees and to describe the individual profiles. It is necessary to further develop it in the future.
- An observatory platform where all information is presented and updated, tools are available etc. This would help to bundle the various pieces and make clear for people and organisations what is available and what it would bring.
- Lifelong learning and reskilling are key priorities as it becomes more important for people to be able to change their career, be flexible and mobile – also/especially people who are not working in IT but whose work is impacted by IT
- Structural implementation of digital skills and basic professional skills in early education.
- Ambassadors to move forward Practical use
- The involvement of the main entities in the field: business groups, professional associations, consortiums, agencies.
- The Framework should be practical, easy to understand (language) and easy to use – e.g. by adding guidelines

Appendix C: Abstracts of EU studies on IT professionalism

At European level various projects had been undertaken that has proved to be an important milestone in the further development of IT professionalism.

The relevant documents and initiatives are:

- “E-Skills and IT Professionalism: Fostering the IT profession in Europe” (2012)
- “Towards European Quality Labels for the IT Industry Training and Certification” (2013)
- “European e-Competence Framework 3.0” (2013)
- “e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios, ”(2013)
- “European Foundational IT Body of Knowledge” (version 1.0): a first point of reference for anyone interested in working in IT (2014)
- “e-Skills in Europe: Measuring Progress and Moving Ahead” (2014)
- “The International Dimension and the Impact of Globalisation on e-Skills” (2014)

In the final report on “**e-Skills and IT Professionalism: Fostering the IT profession in Europe**” four building blocks for a European Framework for IT Professionalism were proposed. Firstly, a Body of Knowledge, which will serve as one method to define a common language. This is a common level of understanding of the topic, upon which specialist knowledge can be built on. Secondly, the need for a European competence framework was underlined. To be able to understand the capability and competency needs of individuals working in IT roles and organisations recruiting and developing individuals, it is essential to formulate a competence framework. Thirdly, education, training and certification in the IT sector needs to be rendered transparent. Especially in the IT sector formal, non-formal and informal education exist easily side-by-side and are perceived as mutually supportive components of an IT professional’s career development. Fourthly and finally, professional ethics are a component of every mature profession and need to be addressed in the IT profession.

The subject of certification was further developed in the study “**Towards European Quality Labels for the IT Industry Training and Certification**”. The main goal of this study was to develop a proposal for an European e-skills quality label, along with the prototype on online services and tools to promote transparency and to provide tools and support for users in IT industry training and certification. As the prevailing idea is to use existing frameworks and further develop these, the proposed label is based on the European e-Competence Framework and EQAVET (the European Quality Assurance in Vocational Education and Training). The result is a mechanism that makes it possible to reference different types of certification and training against the e-Competence Framework and therefore enhance transparency on the job market.

The **European e-Competence Framework (e-CF)**, currently available in its 3.0 version, is a reference framework of 36 IT competences that can be used and understood by IT users and supply companies, by the public sector, as well as by educational and social partners across Europe.

The Framework provides an European general tool dedicated mainly to:

- IT professionals and managers, with clear guidelines for their competence development.
- Human resources managers, enabling the anticipation and planning of competence requirements.
- Education and training, enabling effective planning and design of IT curricula.
- Policy makers and market researchers, providing a clear and Europe-wide agreed reference for IT skills and competences in a long-term perspective.

- Procurement managers, providing a common language for effective technical terms of reference in national and international bids.

The e-CF is structured around four dimensions reflecting different levels of business and human resource planning requirements in addition to job proficiency guidelines. “Dimension 1” includes five e-Competence areas, derived from the IT business processes: Plan, Build, Run, Enable and Manage. “Dimension 2” is made of a set of reference e-Competences for each area. “Dimension 3” are proficiency levels of each e-Competence ranging from e-1 to e-5, which are related to the EQF levels 3 to 8. “Dimension 4” are samples of knowledge and skills relate to e-Competences in Dimension 2.

Within the European e-Competences Framework some of the identified competences can easily be reconnected to skills closely connected to the e-leadership domain. The study **“e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios”** has underlined the need for e-Leadership skills, a new type of leadership that is becoming essential to organisational innovation and competitiveness.. Next to IT user skills, IT practitioner skills and IT business skills, e-Leadership skills are skills that enable one to accomplish a goal that relies on IT through the direction of human resources and uses of IT. This means that, e-leaders are the leaders who draw on technology to accomplish an IT-enabled objective.¹⁷⁵

To enhance communication and further develop the IT profession, end of 2014 the first version of **‘The European Foundational IT Body of Knowledge’** was published. The IT body of knowledge is the base-level knowledge required to enter the IT profession and acts as the first point of reference for anyone interested in working in IT’. At the moment, there is no authoritative source within the EU that defines and organises the core knowledge of the IT discipline. An EU Foundational IT Body of Knowledge is therefore needed to provide the basis for a common understanding of the foundational knowledge and IT professional should possess¹⁷⁶. Having a common way of referring to IT knowledge, i.e. a ‘go-to’ point of reference, will facilitate communication among IT professionals and provide a baseline for competency models, certification programmes, educational programmes, and other workforce development initiatives¹⁷⁷

The study on **“e-Skills in Europe: Measuring Progress and Moving Ahead”** maps and monitors the supply and demand of e-skills across Europe and benchmarks national policy initiatives and multi-stakeholder partnerships in the European Union. Based on the findings, in the report five policy recommendations have been made.

- Launch initiatives in countries lagging behind
- Scale up efforts through longer term policy commitment
- Adapt training and policy to the digital age
- Foster IT professionalism and quality
- Build bridges for all students, graduates and workers

To this end, the analyses of the evolution of the supply and demand in the last ten years, will help understand the impact of the initiatives launched at EU and national level since 2008, but will also help to efficiently propose new approaches to improve the situation and identify successful means to foster multi-stakeholder partnerships.

¹⁷⁵ http://ec.europa.eu/enterprise/sectors/IT/files/eskills/insead_eleadership_en.pdf

¹⁷⁶ IT literacy is defined as being familiar with the fundamental information technology concepts and having the ability to utilise computers and related technology efficiently. One of the components is computer literacy. One way of becoming computer literate is to take the European Computer Driving Licence (<http://www.ecdl.org/>).

¹⁷⁷ “e-Skills and IT Professionalism: Fostering the IT profession in Europe”; http://ec.europa.eu/enterprise/sectors/IT/files/eskills/IT_professionalism_report_en.pdf

As the Digital Economy is not restricted to borders, and highly skilled IT professionals have high mobility, the study “**The International Dimension and the Impact of Globalisation on e-Skills**” focuses on the influence of more and more globalised world. This study explores the international dimension of e-Skills, a shortage that is global and growing. Moreover, the study assess the impact of globalisation on high-level e-skills as off shoring is impacting IT jobs. Certain skills will be less affected than others and understanding the impact of globalisation on the IT profession will lead to better address e-skills shortages globally through education and policy action. Therefore it will be possible to promote IT Professionalism in the longer term. The solution is to further build on and develop multiple competence frameworks, educational standards, codes of ethics, and bodies of knowledge.

In the areas of e-Leadership and KET skills several studies have been completed as well. For relevant materials we refer to the project websites:

- e-Leadership: <http://eskills-guide.eu/documents/> and <http://eskills-scale.eu/home/>
- KETs: http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8764&lang=en&title=Final-report%3A-Skills-for-Key-Enabling-Technologies-in-Europe

Appendix D: Overview of action plan in Spain, Ireland and Italy

D.1 Action plan for Implementation of IT Profession Framework in Spain



December 13th, 2016

Actions for Implementation of ICT Profession Framework in Spain 2016

1. Objective of the document

Real execution of the second action plan draft (Spain action plan v2.1) and project evolution until 13th December 2016.

2. Action table

Understanding the action table:

"N°": Internal identification number

"Action title": Short name of the action

"Description and time": Short explanation and notes to understand the action scope and idea; and the estimated moment of implementation.

"Bloc": ICTPF blocs:

1: eCompetences

2: BoK

3: Certification, learning

4: Ethics

5: Others. Very important actions in the general scope of ITprofession and the goals of the initiative, whom are not clearly in any of the four conceptual blocs.

"Scope/Priority"

Scope: Spain or UE

UE means, we must decide inside the ICTPF initiative if this action is interesting to be implemented or at least promoted or proposed to EC to be developed in the near future, as another kind of outcome of the ICTPF initiative.

Priority: 0 to 10 number. Higher number means higher priority.

Colors:

Black: Done

Blue: In process (Not finished)

No	Action title	Description and time	Bloc	Scope/Priority
1	Promoting an spanish experts pool on ICTPF	Creating a national experts pool (With 4 expert blocs, and a coordinator) Achieving an intense contribution to ICTPF, as a key driving force to implement the ICTPF in Spain Dec 2015-Jan 2016	All	Spain / 10
2	Spanish translation of European Norm EN 16234 "e-Competences and	April – September 2016 Official presentation 13 December 2016 (In coordination with AENOR (Spanish National Entity of Standardization)	1	Spain / 10

No	Action title	Description and time	Bloc	Scope/Priority
	ICT Professionalism".			
3	Diffusion in Spain of European Norm EN 16234 "e-Competences and ICT Professionalism".	In coordination with AENOR (Spanish National Entity of Standardization) Informal advance diffusion information on DES Madrid (may 24th) Other events: Valencia 2th June 2016, Salamanca 15 th September Publications (Digital and paper)	1	Spain / 10
34	Collaboration on survey about European ICT Professionalism Framework	Survey European ICT Professionalism Framework Contribution and diffusion April-May 2016		EU / 10
6	Promote the use of EN 16234 to generate an standardized version of Spanish university qualifications in informatics engineering.	Specification of correspondence between competences of bachelor and master of informatics engineering university degrees with EN 16234. Map the EN 16234 with the current academic recommendations al Spanish level	1	Spain / 10
7	Promoting and Spanish map of EN 16234 standardized definition of the professional IT profiles	This result will be very useful to informatics engineering universities Distribute professional profiles map among universities in order to generate academic roadmaps for students	1	Spain / 10
9	Diffusion of BOK in Spain and obtaining feedback	Firstly in universities.	2	Spain / ?
27	Collaboration on survey and review: IT2017 curriculum framework for Universities	IT2017 curriculum framework for Universities. Joint project between IEEE CS and ACM. Contribution and diffusion August-September 2016		EU
14	Nowadays IT Certifications Map	Specification of Spanish IT Certification Map (Chaotic use of designations, descriptions and terms ("certification", "accreditation", specialist, expert, master, etc.). With a special issue about the use and abuse of term	3	Spain-UE / 10

No	Action title	Description and time	Bloc	Scope/Priority
		<p>"certification".</p> <p>CCII in collaboration with Fondazione Politecnico di Milano</p> <p>In progress. (Data caption November-January)</p>		
16	CCII chartered IT professionals certification model	<p>CCII chartered IT professionals certification model as an implementation result of ICTPF in Spain.</p> <p>2016-2017</p>	3	Spain / 10
17	Creation of Spanish National Commission on Information and knowledge technology Ethics	<p>Promoted by CCII.</p> <p>National Commission on Ethics v.1.0. (Mars 2016) Final version delayed until Framework proposal about professional ethics guidelines.</p>	4	Spain /10
18	IKT Code of Ethics	<p>Evolution of deontological and ethics codes in regional informatics engineering colleges in Spain, IT professionals participation process and ICTPF conclusions.</p> <p>Evolution from diverse regional and partial deontological codes, to one single national deontological code (Delayed until Framework proposal about professional ethics guidelines.)</p> <p>Legal mandate to CCII</p> <p>2016-2017</p>	4	Spain /10
19	Definition of the scope and practical results of this first version of IT Professional Ethics bloc and the pending tasks	<p>Clarifying Professional Ethics bloc scope</p> <p>Two Spanish experts in Brussels 9th September Workshop.</p> <p>Documents and proposals contribution</p>	4	EU / 10
30	Promotion and diffusion of the ICTPF	<p>Official presentation DES Madrid 2016 (24th May):</p> <p>Presentation</p> <p>Calling for support and collaboration</p> <p>Other events: Valencia 2th June 2016, Salamanca 15th September</p>	All	Spain / 10
31	Open ICTPF interest and participation register	<p>Web page to promote an open register of interest and/or participation of organizations in implementation actions of the ICTPF in Spain. (Opened 24th may)</p>	All	Spain / 10
32	ICTPF EU meetings, events, task and	<p>Initial Workshop 4th February Brussels.</p> <p>Workshop 9th September Brussels.</p> <p>ITPE network 26 November Amsterdam.</p>	All	Spain-EU / 10

No	Action title	Description and time	Bloc	Scope/Priority
	documents	Main Conference 6 th December Brussels. 4 virtual meetings for different tasks and Steering Committee. Contribution and collaboration in documents and tasks.		
33	Normas en materia de gestión de proyectos	Norma CCII-N2015-01 Norma de Visado de Proyectos y Actuaciones Profesionales en Ingeniería Informática Norma CCII-N2016-02 Norma Técnica para la realización de la Documentación de Proyectos en Ingeniería Informática (Related to action number 21)	5	
35	Participatory Workshop 13th Dec. Madrid: European ICT Professionalism Framework in Spain	National participatory workshop, 13th December, in Madrid. Provide updated information about the initiative in Europe and in Spain Share the implemented actions in Spain around European ICT Professionalism Framework in 2016 Open to Spanish stakeholders a participatory debate and contribution to define the action plan for 2017, with a wide collection of visions and proposals.	All	Spain / 8

After the participatory Workshop for information and implementation actions in Spain (13th December 2016.), the stakeholders' input will serve to define the Framework Implementation Action Plan v2.0 (January 2017), as an action prioritisation for the framework evolution in 2017 in Spain.

D.2 Action plan for European framework for IT professionalism Implementation in Ireland

1. Convene an Expert Group of IT professionals to advise on the implementation and to contribute to idea development in Europe.
 - a. This group was effectively launched at a workshop held on 12th May, following the 2016 IT Professionals Day.
 - b. The Expert Group will also become the steering group for the re-establishment of the Irish National Coalition for Digital Jobs
2. Organise an official launch of EN16234 (e-CF) in September, in collaboration with the Irish National Standard's Body, NSAI.
3. Follow-up on proposal made to Irish qualifications authority, Quality and Qualifications Ireland (QQI), to map e-CF to relevant academic awards.
4. Publish the IT Body of Knowledge, and promote awareness of its existence to IT professional members of ICS.
 - a. Map the BoK to common job profiles (generic and entry level)
 - b. Use the cross-referencing of e-CF and the BoK to assist the mapping of e-CF to academic awards (No. 3 above).
5. Initiate a project to use e-CF to assess and counsel employees on competence and education.
 - a. Self-assessment, followed by manager validation
 - b. Professional development/education planning

- c. Continuous Professional Development (CPD) points awarded (This will initially be a paper based process until we can source an online solution that meets our needs)
- 6. Strengthen initiatives to grow the talent pool by working with primary and secondary schools, stressing the importance of both user and professional competence.
 - a. Cliste –digital and computing skills programme integrated into Irish national primary curriculum.
 - b. Computing Curriculum – second level computing courses created because IT/Computing is not an official school subject in Ireland.
 - c. Tech Week
 - i. Formula 1 in Schools Competition
 - ii. National Scratch Competition
 - iii. Bebras Challenge
 - iv. IT Professionals Day
- 7. Utilise the 7 annual conferences run by ICS to promote the professionalism agenda.
 - a. CIO and IT Leaders
 - b. Health Informatics
 - c. Business Analysis
 - d. IT Architecture
 - e. Data Protection and Privacy
 - f. Training and Development
- 8. Leverage the ICS CIO Forum and Advisory Board, made up of key public and private sector senior IT executives (Xilinx, Bord Gais Energy, Intel, Zurich Life, Kerry Group, Symantec, Irish Life, Central Bank, DeCare Systems, Omnipay, Revenue Commissioners, and UDC Healthcare etc.).
- 9. Likewise, leverage the newly formed eHealth CIO Forum.
- 10. Take advantage of enhanced public visibility and media exposure attracted by the 50th anniversary of the ICS in 2017, and celebrator events.
 - a. Turing Lecture, Dublin Castle, February 22nd, 2017.
 - b. World Conference on Computers in Education, Dublin Castle and Trinity College, 3-6th July, 2017.
- 11. Extend the impact of IT Professionals Day, celebrated at the start of the national Tech Week, lobbying for replication in other EU countries, as happened in Malta in 2016.
- 12. Re-launch the Irish National Coalition for Digital Jobs, with a view to having a contribution to make at the Grand Coalition event in the autumn, 2016.

Appendix E: Questionnaire and output online surveys

E.1 Surveys questionnaire

E.1.1 Online Survey on gathering expectations on a European Framework for the IT Profession

Target groups: IT professionals at all levels and stakeholders involved in the training, education, employment, certification of these IT professionals

E.1.2 Introducing the European Framework for the IT Profession

The European Commission and the consortium partners Capgemini Consulting, EY and IDC, kicked off a new initiative that will propose a comprehensive Framework for the IT profession in Europe. This Framework will be an important step to encourage further growth of the knowledge, skills and competences of the European IT workforce and –people.

There is broad consensus about the crucial importance of e-skills for Europe given the e-skills shortages, gaps and mismatches that have a continuing negative effect on achieving further growth, competitiveness, innovation and employment in Europe.

The European Union has been actively promoting digital skills (e-skills) for over a decade, with the launch of the Grand Coalition for Digital Jobs in 2013 as a major milestone at European level. Europe has progressed significantly although there is still a lot to be done. The proactive approach of the European Union has fostered significant interest and action from governments and multi-stakeholder partnerships to promote a digital agenda. Now is the time to further support those actions at national level. This initiative will start implementation of the aforementioned Framework for the IT Profession in at least three countries, and thus putting ambition into action.

The nature of jobs in the broader IT domain is changing. It is no longer enough merely to be a technical expert. The industry needs professionals with a diversity of knowledge and skills in ICT. IT professionals are required to also understand the business, operational and HR management aspects. Industry confirms they are looking for multidisciplinary IT professionals and dual thinkers. As new technologies develop rapidly, e-skills are becoming increasingly sophisticated and need to be constantly updated. This study is a vital step to further maturing the IT profession, while at the same time attracting more people to commence a career in ICT.

The European Framework for the IT profession will be based on four building blocks:

- **Competences:** an understanding of the capability and competency needs of individuals working in various roles is essential for organizations to effectively recruit and develop suitable employees. The European Competence Framework¹⁷⁸ is a widely recognized standard.
- **Body of knowledge (BOK):** a comprehensive and up-to-date knowledge accommodating a common IT body of knowledge and pertinent specialist knowledge and skills. Besides many specific BOK's, the European Commission released a first version of the Foundational IT Body of Knowledge¹⁷⁹ last year.

¹⁷⁸ <http://www.ecompetences.eu>

¹⁷⁹ http://ictprofessionalism.eu/wp-content/uploads/EU-Foundational-ICT-Body-of-Knowledge_Brochure_final.pdf

- **Education and Training and certification:** certifications, qualifications, non-formal learning and informal learning are mutually supportive components of a professional's career development.
- **Ethics:** a defining aspect of any profession involves adhering to professional ethical conduct.

The key challenge in the initiative is to create synergies: the Framework for the IT profession should be more than just the sum of its four building blocks. Describing these synergies is vital to show the value to those that are supposed to use it: governments, industry and educational institutions – but also IT professionals themselves. Bringing the European efforts to the individual is pivotal for success.

AND THEREFORE, WE NEED YOUR HELP!

E.1.3 What we ask you to do

Your contribution by filling in this 10-15 minutes survey would be highly appreciated, as it helps to:

- Identify different target groups and their specific needs
- Gather expectations about the European Framework for the IT profession
- Refine the value proposition related to the four building blocks of IT professionalism
- Develop concrete and demand-driven solutions to be implemented within European countries

Building a Framework for the IT profession can only be done by involving the IT professional him/herself, and the many stakeholders playing a role in the IT ecology.

E.1.4 More information and contact

Background information about the project: www.ictprofessionalism.eu .

Contact details: please send your question or request to niels.vander.linden@capgemini.com or Francesca.Bonazzoli@it.ey.com

E.1.5 Survey questions

This survey consists of 6 sections. Each section consists of a few statements that we would like your opinion on. Each section also lists several actions that were proposed during the first phase of the project. We would appreciate your evaluation on possible effect of the action and if you consider it desirable.

It will take you approximately 10-15 minutes to complete the survey.

1. About you / respondent identification

- In which capacity are you participating in this survey? *Dropdown menu with affiliation (see list below)*
- What is your country of residence? *Dropdown with country of residence (please add a list including all countries globally)*
- What is your nationality? *Dropdown with country of residence (please add a list including all countries globally)*
- Please indicate your gender. *Dropdown gender (male – female)*
- Please indicate your age group. *Dropdown age (0-19, 20-29, 30-39, 40-49, 50-59, 60-69, over 70)*
- Do you consider yourself an IT practitioner, did you work as an IT practitioner in the past, or are you working in a job that is related to the profession (e.g. as a teacher, or union representative)? *Dropdown 'I*

consider myself an IT practitioner', 'I used to work as IT practitioner', 'I do not work, and have not worked as IT practitioner'.

Affiliation:

- Public sector organisation
- Education provider (university, business school)
- Lower or secondary school
- Professional association
- Industry association
- Industry / supplier of ICT
- ICT-using Industry
- Independent consultant / self employed / entrepreneur
- Certification / accreditation institution
- Trade union
- Standardisation body
- Other (please specify): ...*include open field*

2. Ethics

A defining aspect of any profession involves adhering to professional ethical conduct. Ethics in the IT Profession regulates the boundaries of relationships with customers, colleagues and society. Ethical principles should inspire and inform any individual daily professional practice and keep IT professionals accountable for their work.

For the following statements, please indicate to what extent you (don't) agree (strongly agree/agree/disagree/strongly disagree/do not know):

- Any organisation, as a way of guaranteeing professionalism, should seek to employ only IT professionals who are members of a professional association and abide by a Code of Ethics.
- Similar to professions of Law or Medicine, membership of a professional association should be inextricably linked to the ability to practice, and, in some cases, the loss of that professional membership should result in the loss of the right to practice.
- Organisations/employers are not doing enough to encourage and facilitate applying a correct attitude in the daily workplace.
- Ethics should be a part of continuous learning of IT professionals and it should be possible for employers to track achievements of professionals in this regard.
- Establishing (voluntary) national registers of IT professionals will increase transparency of achieved competences.

Several actions have been suggested to further promote ethics and incorporate in the IT Professional Framework. Please mark to what extent these actions are **effective** (very effective, effective, not effective, very ineffective/ do not know) and which would have your **support** (strong support/support/no support/absolutely no support/ do not know).

Suggested actions as regards 'Ethics'

Creating a first version of a European Code of Ethics would contribute in raising awareness of IT Professionals' responsibilities and obligations towards society

Start (voluntary) registration of IT professionals

The evaluation of IT services and activities to determining the impact of IT products and services in the general interest; and explore if regulation is needed

Training modules to inform and train professionals on Ethics

Training modules to inform and train employers on Ethics

Include ethical principles in certification and accreditation

Mandatory ethics and IT education at bachelor level of IT professional studies and also through other activities (e.g. seminars on professional ethics, peer learning within companies and between computer society members, professional magazines, scientific journals or books);

Please use this comment box to make additional suggestions, remarks or explain your choices. *< include open comment box for respondents to explain or add >*

3. Knowledge

A Body of Knowledge (BoK) is the accepted ontology for a specific domain. In essence, a BoK forms a considerable repository for the professional knowledge as used by various professionals. BoKs reflect documented accepted good practices and support enhanced understanding in a subject area. Hence, BoKs often inform course syllabi and serve as a basis for proficiency standards against which industry certifications and higher education qualifications can be issued.

The European Foundational IT Body of Knowledge is an essential building block of the Framework for the IT Profession and aims to provide a 'go-to' reference for IT in Europe.

The European Foundational IT Body of Knowledge, defines "the base-level knowledge required for all IT professionals and acts as the first point of reference for anyone interested in working in ICT" (CEPIS, 2012). Different from skills (know-how) and its application (competences), knowledge constitutes the know what of the IT profession. Besides a Foundational BoK, various specific BoK's exist that refer to the in-depth technical or specialist knowledge of a specific IT domain.

For the following statements, please indicate to what extent you (don't) agree (strongly agree/agree/disagree/strongly disagree/do not know):

- Non-IT professionals considering a career in IT would benefit from a better understanding of the base-level knowledge required from every IT professional.
- There is a growing need for 'dual thinkers' to cut through the silo-mentality within IT whereby professionals do not always appreciate the impact of their actions.
- Knowledge of IT should be learned mandatory at primary school

Several actions have been suggested to further promote knowledge of IT and in particular the European Foundational IT Body of Knowledge that is part of the IT Professional Framework. Please mark to what extent these actions are **effective** (very effective, effective, not effective, very ineffective/ do not know) and which would have your **support** (strong support/support/no support/absolutely no support/ do not know).

Suggested actions as regards 'Knowledge'
Increase awareness about the <i>European Foundational IT Body of Knowledge (v1.0) (or: fBOK)</i>
Further increase the number of references to specific BOK's and potentially training and certification
Provide foundational modules on the various knowledge areas of the fBOK as to allow non-IT professionals to better understand IT and consider a possible career in ICT
Further connect with Knowledge Foundations (that own specific BOK's) to stimulate adoption of a common language and gather feedback on the current version 1.0
Mapping of curricula of universities and other educational providers with the fBOK to stimulate adoption of a common language and gather feedback on the current version 1.0
Develop guidelines and supportive tools to make the use of the fBOK easier
* <i>fBOK: European Foundational IT Body of Knowledge (v1.0)</i>

Please use this comment box to make additional suggestions, remarks or explain your choices. < include open comment box for respondents to explain or add >

4. Competences

An understanding of the capability and competency needs of individuals working in various roles is essential for organizations to effectively recruit and develop suitable employees. Understanding the core areas of expertise required by various roles and maintaining appropriate levels of competences through commitment to continuous professional development is necessary for building any profession.

A common framework on the IT competences represents a cost-saving and joint solution to define, describe and explain the competences required by the IT labour market. The development of an European e-Competence Framework (e-CF) was strongly endorsed by the European Commission as a solution to facilitate the HR recruitment and assessment within any IT company or organisation.

For the following statements, please indicate to what extent you (don't) agree (strongly agree/agree/disagree/strongly disagree/do not know):

- There is no clarity about how the development of e-competences supports long-term career goals.
- I use the e-CF to describe my capabilities and increase my mobility and employability.
- Educators need to improve their offerings to better target gaps in e-competences.
- Recruitment processes need to benefit more from using a common language for e-competences and hence increase uniformity.
- Personal and Business competences are equally important as IT competences

Several actions have been suggested to further promote competency development and the e-CF as a building block of the European IT Professional Framework in particular. Please mark to what extent these actions are **effective** (very effective, effective, not effective, very ineffective/ do not know) and which would have your **support** (strong support/support/no support/absolutely no support/ do not know).

Suggested actions as regards 'Competences'

Further develop the e-CF by improving the level of granularity of description of competences. This would make the link between competences and role profiles easier to be defined and applied in HR processes (from recruiting to career development and re-skilling)

Raise awareness about e-CF complementary tools (self assessment, benchmark, job profiles, etc)

Align platforms such as LinkedIn with competencies used in eCF

Stimulate take-up of European standards by asking for e-Cf competencies in public procurement

Explore collaboration and create 'one' mapping of e-CF and to Skills Framework for the Information Age¹⁸⁰ (SFIA)

Promoting a clear differentiation between IT professional competences and IT user competences, and how to implement this in concrete activities (training, certification, enterprises etc)

Please use this comment box to make additional suggestions, remarks or explain your choices. < include open comment box for respondents to explain or add >

5. Education & training & certification

Certifications, qualifications, non-formal learning and informal learning are mutually supportive components of a professional's career development and they attest to an individual's competences and skills.

For the following statements, please indicate to what extent you (don't) agree (strongly agree/agree/disagree/strongly disagree/do not know):

- There is a need to improve the transparency and comparability of courses in terms of developed e-competences and associated proficiency levels to support more informed course selection decisions.
- There should be increased attention in education courses for practical application of knowledge through e.g. internships.
- Ethical attitude should have a more prominent place in education, training and certification.
- Education and training providers should increase their ability to flex with changing demand as the rate of technology changes and adoption is speeding up.
- Mobility of IT professionals from outside Europe to Europe, and within Europe, is insufficiently supported

Several actions have been suggested to further facilitate Education and Training as part of the IT Professional Framework. Please mark to what extent these actions are **effective** (very effective, effective, not effective, very ineffective/ do not know) and which would have your **support** (strong support/support/no support/absolutely no support/ do not know).

Suggested actions as regards 'Education and training'

Adapting primary and secondary education in order to provide basic IT user skills at an early age and raise interest in continuing with computing related studies after secondary school

More computer science in school, change curriculum as well as the exams, incorporate knowledge and skills development in the curricula

¹⁸⁰ <http://www.sfia-online.org/en>

Map education courses to the e-CF and audit the mapping process in order to improve the transparency, relevance and comparability of courses in terms of developed e-competences and associated proficiency levels
Train the trainer initiatives/ teach the teachers, funded by the government
Foundational courses about what IT comprehends for teachers, but also for other people who are increasingly confronted with IT in their workplace. Possibly 'domain-specific' coursed for e.g. IT in Health, IT in Logistics, IT in Finance etc.
Stimulate collaboration between industry and education and invite industry to curricula development.
Introduce more innovative learning and teaching (e.g. online courses, e-learning modules, tutorials and self-assessment tools) to stimulate students to acquire high level skills
To increase initiatives aimed at promoting IT programs in order to attract young people and girls (i.e Testimonials, Code week, games, etc)

With transparency being one of the underlying goals of maturing the IT profession, certification is certainly an area where progress can be made. Often referred to as the 'certification-jungle', both professionals as well as employers find it difficult to understand the real value of a particular certification. Initiatives have been set up with the aim of increasing transparency in this regard, but these would need to be scaled up to increase the impact and reach greater coverage across Europe.

Please mark to what extent these actions are **effective** (very effective, effective, not effective, very ineffective/ do not know) and which would have your **support** (strong support/support/no support/absolutely no support/ do not know).

Suggested actions as regards 'Certifications'
Diploma vs. recognition of skills by badges.
Bring transparency in certification jungle, e.g. by publishing a quality labels tool.
Use the professional framework as basis for professional certifications
Create an IT certifications map at national levels and then scale-up, and/or link to certification quality labels
Implement a chartered IT professionals certification model
Improve mutual recognition of qualifications/certifications across countries by stimulating take-up of the European e-Competence Framework

Please use this comment box to make additional suggestions, remarks or explain your choices. *< include open comment box for respondents to explain or add >*

6 Your final comments

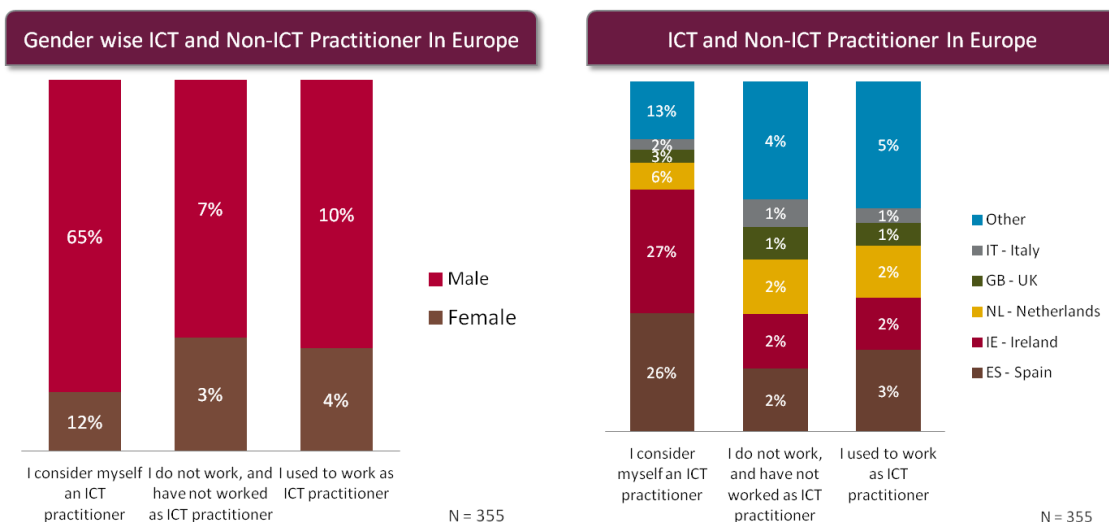
- In your experience, what else could be done to further mature the IT profession and/or ensure the demand for IT professionals can be met in the future? *< include open comment box for respondents to explain or add >*
- If you have any additional comments/observations/additions relating to any question, please provide them below. *< include open comment box for respondents to explain or add >*

Thank you very much for completing the survey!

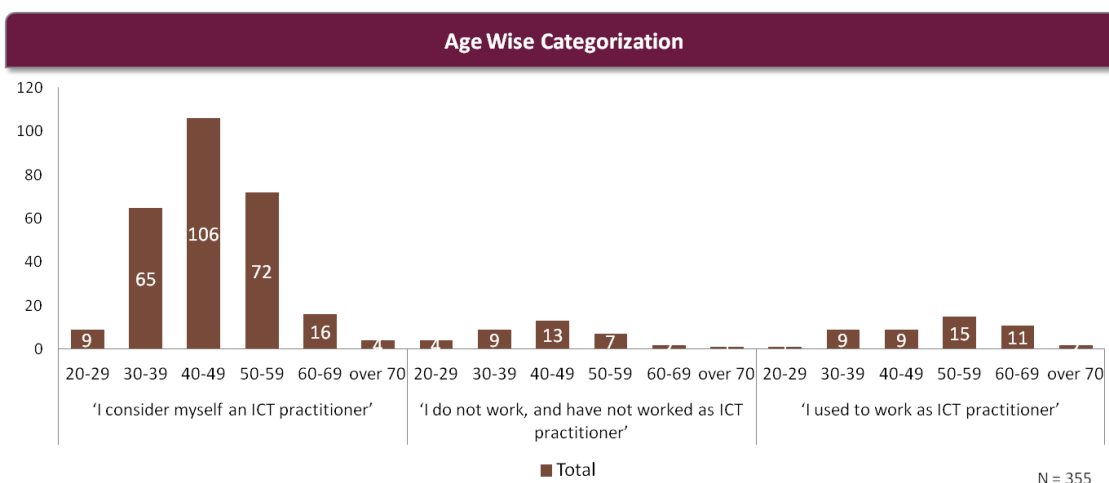
Please follow the project, and be informed of the survey results, by visiting www.ictprofessionalism.eu.

E.2 Results from the surveys

Demographics

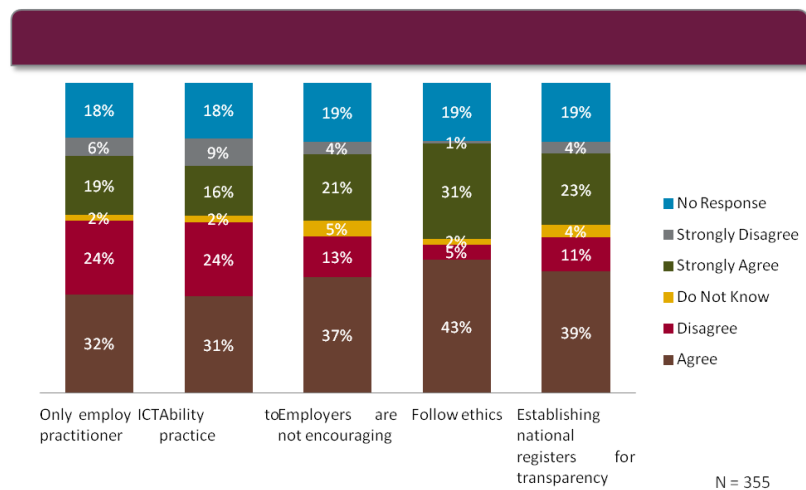


- The male candidate who consider themselves as ICT practitioner or used to work as, are about 65% and 10% and in Europe, Ireland is leading with 27% of ICT practitioner
- The female candidate who consider themselves as ICT practitioner or used to work as, are about 12% and 4% as compare to 3% who do not consider themselves as ICT practitioner



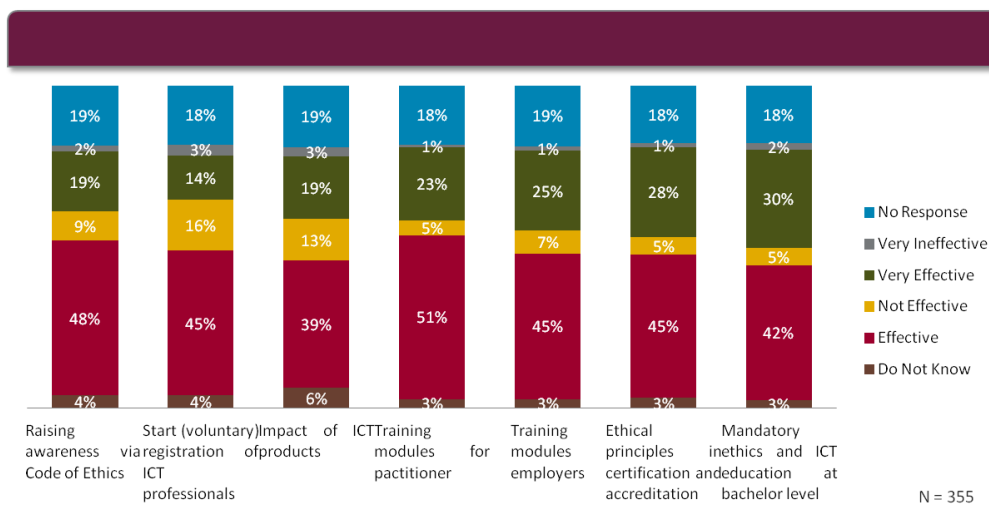
- Between the age group 40-49 and 50-59 around 30% and 20% of candidate consider themselves as an ICT practitioner
- Between the age group 30-39 and 40-49 2% and 3% of the candidate consider themselves as ICT practitioner
- 4% of the total candidate who used to work as ICT practitioner

Group Of Questions Analysis: Q9-Q13



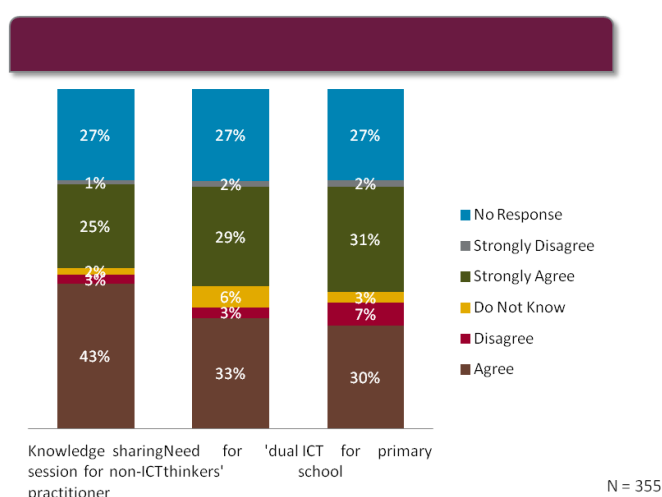
- 32% of the respondent consider, an organization should employ only ICT practitioner and who are the member of professional association and 24% do not agree with the statement
- 31% of the respondent consider that the member of professional association should have the ability to practice and 24% disagree on the and 37% agree on the point that organization is not encouraging
- 43% of the respondent believe that Ethics should be a part of continuous learning of ICT practitioner
- 39% National Registry system should be established to increase the transparency of achieved competences

Group Of Questions Analysis: Q14-Q20



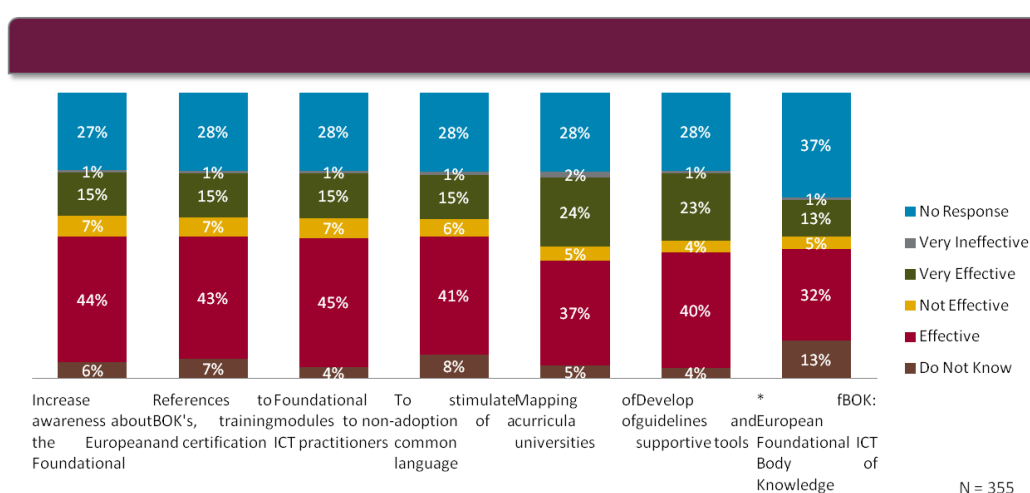
- 48% of the respondent believe that first version of the European Code of Ethics would help is raising awareness
- 39% of the respondent thinks says that there should be some activity to determine the impact of ICT practitioner
- 51% and 45% of respondent believe that there should be training module for practitioner and employers respectively
- 45% of the respondent believe that it will be effective to include ethical principles in certification and accreditation and mere 5% say it will not be effective
- 42% of the respondent believe that mandatory ethics and ICT education should be there at bachelor level of ICT professional studies

Group Of Questions Analysis: Q22-Q24



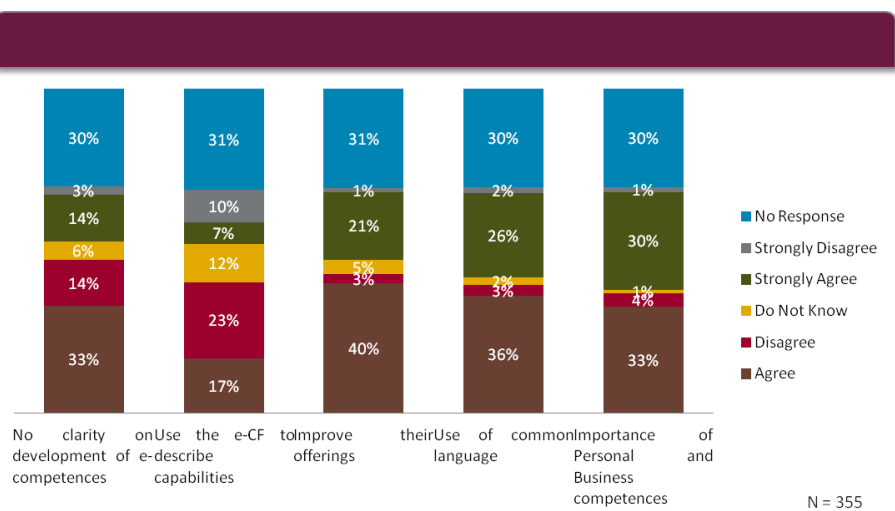
- 43% of the respondent agrees that, candidate considering career in ICT should understand the base knowledge required from ICT professionals
- 33% of the candidate agrees that, there is a need for dual thinker to cut through the silo mentality within ICT and only 3% of the respondent are showing the difference
- 30% and 31% of the respondent agrees and strongly agrees that Knowledge of ICT should be learned mandatory at primary school and only 2% of the respondent shows the strong disagreement

Group Of Questions Analysis: Q25-Q31



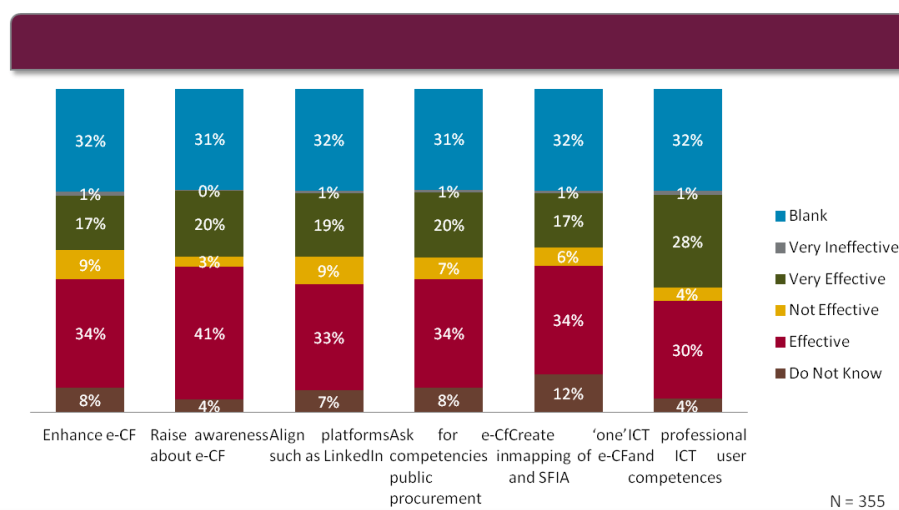
- 43% of the respondent want to have increase in number of reference to specific BOK's, training and certification
- 45% and 15% respondent believe it is effective and very effective to provide foundational module to the non-ICT practitioner
- 41% of the respondent believe it is effective to have a adoption of a common language of which 24% believe it would be very effective to map the curricula of university course
- 40% of the respondent believe that it would be effective to have guidelines and supportive tool and of which 23% respondent believe it would be very effective

Group Of Questions Analysis: Q33-Q37



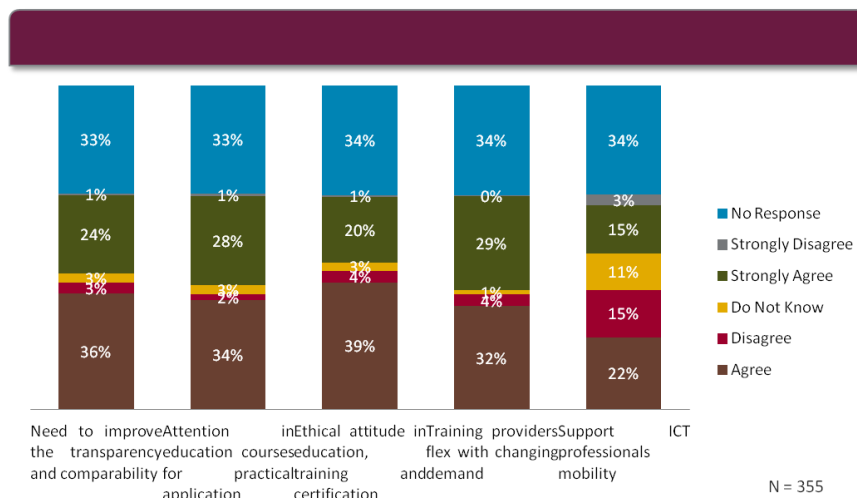
- It is clear from the survey that there is no clarity on having e- competences would support the long term career goals
- Only 17% of the respondent use the e-CF to describe there capabilities
- It is highly recommended that educators needs to improve their offerings to bridge the gaps in e- competences
- Use of common language during the recruitment process is required
- There should be balance between personal and business competences

Group Of Questions Analysis: Q38-Q43



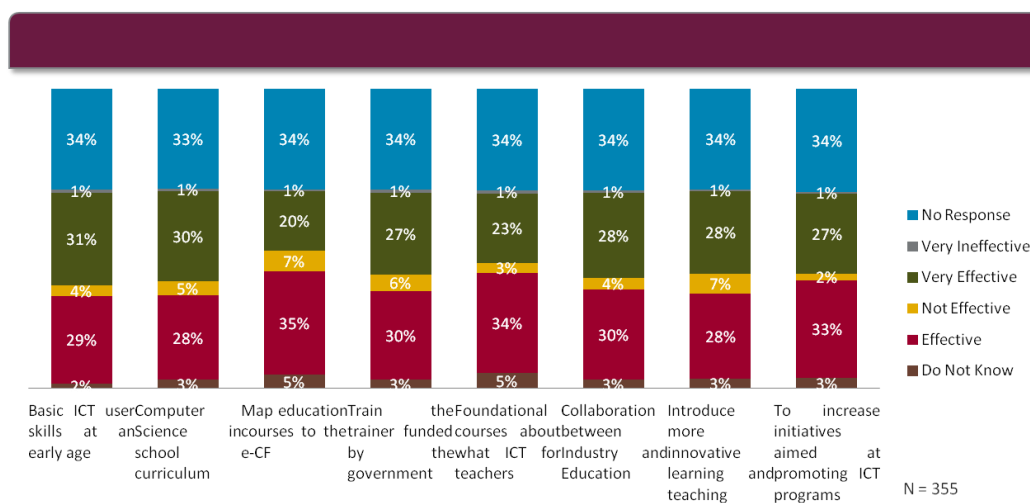
- Further enhancement is required in the e-CF by improving the level of granularity of description of competences
- 41% of the respondent believe that organization needs to raise awareness about the e-CF complementary tools of which 20% believe it would be very effective
- Around 52% of the respondent believe it would be effective and very effective to align platforms such as LinkedIn with competencies used in e-CF
- 51% of the respondent believe that it would be effective and very effective to have one mapping to e-CF and SFIA (Skills Framework for the Information Age)
- There should be clear differentiation between ICT professional competences and ICT user competences

Group Of Questions Analysis: Q45-Q49



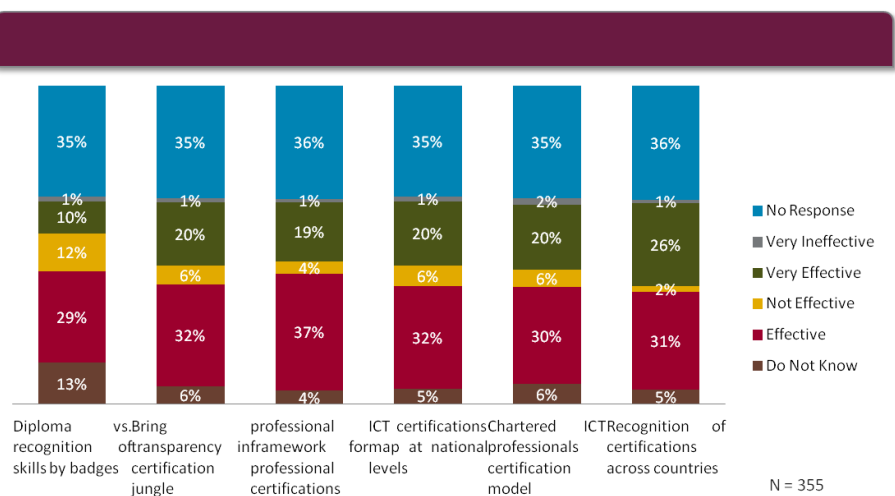
- Around 60% of the respondent agree and strongly agree on the fact that there is a need to improve the transparency and comparability of courses in terms of developed e-competences
- More importance should be give to the practical application of the knowledge
- There should be ethical attitude in education, training and certification
- 61% of the respondent believe that trainer should be flexing with the changing demand of technology
- 37% of the respondent agrees on that Mobility of ICT professionals from outside Europe to Europe, and within Europe, is insufficiently supported

Group Of Questions Analysis: Q50-Q57



- 31% of the respondent believe that it would be very effective to adapt primary and secondary children to provide basics of ICT user skills
- Around 58% of the respondent believe that it would be effective to include computer science curriculum in school
- It would be effective if there is a train the trainer initiative funded by the government
- 57% of the respondent says that it would be effective for people to have ICT knowledge in the field of Health, Logistics etc.
- Around 58% of the respondent says it would be effective to have stimulate collaboration between industry and education

Group Of Questions Analysis: Q58-Q63



- There should be a badges to differentiate between the skills
- 52% of the respondent believe that it would be effective to have a transparency in professional certification and 56% says to have professional framework
- ICT certification should be map at national level and it would be effective to have Chartered ICT professionals certification model
- 57% of the respondent believe it would be effective to if ICT certification gets recognized across countries

Appendix F: Guidelines on Statements of Professional Ethics

These guidelines set out basic principles which are expected from Statements of Professional Ethics for the IT Profession in Europe. They are intended to apply both to the direct actions of the professional and to the indirect actions i.e. the automated actions of the technologies implemented by the professional.

Observance to a Statement of Professional Ethics must comply with company's principles to satisfy those principles, failing to which would reason an explanation for the failure.

The creation of compliant statements of Professional Ethics brings with them the need to promote a practice of continuous compliance and periodic re-evaluation, in strong preference to a practice of periodic compliance via audit. This way, such statements become the basis for ensuring that the highest levels of Professional Ethics are obtained.

The creation of a European framework for IT professionalism, and with it a framework for IT Professional Ethics, creates a need to provide suitable supports. Such supports are intended to include:

- Promoting the highest levels of Professional Ethics, in industry, among Professionals and professionals, and to society and the public.
- Assistance for the professional in trying to address problematic areas, including “safe spaces” where ethical issues can be discussed
- Educational support to prepare professionals to address ethical areas within their professional environments
- Case studies and other educational resources to help develop professionals' expertise in considerations of Professional Ethics.

The framework acknowledges that there are limitations. Professionals, no matter how expert, nor how highly trained, are nevertheless human beings working in human environments; “to err is human”. Ethics itself is not static; it evolves to reflect changes in cultural norms and technological challenges; this evolution itself drives the need for continuing education and development for professionals in Professional Ethics, as well as for professionals to contribute appropriately to the discussions that are involved in that evolution.

This report recommends that procurers of IT services and systems should require that the relevant implementing professionals have a validated statement of adhering to a code of ethics/conduct/practice that is compliant with these European guidelines.

A Professional Ethics Statement

There are four general principles of Professional and ethical conduct which form the basis for any statement on Professional Ethics. These principles recognise that activities of a professional nature impose specific duties on professionals; these are to serve:

- the interests of the public and of society
- the employer or client
- the informatics profession
- the professional practitioner.

These duties imply particular requirements that need to be observed by professional informatics professionals, and which need to be incorporated into any compliant Statement of Professional Ethics along with appropriate guidance.

Sometimes these principles may find themselves at odds. It is the skill of the IT Professional to apply expert judgement in achieving the most appropriate balance, or to advise where an appropriate balance cannot be found.

Protection of Public Interest and Legal Compliance

“The IT Professional acts to protect the safety and interests of the Public, and Society; and at all times acts in compliance with the relevant law.”

The medical profession promises to “first do no harm.” IT Professionals must be similarly bound. IT systems have great power to advertently or inadvertently cause damage or harm at all levels. Therefore the first question of the IT Professional should be whether the implementation of the system has suitable safeguards for protecting public health, safety and the environment; have the risks been assessed? Have the likely and potential outcomes following system implementation been considered?

It must be acknowledged that it is possible to be fully legally compliant, and remain unethical (and *vice versa*). Nevertheless, the IT Professional has a duty to ensure that the system implementation does not itself break the law, and that live use of the system does not lead to the law being broken. Of particular concern here is recognition of the rights of individuals to information privacy, and other rights as enshrined in the European Convention on Human Rights; the IT Professional has a duty to avoid actions that can lead to adverse effects on such rights.

This principle implies that the IT Professional has a duty to obtain a knowledge and understanding of relevant legislation, regulation and standards, and has a consequent duty to apply these as system requirements whether requested by the customer or not. Included in this is that recognition of the rights of third parties, and the intellectual property rights of others are, not prejudiced.

Responsibility to Employers and Clients

“The IT Professional acts in the best interests of their employer or client, to use their relevant knowledge, skill and capability to provide the best possible solution to the best of their ability.”

The employer or client calls on the IT Professional to provide a solution to requirements based on the application of relevant skills, knowledge and capabilities. The IT Professional is relied on, in this circumstance, to provide these solutions to the best of their ability, cognisant of best practice and implied or inferred requirements. In performing this work, the IT Professional must draw the employer or client’s attention to the consequences of ignoring or overruling professional judgement.

A key expectation is that professional work will be performed within the time expected and within the budget quoted; earliest possible notification is required if these expectations are unlikely to be fulfilled. Professional assignments must not be terminated except for good reason and with reasonable notice.

Equally, the IT Professional must not offer or provide any inducement to a third party in return for the introduction of business from a client, unless there is full disclosure of the facts to that client

Professional Dignity and Promotion of Professional Aims

“The IT Professional protects the dignity of the IT Profession, and acts to develop and promote both the Profession and its professionals.”

The professional has a duty to the profession from which they derive their living. The professional must act with integrity towards fellow professionals, and to members of other professions who may be engaged in related work. Activities which are incompatible with professional status must be avoided.

To stay alive, the profession must grow and advance its knowledge. The professional has a duty to the improvement of professional standards through participation in their development, use and regulation. Professional development must be encouraged, and the professional should support fellow professionals in their development, including the supporting the development of new entrants to the profession.

The professional should work to advance public knowledge and appreciation of IT and the IT Profession, including countering possible false or misleading statements. The professional must not act in any way which detracts from the esteem or reputation of the profession.

Competence, Responsibility and Impartiality

“The IT Professional acts openly and impartially, within their own competence, taking responsibility for their work, and any work directed by them.”

Concomitant to the expectation of best practice application of skills, expertise and knowledge to the implementation of solutions, the professional must avoid any claims of levels of competence that are not possessed.

The professional accepts responsibility for work performed, including the work of subordinates and associates under their direction.

Situations giving rise to conflict of interest to professionals or clients must be avoided; full disclosure of such circumstances that may arise must be advised to clients in advance.

Appendix G: SFIA – e-CF Comparison & Mapping Review

SFIA – e-CF Comparison & Mapping Review

October 2016

Version V2.0

This document reports on an exercise to map the SFIA and e-CF frameworks to establish similarities and differences and to explore future collaboration and the benefits of a possible merging of the two frameworks. The report was commissioned by the *BCS, The Chartered Institute for IT*, and reviewed by both the consortium responsible for the EASME Service contract to develop and implement a European framework for IT professionalism, as well as the stakeholders involved in a working group meeting on 14 June 2017, at the premises of the BCS in London.

It is intended as input to future mapping and merging discussions.

This document has an associated set of mapping matrices, published separately.

Executive Summary

This report describes the findings of a study to compare and map the two frameworks SFIA (Skills Framework for the Information age) and e-CF (European e-Competence Framework) and to consider bringing the two frameworks closer together.

Both frameworks have the same aim – to provide a means of characterising the skills/ competencies necessary for roles within IT. Both frameworks are available in several languages with SFIA including 3 non-European languages.

SFIA has established a global user-base in almost 200 countries and is managed by the SFIA Foundation on behalf of its users. It is updated by open consultation with the users and is free of charge for non-commercial, internal use. Tools support is available from several Accredited Partners. SFIA was first published in 2000.

e-CF has established a mostly European user-base of organisations of all kinds and is a reference base of a number of EU project initiatives inside and outside of the CEN (European Committee for Standardisation) context. It has been adopted as a European Standard by CEN in April 2016 and is being promoted for adoption throughout Europe. It is free of charge and is supported by an online tool. The first initial version of the e-CF¹⁸¹ was released in 2008. There are countries outside of Europe that are adopting e-CF (such as Northern African countries e.g. Tunisia and the Russian Federation).

This comparison and mapping has focussed on the more difficult task of ‘equivalence’ – comparison for alignment of service offerings is relatively straightforward as rigour is not required. The main points are as follows:

- The coverage of IT skills in SFIA is wider than in e-CF. The description of SFIA skills is more specific and the use is especially for IT professionals. The description of e-CF is more high level and the use is for Professionals who are dedicated using IT competences (IT Professionals) or professionals who are using some IT competences (in other domains).
- The levels within the frameworks do not align one-to-one and there is overlap.
- Some e-CF competencies encompass more than one SFIA Skill.
- There is rarely a one-to-one mapping of skills and competencies and so information is distributed throughout the frameworks making a clear comparison very difficult.
- Both frameworks need to be interpreted for use.
- Both frameworks have attributes outside of the skills or competency descriptions; the Generic Responsibilities in SFIA and the Annex Table attributes of e-CF.
- The ‘ecosystem’ surrounding SFIA has been built over the last 16 years.

¹⁸¹ The Council of Ministers stated in the Competitiveness Council Conclusions (22-23 November 2007) that it supports the intention of the Commission to develop a European e-Competence Framework. See (page 17): http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/intm/97225.pdf

- The e-CF is more recent. Since e-CF became a European Standard¹⁸² last April more and more governments and employers are adopting e-CF.
- The e-Competence Framework is one part of four basic building blocks, describing IT professionalism. The other building blocks are Knowledge, Education & Training and Ethics. This enables a comprehensive and coherent approach to IT Professional Development.

A comparison summary of some of the areas needed to be considered is provided in Appendix A along with a reference to the comparison mapping document which provides detail at the individual skills and competencies in each framework.

There is no reason why the two frameworks should not co-exist but clearly there is a benefit to bringing the two frameworks closer together and possibly can be merged as one This appears to be relatively straightforward from a technical point of view as there is so much similarity in the two frameworks however the issues of ownership, migration for key users and issues relating to a number of underlying principles would need to be resolved.

¹⁸² CEN/TC 428 - Digital Competences and IT Professionalism

G.1 Introduction

G.1.1 Background

BCS, The Chartered Institute for IT, commissioned this report to be a comparison review of both SFIA and e-CF for input into a proposed mapping workshop. It provides a review of the current skills and competency landscape, a comparison of the SFIA and e-CF Frameworks and a mapping between the two.

G.1.2 Output from this Review

The deliverables from this review are:

- This report detailing the comparison of the frameworks and a mapping of both frameworks
- A presentation of findings of this review for the proposed mapping workshop

Note: While the mapping matrices could be considered a 'stand-alone' document, it does not have all the considerations behind it and so the mapping matrices should be read, and indeed used, in conjunction with this report as a whole.

G.1.3 Conduct of the Review and Mapping

This work was funded by BCS, The Chartered Institute for IT and conducted primarily by Ian Seward, an independent consultant; he is an experienced SFIA Accredited Consultant and the general manager of the SFIA Foundation.

This mapping exercise was carried out as a 'desk study' of the two frameworks using some existing mappings as input, and with input and review from experienced skills and competency expert professionals from the global SFIA community.

G.1.4 Skills and Competency Frameworks Reviewed

The following skills and competency frameworks (and specific documents) were reviewed:

- SFIA – The Skills Framework for the Information Age
 - SFIA V6 – The Complete Reference Guide
 - SFIA V5 – in part
- European e-Competence Framework V3.0
 - European e-Competence Framework – CWA 16234:2014 Part 1
 - User Guide for the application of the e-CF 3.0 – CWA 16234:2014 Part 2
 - Building the e-CF – Methodology documentation – CWA 16234:2014 Part 3
 - Case Studies for the Application of the e-CF 3.0 – CWA 16234:2014 Part 4
 - The European Qualifications Framework EQF

G.1.5 Background to Collaboration

During a recent e-CF/SFIA Collaboration workshop (March 2016) a number of topics were discussed:

- e-CF expressed that the cost of the update process was considerable and wanted to know how SFIA managed this

- fees and sustainability
- growing a user base

It was decided that the possibility of collaboration should be considered and, as a first stage, a mapping of the two frameworks should be undertaken possibly to frame further collaboration activities.

G.2 Description of the Skills Framework Landscape

G.2.1 Introduction to the Skills Framework Landscape

A number of skills and competency frameworks for IT have been developed. SFIA, The Skills Framework for the Information Age and e-CF appear to be the two leaders in this area at present. While SFIA and e-CF are considered as the two leaders for the purposes of this study, other frameworks do exist. For instance, the Japanese have created the iCD Skills Framework which is very well regarded in Japan. Other models in the US are ITCM, Information Technology Competency Model and ITC ACM, Information Technology Competency Model of the Association for Computing Machinery.

Overall, these frameworks have different structures, style and underlying principles, but they share a common intent – to help to enhance the skills and competency of those working in IT (or in some cases a subset of IT).

Therefore, it makes sense to look at possibilities for collaboration.

Furthermore, it should be noted that even if many skills and competency frameworks can co-exist, logic does suggest that it is more suitable to understand the differences/complementarities among such frameworks in order to integrate them in a unique solution.

G.2.2 SFIA

SFIA, The Skills Framework for the Information Age was first published in 2000: this was as a result of a collaboration by a number of organisations that had been using, or working with, several different UK competency frameworks; an example would be the BCS' Industry Structure Model from the late 1980s/1990. The SFIA Foundation was established as a not-for-profit organisation to develop, maintain and promote the framework for the benefit of the IT industry and IT professionals in the UK.

As a not-for-profit organisation, the Foundation has never actively promoted the framework either within the UK or globally; the framework has simply been made available to those who want to use it. The vast majority of users make use of SFIA free of charge with only a modest charge being made for commercial exploitation (selling SFIA consultancy and tools).

Regardless of 'legal ownership' – SFIA is 'owned' by the global IT Industry user community, it is updated through open consultation with its users; it is used by industry because of its usefulness, kept relevant, and there are no barriers to its use. It is not enforced or mandated by anybody.

Since 2000, thousands of organisations have made use of the SFIA Framework and many have presented at the various SFIA conferences (for instance, at the SFIA Version 6 Conference in Sydney, Australia in August 2015 with nearly 20 case study presentations). Many organisations have embedded SFIA deeply into their skills management activities and do not separately recognise SFIA from what they do. Others willing to adopt a skills or competency framework might use a mapping against SFIA to validate other frameworks.

Today, SFIA is a global IT Skills and Competency Framework with users in almost 200 countries. It is the basis of a number of large programmes: Australian Public Sector IT job roles are defined using SFIA skills; the BCS Chartered status, membership, career paths and professional development scheme is underpinned by SFIA.

A number of tool providers provide support for the SFIA framework and numerous organisations have built their own internal tooling.

SFIA is available in 6 languages with two more under discussion.

G.2.3 e-CF

The European e-Competence Framework (e-CF) was initiated by the CEN Workshop on IT Skills, which is bringing together experts representing the IT industry, academic institutions, vocational training organisations, IT professional associations, social partners and research institutions. The workshop aims to strengthen the IT profession through the creation of relevant supporting standards that can be applied throughout Europe. All interested stakeholders are invited to participate in the activities of CEN, which is supported by the European Commission and the European Free Trade Association. Following input and high-level involvement of European IT sector experts and stakeholders, the framework's first initial version was released in 2008. The e-CF was originally established in order to offer a competency tool with underlying knowledge for European IT professionals. By 2010 and with experience and application feedback, version 2 was then published: a framework with greater depth, updated user guide, new methodology documentation and an online tool with user-specific profile building capabilities. The current e-CF version 3.0 was published in December 2014. The development of a new version (4.0) should start in 2017 and would be available in 2018.

In 2016, the e-CF became a European standard and published as the European Norm EN 16234-1. While maintaining an identical structure and content to the e-CF 3.0, the new EN format eases the application of the framework Europe-wide.

As regards the content, the e-CF provides a reference of 40 competences applied at the Information Technology (IT) workplace organised into five main IT business areas. It offers clear definitions and a common language for competences, skills, knowledge and proficiency levels that can be understood across Europe. Being structured into 4 Dimensions, the framework includes organisational perspectives (in Dimensions 1 and 2) together with Dimension 3 to 'bridge individual and organisational competences'.

As regards its potential application, the e-CF fits for use by individuals, businesses and other organisations in public and private sectors including HR departments and individuals. In fact, it enables the identification of skills and competences required to successfully perform duties and fulfil responsibilities related to the IT workplace. Overall, the widespread adoption of e-CF has improved the transparency, mobility and efficiency of the IT sector.

Throughout its life, e-CF has been trialled in a number of pilot projects, approximately 40. A profiling tool has been developed to support the e-CF framework. The e-CF is available in 4 European languages presently.

The e-CF is a component of the EU strategy for e-Skills in the 21st Century and contributes to the achievement of the policy objectives of the Grand Coalition for digital Jobs.

To ensure its validity in time, the e-CF undergoes updates every three years thus adapting to rapid changes within the IT environment.

Competences – as described in the e-CF - is one of four basic building blocks describing IT professionalism. The other parts are Knowledge, Education & Training and Ethics.

G.3 Method for Mapping

G.3.1 Introduction

This mapping has been carried out by ‘desk study’ and a survey of skills and competency (SFIA) experts, who have many years’ hands-on experience of enhancing IT skills within user organisations and specifically, the use of SFIA. Additionally, there are inputs from a number of organisations that have undertaken mappings to ‘some degree’.

Note: The input to this mapping has largely come from the global SFIA community which resulted from many years of implementation practice.

The section below describes current mappings made available to this study and gives an overview of some of the issues that they do not cover adequately: this mapping exercise will try to take these mappings further and begin to address some of those issues. It has however, become apparent just how complex this mapping exercise really is and so, while this mapping takes things further and identifies some of the issues, it probably does not address all issues completely.

When choosing a mapping – or, indeed, embarking on a mapping – one must consider the purpose the mapping will be put to, it is likely that with a different objective one mapping might be different to another. Some possible uses are listed below:

- Validating or justifying one framework against another
- Enabling either framework to be used for comparison against a model of competence e.g. for individual certification where any tolerance is critical.
- Internal use in managing and developing skills and competencies and only needing a superficial awareness of other frameworks – i.e. the tolerances are interesting rather than critical.

Mapping for equivalence, for example certification, is very different to mapping for the provision of training or subject qualification.

One additional issue to be considered is that of language and translation: SFIA is first produced in English then translated into 6 languages (with 2 more scheduled); e-CF’s profiling tool is available in 4 European languages (maintenance updates include words changes in order to clarify meanings). The current mapping does not take into account possible misinterpretations occurred in translations.

G.3.2 Existing Mappings

A number of mappings have been produced and those made available to this exercise have been considered in this report. None is identified nor critiqued specifically, as the circumstances of those mappings remain unknown. It is fair to say that a number of those mappings have been mostly ‘an initial cursory glance’ and take a rather simplistic view.

Whilst a useful ‘first look’ – and, no doubt, useful for the purpose that they were intended – these mappings have rather oversimplified the situation and typically, not explored beyond the name of the skill or competence in one framework to the name of the skill or competence in the other, in order to establish ‘equivalence’.

Firstly, the description below the name has often not been considered and the ‘mapper’ has used their subjective view of what they understand the skill to be and concluded that since it is called the same, or pretty

much so, and the description matches to some degree, then the skills or competence equate: the detail below the description, therefore, has almost certainly not been fully considered.

Secondly, the current mappings made available to this study, make a reasonable high-level mapping of the levels (SFIA 1-7 and e-CF 1-5) effectively by saying 1=1 and 7=5 and then distributing the levels somehow in between: again this is useful to some degree but lacks the rigour of detailed comparison and can be quite misleading.

And thirdly, the underlying concepts and principles have not generally been considered as part of mapping exercises.

G.3.3 What makes a good Mapping?

A good mapping is one that fairly represents:

- How the frameworks are related
- Determines equivalence – essential for certification or rigorous comparison
- Adequately describes and compares the underlying concepts
- Identifies equivalences, omissions or gaps
- Considers tolerances
- Identifies issues for users
- Enables considered selection
- Allows a determination under one framework to be equated to a determination in the other framework

It is likely that there is a lot of personal opinion in any mapping and, although undesirable, it does reflect the subjective nature of such an exercise; while this is to be minimised, it probably cannot be removed altogether.

An example of this is 'tolerance'. Both models are discrete scales of competence one of 5 levels and one of 7 levels – half-levels make no sense at all. It is often difficult to determine if someone is at one level or another even in one framework, but where a level in one framework bridges two levels in the other framework this adds complication and introduces more 'error' – put simply there is probably an error of one framework level in any mapping and this is very significant where the number of levels is as few as 5.

This exercise is intended to form the basis of a workshop to review mappings and decide what mapping could be taken forward as the 'agreed-mapping'. It is also intended to inform future discussions on collaboration and any possible merging of the two frameworks. For this reason, the mapping is intended to be fair but also to not ignore issues which need to be resolved if such a mapping is to be used for direct comparison, contractual purposes or certification of any rigour.

G.4 Comparative Description of the two Frameworks

G.4.1 Introduction and High-Level Similarities

Both e-CF and SFIA aim to do the same thing – provide a means of characterising the skills and competencies necessary for roles within IT. Both frameworks, of course, use similar terms, sometimes for the same thing and sometimes for a different aspect – this has the potential to cause confusion, as it leads to assumptions.

A comparison summary of some of the areas needed to be considered is provided in Appendix A along with a reference to the comparison mapping document which provides detail at the individual skills and competencies in each framework.

Both frameworks are models of skills or competencies against a level of competence or proficiency. Not all skills or competencies can be practised at all levels, for instance, a strategic IT skill is not practised at SFIA Level 1 or e-CF Level 1.

Both frameworks describe attributes that are additional to the skill or competency at level but necessary to underpin that skill at level. The frameworks each have a consistent structure that enables easy navigation.

For the purposes of this review, a comparison of the structure of each framework is provided below with detailed description of the structure in subsequent sections.

SFIA	e-CF		Comment
Category/sub-category	e-CF Area	Dimension1	At convenience for organising the skills and competencies. SFIA has an Area of Work View and e-CF has a Lifecycle View'. Both have more of a business change than an engineering flavour.
Skill	Competence	Dimension2	The Skills and Competencies in the framework. For example: Project Management (SFIA) & Project Management (e-CF)
Skill Description	(Competence) Description		A description of the Skill (SFIA) or Competency (e-CF). These are generally similar although style varies between the frameworks.
Level	Proficiency Level	Dimension3	The Competence or Proficiency Scale SFIA: 7 levels. e-CF: 5 levels.
Skill at Level	Proficiency at Level		A description of the Skill (SFIA) or Competency (e-CF) at each level. Both describe actions performed for the skill or competence at increasing levels of proficiency or competence.
	Skill Area	Dimension4	These are additional statements of actions for an e-CF Competence. SFIA: These statements are usually included in the Skills Description and/or the Skill at Level. e-CF: Additional Skills Statements apply to all levels.
	Knowledge Area		SFIA: Deliberately does not define knowledge areas for the skills. It does, however, imply knowledge of appropriate technologies and, more specifically, non-technical aspects within the levels. e-CF: Identifies a mix of technical and non-technical knowledge.
Generic Responsibility Attributes			SFIA: This is the key generic description of attributes for any level. e-CF: Not explicitly defined other than in the description of alignment with the EQF but Business Skills and Influence are not explicitly covered and some descriptions span levels.

Mapped Structure of the Frameworks

A skill is a specific and desirable expertise, when combined with other skills can create a competency in an individual.

A competence is a demonstrated ability to apply knowledge, skills and attitudes to achieve observable results.

For example a Tester needs testing skills:

- SFIA skills: executes test scripts under supervision, records results and report issues.
- Within SFIA this means that a person performs the Testing skills at competency level 1.
- e-CF skills: design tests of IT systems and report and document tests and results.
- To be competent at level1 the IT Professional must also be aware of the underlying knowledge (like different sorts of tests) and that the professional will apply this knowledge using the skills to get a result (performs simple tests in strict compliance with detailed instructions).

G.4.2 SFIA

SFIA Overview

SFIA has identified 97 IT skills (Professional Skills) and 7 levels of competence. While the number of skills has varied a little over the releases, the number of levels, 7, has not. Not all skills can be practised at all levels, for instance, a strategic IT skill is not practised at SFIA Level 1. A key component of the SFIA Framework is the concept of demonstrated experience of a professional skill and generic responsibilities.

SFIA describes Professional Skills at levels of competence. While recognising the importance of other attributes, SFIA does not make an attempt to define these.

- Professional Skills
SFIA defines professional skills
- Behavioural Skills
SFIA does not define behavioural skills as many organisations have their own internal behaviours and values defined. An organisation's internal behaviours and values can generally be aligned to the SFIA Generic Responsibilities.
- Knowledge
SFIA recognises the importance of knowledge but does not define requirements. Technologies, standards, and legislation changes frequently and organisation requirements vary – SFIA does not define knowledge requirements.
- Experience
SFIA recognises experience through demonstrated practice of the professional skill at level. It does not place particular requirements on years or any other particular description of experience.
- Qualifications
SFIA recognises the part qualifications play but does not define requirements. Qualifications change as new offerings are available and, in general, qualification does not equate to demonstrated experience of competence – SFIA does not define qualification requirements.

While several organisations have extended SFIA to address the above areas, at least in part, SFIA has left this to SFIA users rather than make definitions in this area.

SFIA Generic Responsibilities

The levels of responsibility and accountability used in SFIA (the 7 levels) are described in generic terms and the individual skill at level descriptions are defined to be consistent with these generic levels. The SFIA Generic Responsibilities are:

- Autonomy
- Influence
- Complexity
- Business Skills

Simply, at higher levels of competence one would be expected to have greater autonomy, greater influence, be able to handle greater complexity, and have a better understanding and consideration of business skills.

SFIA Structure

SFIA Skills (professional skills) are arranged into Categories and Sub-Categories these are just logical collections and to aid navigation. The categories do not relate to any particular lifecycle or standard although if one is working in a particular area then it is likely that one will have skills mostly from that area, Delivery and Operation, for instance.

SFIA Categories are:

- Strategy and Architecture
- Change and Transformation
- Development and Implementation
- Delivery and Operations
- Skills & Quality
- Relationships and Engagement

Throughout the SFIA Reference Guide, Skills are structured consistently as follows:

- Skill Name
A name used for reference.
- Skill Code
A unique simple code.
- Overall Description
A broad definition of the skill.
- Level Descriptions
A definition of the skill at each of the 7 levels. The phrasing facilitates their use as professional competencies. In general these are single paragraphs, of a few sentences, describing what is should be demonstrated at that level for that skill.

G.4.3 E-CF

e-CF Overview

e-CF has identified 40 IT Competencies and 5 Levels. The 5 levels are mapped to the European Qualification Framework (EQF) levels 3-8. Not all competencies are described at all levels. The e-CF introduces 'Dimensions' as a means of structuring the information in a consistent way: Dimension 1, for instance, provides a grouping that would be recognised with a lifecycle view as Plan, Build, Run, supported by Enable and controlled by Manage.

Alignment with the EQF

There is categorising in e-CF that could be seen as similar to the generics from SFIA, notably the table at the end aligning the e-CF Levels to the EQF Levels.

The levels of responsibility and accountability are described in generic terms and the individual skill at level descriptions are defined to be consistent with these generic levels. The e-CF Generic Responsibilities are:

- Level Description
- Typical Tasks
- Complexity
- Autonomy
- Behaviour

At higher levels of proficiency, one would be expected to have greater autonomy and handle greater complexity: there is no explicit linking to the business and the introduction of Behaviour.

Like SFIA, e-CF does not include behavioural (or personal) competences because organisations use their own definitions. Same for business competences.

One aspect of this which is particularly useful is the anecdotal description of Levels to 'example position' such as 'Senior Professional / Manager'.

E-CF Structure

The structure of the e-CF is consistent: essentially the competencies (Dimension 2) are distributed throughout the e-CF areas (Dimension 1). Each competence is described at up to 5 levels of proficiency (Dimension 3) and up to 14 knowledge statements and 11 skills statements (Dimension 4):

- e-CF Area – Dimension 1
There are 5 e-CF areas which are groupings:
 - A. Plan
 - B. Build
 - C. Run
 - D. Enable
 - E. Manage

- e-CF Competence – Dimension 2
The 40 e-CF Competencies are distributed throughout the 5 e-CF areas. Each competence has a Name and an overall Description.
- e-CF Proficiency Level – Dimension 3
Each of the competencies has up to 5 proficiency levels, with not all competencies having an entry at each level.
- e-CF Skills and Knowledge – Dimension 4
Each competency can also have a number of Skill descriptors and Knowledge Descriptors. These may be a single sentence or just a couple of words e.g. market needs’ for a knowledge or ‘think out of the box’ for a skill. These additional statements apply to the competence at all levels.

Note: the e-CF uses a 2-dimensional model of 40 competencies by 5 levels. The statements for knowledge and skills are unique to the competence they are associated with and are additional information to describe the competence.

Ease of Use

Any user new to skills and competency frameworks may consider both the frameworks complex: there are 97 skills at 7 levels in SFIA (the generic responsibilities are often forgotten); there are 40 competencies at 5 levels with up to 14 knowledge statements and 11 skills statements in e-CF.).

In reality, if you are familiar with one framework then, with a good amount of reading, the other framework is quite understandable.

Both frameworks can be obtained by downloading the documentation from the respective website. SFIA is available as one document and e-CF, while available as one document, has supporting documents and also a description of the EQF. In addition to the framework, the e-CF documentation describes more about how the framework was developed and the various organisations that were involved in the working groups to define the model. Differently, the SFIA Foundation has concentrated on the Framework and not in suggesting its use to industry; these aspects are discussed throughout the global user community and through various papers from individual SFIA users.

The ‘SFIA Wall Chart’ is a simple A3 document and, once one is familiar with the framework, this provides great initial navigation with subsequent reference to the Reference Model for detail.

The single competence per page nature of the e-CF document is particularly clear while the various uses of SFIA (and how it is applied for those uses) are only briefly touched on within SFIA documentation.

G.5 Detailed Mapping of SFIA and e-CF

G.5.1 Introduction

While both frameworks have the same aim they have different structures, terminology, underlying concepts and presentation. This section describes the mapping in detail. It is presented in three parts:

- Style
- Underlying concepts
- Levels
- Skills / Competencies

- Approach and Use

In determining whether a SFIA Skills is adequately addressed by an e-CF Competence (and vice versa) the following components need to be considered as a whole:

- SFIA
 - Generic Responsibilities for a Level
 - Skill Description
 - Skill Level Description
- e-CF
 - e-Competences as part of the lifecycle (dimension 1)
 - Competence Description (dimension 2)
 - e-CF Proficiency Level description (Dimension 3)
 - Competence Knowledge areas and Skill areas (Dimension 4)

G.5.2 Style

e-CF has produced high quality printed material to better describe the process run by the Commission and to easily disseminate its results to the users' community. .

From a comparative perspective, SFIA documentation is currently improving its style but the framework seems to be more consolidated. In a single document there is a description of underlying concepts, ideas for use and the whole of the Framework. The information in SFIA uses a more descriptive style while the e-CF is more concise (e.g. 'Dimension 4').

While organised in different ways, the amount of text describing a SFIA Skills at a Level is much the same as that for an e-CF Competence at Level.

G.5.3 Underlying Concepts

While both frameworks have the same aim they have different structures, and terminology, and differences to some underlying concepts.

SFIA

The SFIA Framework is founded on the belief that demonstrated experience is essential in determining whether a skill or competence is present. It does not define any particular length of service, qualification, knowledge or level of knowledge. It is recognised that qualifications can be valuable and knowledge is essential but it does not seek to define or describe these in detail.

To be able to perform a skill at a particular level it is expected that one can perform the skill at the level below and so on. (This is something currently being debated.)

The nature of the skills changes as one moves up in the levels, in particular, the operational competence of a skill at Level 6 may be greater than the operational competence of the skill at Level 7 – this is one aspect of the debate mentioned in the previous paragraph.

To perform a role one will likely require more than one skill, possibly at different levels.

The Generic Levels of Responsibility are an essential component of SFIA and pitches a level of operation on the basis of Autonomy, Influence, Complexity and Business Skills.

The model must be relevant to industry, and that industry is the best qualified to ensure its relevance and integrity going forward. SFIA is therefore updated and validated by its users through the user group and Council by open consultation – the Framework itself is not driven by any particular agenda.

Use of SFIA is not ‘pushed’ by the Foundation, rather it is ‘pulled’ by industry and business.

e-CF

e-CF is also founded on the belief that experience of the competence being performed is essential. The framework is linked to the EQF and requires increasing knowledge, innovation and technical competence as one moves up in the levels.

Although being placed in an appendix to the framework, the e-CF and EQF Level table is key to e-CF and there is overlapping with the generic responsibilities of SFIA in their intent.

The inclusion of ‘Behaviour’ in the Appendix table is an example of extend the framework with behaviour (personal) competences. This is worthy of further development; at present the statements are written as additional tasks.

The Dimension 4 components of the competencies appear to be less well formed than the other components of the framework. Superficially, this suggests more detail but, in fact, when scrutinised they are not described and are open to significant interpretation, and it is not clear what part they would play in using the framework. They are clearly there to bolster the Competency Descriptions but potentially will be ignored as they are difficult to interpret comparatively (‘thinking outside of the box’, ‘security’, etc..).

The Dimension 4 consists of examples of knowledge and skills and they are related to the description of the competence. The knowledge and skills are to be used in a stackable way (an IT professional who is competent at the highest proficiency level has all the named knowledge and skill examples). There is a possibility to extend the dimension 4 components in time by including more exhaustive examples. .

The framework is made by and for IT industry and IT user industries, academic institutions, vocational training organisations, IT professional associations, social partners and research institutions. It is a collaborative development that established the first version and contributed to further updates in the years after. Besides the Commission there are other supporters of the e-CF that contribute to awareness raising and that stimulate take-up of the e-CF. This results in an increasing number of users across Europe (and even outside Europe).

G.5.4 Levels

Overview

Both frameworks describes the levels for each skill. In the case of SFIA, this is done through a mix of the Generic Responsibilities, the Skills Description and the Level Description for the skill. In the case of e-CF, this is done through a mix of the Competence Description, the e-CF Proficiency Description, the Skill Statements and the Knowledge Statements and a table of Levels mapped to the EQF.

Both frameworks recognise that there are some generic attributes for the Levels but these are more explicitly identified in SFIA and considered key. The inclusion of ‘Attitude’ is particularly interesting and could be hugely

beneficial to a framework (SFIA could benefit from this) but the descriptions of attitude are more additional tasks performed rather than ‘professional attitude’.

The table below illustrates the alignment of SFIA Levels and e-CF Levels. This is discussed more specifically in the sections below.

SFIA Levels		e-CF Levels	Comment
7	Set strategy, Inspire, Mobilise		SFIA & e-CF Levels overlap. e-CF Level 5 is really Tech/Skill Leadership SFIA Level 7 is generally above e-CF Level 5 organisationally. Clarify Skill Leadership vs Org. Leadership and Accountability
6	Initiate, Influence	e-CF 5 Principal	SFIA & e-CF Levels overlap. e-CF Level 5 could be SFIA Level 6 (more likely) or 7 (weakly). SFIA Level 6 is either e-CF Level 4 or 5 (more likely).
5	Ensure, Advise	e-CF 4 Lead Professional	SFIA & e-CF Levels overlap. e-CF Level 4 could be SFIA Level 5 (more likely) or 6 (weakly). SFIA Level 5 is either e-CF Level 3 or 4 (more likely).
4	Enable	e-CF 3 Senior Professional or Manager	SFIA & e-CF Levels overlap. e-CF Level 3 could be SFIA Level 4 or 5. SFIA Level 4 is e-CF Level 3.
3	Apply	e-CF 2 Professional	SFIA & e-CF Levels overlap. e-CF Level 2 could be SFIA Level 2 or 3. SFIA Level 3 is e-CF Level 2
2	Assist		SFIA & e-CF Levels overlap. e-CF Level 2 could be SFIA Level 2 or 3. SFIA Level 2 is either e-CF Level 1 or 2.
1	Follow	e-CF 1 Associate	SFIA & e-CF Levels overlap. SFIA: Appears to start at a lower level than e-CF. e-CF Level 1 could be SFIA Level 1 or 2. SFIA Level 1 is e-CF Level 1 or lower(?).

Mapped Alignment of Levels

SFIA

The SFIA Levels have an anecdotal descriptor which is useful, and then generic descriptions of Autonomy, Influence, Complexity and Business Skills: these have been refined over the years but have not been significantly changed as they have served industry and business well.

SFIA could probably benefit from adding something like the Level descriptors and Behaviours of e-CF but would have to have generic Behaviour descriptions rather than cross over into the behaviours and values that organisations have evolved themselves.

SFIA has 7 levels and some users feel that the current situation does not have adequate range between Level 3 and Level 6; while this is outside the scope of this review, it illustrates that there are still questions to be answered regards current levels.

e-CF

e-CF Levels have a more explicit descriptor similar to role title (e.g. Associate), then a Level description and generic descriptions of Typical Tasks, Complexity, Autonomy and Behaviour. There is no recognition of business skills and complexity descriptions span more than one level, which makes it difficult to use as a component of determining a level.

A particularly good aspect of the e-CF is the generic Level Description past the title.

The equating of the e-CF Levels to the EQF Level is powerful in promoting both those frameworks but it makes a link which does not occur easily in reality. EQF Level 8 is 'knowledge at the most advanced frontier ...', e-CF Level 5 is equated to this but in fact this is a proficiency level with knowledge and skills.

G.5.5 Skills and Competences

Overview

In considering the mapping of the two frameworks, refer to the Mapping Matrices presented in a separate excel document. This section provides a summary and discussion of the mapping:

In some ways, a skill and a competency are similar. They both identify an ability that an individual has acquired through training and experience. But the two concepts are not identical. Skills define specific learned activities, and they range widely in terms of complexity (the "what").

Competencies translating skills into on-the-job behaviours that demonstrate the ability to perform the job requirements competently (the "how" and the "what").

For this purpose we assume an e-CF Competence to be equivalent to a SFIA Skill with the skill descriptor very similar; the Level Descriptors are similar too although SFIA's are more detailed and give some context. The e-CF Dimension 4 attributes (skills) add further content to e-CF to bolster the level descriptors (to equal SFIA) and in some case add specifics not present in SFIA. The knowledge statements do not have an equivalent in SFIA although there is the presumption that, in having the skill, one has the underlying knowledge. Specific knowledge statements in e-CF, and also, to some extent, the skills statements do not fit well with the design goal of SFIA to be generic to any IT environment and the importance of the e-CF skill and knowledge statements are not clear (whether mandatory, how many are required and to what level).

There are 97 SFIA skills and 40 e-CF Competencies. However, it is not quite so straightforward, as some of the SFIA skills could be considered satisfied by one e-CF Competency; for example, the 4 SFIA Quality Management skills are covered by the single e-CF IT Quality Management Competency to some degree.

There are several SFIA Skills that are not addressed by e-CF and some instances where a skill is only addressed because e-CF uses a single word in the description.

With regard to e-CF, most Competencies appear to be covered by SFIA (sometimes by more than one SFIA Skill), three stand out as not being adequately satisfied. SFIA does not have the explicit knowledge statements and avoids being specific with regards to both knowledge and skills.

The 'Dimension 4' attributes of e-CF are useful but are generally omitted from SFIA. Some of the skills from Dimension 4 are covered in the descriptions in the core skills of SFIA or at Level but not all. The knowledge statements are not addressed in SFIA at all. When using SFIA there is an assumption that the underlying necessary knowledge is present – it is not defined explicitly because knowledge and qualification requirements

appear to change rapidly, and often, and also are dependent on context and national area. In e-CF knowledge and skills are quite generic described so they are not too sensitive and subject to changes and context specifications.

While the 'Dimension 4' attributes of e-CF are potentially useful they are not sufficiently defined to be used to determine competency; they are also aligned at all levels of a Competence and not increasing with level; they are not all required, but suggested, and are not exhaustive. As a result they cannot really form part of an assessment of competence and certainly could not be considered a standard.

G.5.6 Approach and Use

Both frameworks can be interpreted for a specific instance and therefore direct comparison is dependent on the intended use. In fact both frameworks need to be interpreted – for instance is a skill satisfied if any part of the skill, as defined in the framework, is not satisfied? In the case of e-CF for instance, how much 'thinking outside the box' is necessary for each level? In both frameworks what underlying knowledge is actually required and how is this determined?

G.6 Collaboration – Towards a single IT Skills Framework

G.6.1 Introduction - Bringing SFIA and e-CF 'closer together'

Clearly, there are benefits in bringing the two frameworks closer together. Both Frameworks share the same issues that need to be addressed. Compared to SFIA, e-CF has been developed as a European standard which could hinder its application on a global scale - even though there are no reasons known why e-CF could not be used outside the EU (there are non-EU countries taking on e-CF). Undoubtedly, there would be benefits for industry if there were one accepted, properly funded, framework.

The complexity of the mapping should not be underestimated. By having two different structures and some differences in the underlying principles it is not so straightforward to simply align skills with competencies and Levels with Levels. This requires extraction and comparison of the words from the various parts of each framework. That said whilst a mapping is complex and would need to be maintained as new versions of the frameworks are published, it is nonetheless straightforward to see how the frameworks could be brought together over a number of iterations, albeit that a number of underlying principles of each framework need to be agreed.

In fact, it is probably easier to see how the two frameworks could be brought together than to establish a mapping of the two frameworks for equivalence and maintain that mapping through future versions of both frameworks.

However, both frameworks claim to offer a common language for IT skills and competency.

G.6.2 Considerations for the two frameworks operating independently

There is no particular reason why the two frameworks should not go on operating independently in parallel. This situation could certainly continue but does lead to a number of confusions:

- Industry and Business are unsure which framework to adopt
 - They do not want to back the wrong one, so will probably do nothing while waiting for the dust to settle.
- National support organisations are unsure which to recommend

- Decisions will typically be made for political rather than sound engineering reasons.
 - Industry and Business always question why the two exist in the first place
 - Service providers do not want to have to support two frameworks
 - Both organisations will be watching the other rather than doing the right thing for industry and business
 - Both frameworks need similar support
 - This is expensive to do twice, it would be better to put efforts into providing one definitive framework
- To a certain degree there will always be different frameworks apart from e-CF and SFIA. In recent months i-CD from Japan have approached the SFIA Foundation to ask how it manages its activities and is looking to collaborate with SFIA to gain more recognition internationally. A similar approach has been undertaken in the direction of e-CF.

G.6.3 Considerations in SFIA and e-CF moving 'closer together'

In bringing the two frameworks closer together it is the underlying concepts of the two frameworks and the intended use that needs to be considered first. Once these are agreed then the alignment of e-CF to the EQF and, in particular, that greater knowledge may not equate to greater level of operation, influence or competence can be considered and then the number of Levels (how can 5 Levels align to 7 Levels?) can be established

In practice, the Levels cause problems; people naturally want to be seen as the highest level they can – after all, being SFIA Level 7 must be better than being SFIA Level 6 (and similarly for e-CF), although the most competent person in a particular area may be SFIA Level 6 and not Level 7.

As to the number of Levels, while SFIA has had 7 levels since its inception there has been on-going debate whether this is the right number – it is not that there might be fewer levels but more.

While there are obvious benefits to be had from the two frameworks coming closer together, or perhaps merging as one, this needs to be well considered as it will inevitably lead to confusion and potentially damage the existing user base.

The following will need to be considered:

- What does 'moving closer together' mean?
 - Is this mutual recognition of approaches and levelling or merging to arrive at one global framework?
- Users
 - e-CF – The user base, although still growing and mostly confined to Europe, has invested in adopting this framework and would not want to move to something else.
 - SFIA – The SFIA user base, much larger and global, has similarly invested and would not want to move to something that it sees as less relevant.
- Ownership
 - e-CF is owned by the CEN (the European Committee of Standardisation) and users participate in further developments.
 - SFIA is owned by the SFIA Foundation and users participate in further developments.
- Approach to adoption

- e-CF is available as a standard for every organisation to use, and this is promoted by the CEN, in particular members of the CEN Workshop on IT Skills, and other stakeholders that enjoy the benefits of using a common language for competences (including users).
- SFIA is not 'pushed' by anyone; it is 'pulled' by users. The SFIA Board, although recognised as in the 'control position' is not felt to be pushing SFIA; if anything, the users see the Board holding back.
- Globalisation
 - e-CF is mostly European (though take-up outside of Europe is seen)
 - SFIA, on the other hand, is truly global with significant use and representation from countries outside of Europe: this must be recognised
- Funding
 - How would the merging be funded?
 - How would the end framework be funded on an on-going basis?
- Timescales
 - There are still SFIA users on SFIA V4 and V5; there is no particular reason why they should move to a new version. Most users of e-CF are on V3.0 The requirements for this would need to be considered.
 - It seems reasonable that over one or two update cycles the two frameworks could be brought closer together and indeed merged in that timeframe.
- Leadership
 - Leadership for merging would need to be established without fear for the user base.
- Users
 - Throughout such activities the users would have to be the primary consideration; this framework should, first and foremost, be intended to enable users to develop the skills of their staff or individuals to enhance their own skills. Use for promoting certification or particular training or qualifications should be secondary.
- Migration
 - Apart from an understanding of mapping should there be an approach for a user migrating from one framework to another?
- Underlying Principles
 - A common set of underlying principles would need to be established.
- Levels
 - A rigorous alignment of levels would need to be established.
 - Realignment of the Levels of both Frameworks slightly would clarify the mapping and lead to an obvious moving together. Aligning e-CF Levels 1-5 strictly to SFIA 2-6 would address the need to widen operational Levels in SFIA, and recognise the level below e-CF and the more CxO nature of SFIA Level 7.
 - Although there would be consequences for both SFIA and e-CF this should be considered for a moving together. Clearly the issues for SFIA would affect many more SFIA users, and there would be issues regarding EQF alignment for e-CF that would probably affect training providers more than end-user organisations.

- It is preferable to have built upon a standard base of levelling. A new set of levels should be defined. In SFIA seven 'levels of responsibility' are used, which are related to growth within a company (attributes: Autonomy, Influence, Complexity and business skills). In e-CF five 'Proficiency levels' are used, which are related master a competence (components: Autonomy, Context complexity and Behaviour).
- Environment for further development
 - e-CF is one building block of four basic building blocks that describe IT professionalism. The other parts are (Body of) knowledge, Education & Training, and Ethics. The European framework for IT professionalism ensures coherence across these building blocks.

G.7 Possible Outline Collaboration Project

G.7.1 Overview

While it is out of scope of this comparison and mapping report it is nevertheless worth considering an outline of a collaboration project. Fundamentally, this section considers a sensible approach to collaborating and ultimately merging the two frameworks into one as there seems little point in stopping short of this. It is possible to collaborate without ultimately merging but is unlikely to be successful: SFIA is global and must address global needs with minimal funding and certainly no funding to allow taking part in such a collaboration on an equal basis of involvement; e-CF has a European focus, is well-funded and can engage in the political issues necessary to drive this through but does not have the global reach or the user involvement yet. In any such project the following conditions should be met:

- There should be no negative impact on current users
- Existing users must see their investment protected
- There must be equal participation from both parties
- There should be a published roadmap for this project
- There should be an incremental bringing together through new versions of each framework
- The 'merging' must be able to be stopped at any time without damaging either framework or the investment of current users
- The end product must be upwardly compatible from previous versions of each framework

G.7.2 Phased approach to Collaboration

The project should be split into a number of Phases:

- Phase 1 Collaboration Planning
 - Comparison and Mapping Review
 - Definition of Roadmap and Intent
 - Clarification of ownership, funding and collaboration structure
 - Definition of the collaboration framework
 - Collaboration Checkpoint
- Phase 2 Collaboration and Merging Activities
 - Establish joint operations

- Initiate collaborative update cycle – iterative (over 3-5 years)
- Establish global user community infrastructure
- Define and establish Framework infrastructure
- Checkpoints throughout
- Phase 3 Operation
 - Single operation – BAU (business-as-usual)

G.7.3 Appendix A

Detail of the comparison mapping of individual skills and competencies in each framework is provided in the associated Excel Mapping Matrices – SFI/V6 e-CF Comparison V1.0.

A comparison summary of some of the areas that need to be considered in selecting or merging the frameworks is provided below.

Comparison Point	SFIA	e-CF
Coverage of breadth and depth of Enterprise IT (See mapping matrices)	Greater coverage for typical roles and operating models found in IT. Greater granularity e.g. 8 skills in Delivery & Operation	Some single competencies may encompass several skills e.g. Service Delivery as a single competence.
Detail	Greater detail per skill in SFIA (if e-CF dimension is not considered).	Less detail per competence in e-CF. This is bolstered by the additions of 'skills and knowledge statements'.
Structure	Logical consistent structure.	Logical consistent structure.
Approach	The SFIA approach of everything needed being described in one paragraph per skill level is an response to industry requirements.	The multi-dimensional approach of e-CF aids clarity when within a tool but less usable without tool support.
Longevity / Currency	15+ years / Version 6 2015	7+ years / Version 3 2014
Technologies, methods, knowledge and qualifications	SFIA does not mandate technologies, methods or qualifications.	e-CF suggests methods and knowledge within dimension statements that might be required.
Underlying principles	Requires demonstrated experience in performing the skill at level. Generic responsibility levels attributes are key.	Alignment to the QF. Generic attributes of levels described but their importance is unclear.
Documentation	Single complete reference model document. Less professionally presented.	Multiple documents describing the framework and how the framework has been created. More professional publications.
Availability	Free to download from the SFIA website. Available in 6 languages (more planned).	Free to download from the e-CF website. Available in 6 languages (more planned).
Need for interpretation	SFIA needs to be interpreted in use.	e-CF needs to be interpreted in use.
Update approach	Open consultation to the global user base, proposed changes reviewed by the user base and managed publication.	Updates by expert panel selected from e-CF community and framework authoring consultants.
Costs	Free of charge for non-commercial (end-user) use. Licence fee for commercial exploitation (service providers and tool vendors)	Free of charge for all use.
Funding	Modest licence fee for commercial exploitation.	Funded by EU.
Long term sustainability	Currently self-sustaining from licence fees.	Unknown should EU funding cease.
Marketing Model	Pull from industry.	Push from EU / Professional Bodies.
User Base	Difficult to estimate. Some use in nearly 200 countries. Around 1000 user licences for SFIA V6. Many thousands of other users from SFIA V4 and V5 but information archived is not used to market SFIA. Probably many thousands of unlicensed users globally.	Difficult to estimate. 40 case studies published. This is being pushed by the EU so there is probably greater uptake than from the case studies alone.
Ecosystem	Significant supporting infrastructure including: User Council, User community, governing body. Accreditation of consultants, partners and trainers. User conferences in UK and Australia.	e-CF is yet to establish the same ecosystem as SFIA.

Appendix H: Concrete actions by the ASL BiSL Foundation

Building block Foundational IT Body of knowledge: comprehensive and up-to-date knowledge accommodating a common IT body of knowledge and pertinent specialist knowledge and skills.

As mentioned in the building block Competences, the ASL BiSL Foundation has mapped its process-oriented body of knowledge to e-CF's competences. This analysis provided the insight that most of the current e-CF competences address the needs of the IT service *provider*, whether internal or external. The ASL BiSL Foundation's Application Services Library (ASL®), on which the ISO 16350 standard for Application Management is based, is guidance for IT service providers, and corresponds with many of e-CF's competences. The ASL BiSL Foundation recognises the need for end-to-end coverage of IT competences that also include the IT service *consumer* perspective – in other words, the business perspective. The ASL BiSL Foundation's Business Information Service Library (BiSL®) addresses business perspective with practices that guide and support *demand for*, and *use of* ICT. A Demand-Supply-Use value chain offers a more holistic and inclusive way of extracting value from investments in ICT. The ASL BiSL Foundation is prepared to contribute these insights and practices for future updates of the Foundational IT Body of knowledge.

Building block Competences: an understanding of the capability and competency needs of individuals working in various roles is essential for organizations to effectively recruit and develop suitable employees.

The ASL BiSL Foundation has mapped various roles in the Business Information Management domain to the relevant e-CF competences. Using this independent common language makes it easier to compare these roles with roles in other IT domains, such as Business Analysis. This common understanding is increasingly important because of the emergence of multidisciplinary collaborative ways of working, such as Agile and DevOps. The table below illustrates such a high-level mapping for a role at the operational level of Business Information Management, the role of Business information administrator.

e-CF competence						
Business information administrator role with a subset of BiSL processes mapped to e-CF competences (high-level mapping)	A.6 Application design	B.3 Testing	B.5 Documentation production	C.1. User support	D.11 Needs identification	E.8. Information security management
BiSL processes						
Specify information requirements	x				x	
Design non-automated information systems		x	x			
Review and testing		x				
Change management					x	
End user support				x		
Operational supplier management						x

Building block Education and Training: certifications, qualifications, non-formal learning and informal learning are mutually supportive components of a professional's career development.

The ASL BiSL Foundation has a portfolio of certifications that are independently administered by APMG International. Courses are provided by various commercial accredited training providers and are part of the curriculum of universities of applied sciences. The current certifications – and related courses – are ASL® Foundation, BiSL® Foundation and BiSL® Advanced and can be taken after classroom or (blended) online training, or after self-study. All exams can be taken online, any time, any place. These trainings and exams support specific knowledge areas of fBOK, for instance 'Software design and development' (ASL and ISO 16350) and 'IT Strategy and Governance' (BiSL),

Building block Professional Ethics: a defining aspect of any profession involves adhering to professional ethical conduct.

In 2015, members of the ASL BiSL Foundation drew up a Manifesto for the Business Information Management domain, in which they identified principles and values that guide their behaviour. This exercise was an opportunity for the participating members to reflect on their profession from a more fundamental perspective, giving them a better grounding for helping enterprises to realize short-term and long-term business goals by obtaining access to, and ensuring effective use of, valuable information and IT.

Role: Business information administrator

For the core competences also the personal competences are included.

BiSL process cluster	e-CF competence	Personal competence
Change management	A.4. Product/ Service Planning	
Specify information requirements	A.6 Application design	<ul style="list-style-type: none"> Contributes to the design and general functional specification and interfaces <p>Persoonlijke competenties:</p> <ul style="list-style-type: none"> Oordeelsvorming Analytisch vermogen Organisatiebewustzijn Sensitiviteit, inlevingsvermogen
Review and testing	B.3 Testing	<ul style="list-style-type: none"> Performs simple tests in strIT compliance with detailed instructions Records and reports outcomes providing analysis of results. <p>Persoonlijke competenties:</p> <ul style="list-style-type: none"> Methodisch werken Analytisch vermogen Plannen en organiseren Accuratesse Communicatieve vaardigheden Oordeelsvorming Organisatiebewustzijn

Design non-automated information systems Prepare transition Transition management Operational supplier management	B.4 Solution deployment	
Design non-automated information systems Review and testing	B.5 Documentation production	<ul style="list-style-type: none"> ▪ Produces documents describing products, or applications to establish compliance with relevant documentation requirements. ▪ Selects appropriate style and media for presentation materials. ▪ Ensures that functions and features are documented in an appropriate way. ▪ Ensures that existing documents are valid and up to date. <p>Persoonlijke competenties:</p> <ul style="list-style-type: none"> ▪ Accuratesse ▪ Analytisch vermogen ▪ Methodisch werken ▪ Sensitiviteit, inlevingsvermogen ▪ (Schriftelijke) communicatieve vaardigheden ▪ Creativiteit ▪ Oordeelsvorming ▪ Klantgerichtheid
End user support	C.1. User support	<ul style="list-style-type: none"> ▪ Interacts with users, applies basic product knowledge to respond to user requests. Solves incidents, following prescribed procedures. ▪ Systematically interprets user problems and identifies solutions and possible side effects. Escalates complex or unresolved incidents. Records and tracks issues from outset to conclusion. <p>Persoonlijke competenties:</p> <ul style="list-style-type: none"> ▪ Sensitiviteit, inlevingsvermogen ▪ Communicatieve vaardigheden ▪ Analytisch vermogen ▪ Oordeelsvorming ▪ Methodisch werken ▪ Klantgerichtheid ▪ Didactische vaardigheden

		<ul style="list-style-type: none"> ▪ Creativiteit ▪ Flexibiliteit ▪ Organisatiebewustzijn ▪ Accuratesse ▪ Luisteren ▪ Stressbestendigheid
Prepare transition	D.9. Personnel development	
Business data management Specify information requirements	D.10. Information and Knowledge Management	
End user support Change management Specify information requirements	D.11 Needs identification	<ul style="list-style-type: none"> - Establishes reliable relationships with customers and helps them clarify their needs.
Change management	E.2. Project and Portfolio Management	
Specify information requirements	E.3 Risk management	
Change management Specify information requirements Prepare transition Transition management	E.7 Business Change Management	
Operational supplier management	E.8. Information security management	<ul style="list-style-type: none"> - Systematically scans the environment to identify and define vulnerabilities and threats. Records and escalates non-compliance. <p>This most resembles C3:</p> <ul style="list-style-type: none"> ▪ Acts under guidance to record and track reliability data. ▪ Systematically analyses performance data and communicates findings to senior experts. Escalates potential service level failures and security risks, recommends actions to improve service reliability. Tracks reliability data against SLA. <ul style="list-style-type: none"> • Persoonlijke competentiesOrganisatiebewustzijn • Analytisch vermogen • Oordeelsvorming • Integriteit

		<ul style="list-style-type: none"> • Accuratesse • Methodisch werken • Communicatieve vaardigheden • Creativiteit • Abstractievermogen • Klantgerichtheid • Zelfstandigheid
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Appendix I: Long list of implementation initiatives

This paragraph lists all the possible initiatives that have been generated during the course of the first phase of this project. Initiatives have been proposed by engaged organisations and individual stakeholders from various countries during the interviews and workshop, or have been developed by the consortium itself based on desk research and the countless conversations with stakeholders.

I.1.1 Building block 1: Knowledge

The gathered actions concerning the ‘Knowledge’ building block mostly address the need to further promote the creation of the version 1.0 of a European Foundational IT Body of Knowledge (‘fBOK’, April 2015). Promotion of this instrument should lead to organisations (e.g. education providers, knowledge foundations) using the fBOK in practice which contributes to the overall goals of creating uniformity and common language, but also would lead to feedback and recommendations to further improve the fBOK itself.

Suggested actions as regards ‘Knowledge’
Provide fBOK guidelines so it is clear why and how to use it
Improve the visibility and usability of the fBOK through communication and by looking at language used
Merge with existing modules in specific BOK’s and/or develop foundational modules related to fBOK knowledge areas, and certify these
Further promotion of the fBOK with the purpose of gathering feedback from academia and other stakeholders about v1.0
Apply in government career framework, and stimulate use of it by others, such as education and certification providers (government)
Further increase the number of references to specific BOK’s and potentially training and certification
<i>* fBOK: European Foundational IT Body of Knowledge (v1.0)</i>

I.1.2 Building block 2: Competences

Solutions generated as regards the building block of competences mostly relate to stimulate take-up of the e-CF and the job profiles in e-CF. Obviously this is an important element. Increasing take-up of e-CF should start with an analysis of the ‘as-is’: how many organisations currently use e-CF? CEPIS publishes¹⁸³ a list of 34 companies, governments and associations, and 6 educational providers, but it is likely there are more users¹⁸⁴. One way of achieving this insight could be through the professional organisations in each country, and/or national coalitions that possibly have the network in place to generate more accurate numbers. Another option could be to allow *any* user of e-CF to be listed¹⁸⁵.

One action that has already been initiated (see for further explanation paragraph 6.5.2) concerns the alignment of the European e-Competence Framework (e-CF) and The Skills Framework for the Information Age (SFIA). SFIA has been developed in the UK at the beginning of the last decade. It is well recognised in countries such as Australia and registered trademark in 35 countries. In parallel the e-CF for IT professionals has been developed and is now a European standard with the support and approval of the UK. Given that both

¹⁸³ Please see here: <http://www.cepis.org/e-CF>

¹⁸⁴ The e-CF website itself only includes 26: <http://www.ecompetences.eu/current-e-cf-users/>

¹⁸⁵ The e-competences.eu website would be an excellent home for this. CEPIS is committing to ensure the sustainability of this website.

frameworks are widely recognised internationally and that there is a shared goal to establish a common language to describe the requirements of IT professionals, all parties are keen to collaborate on a move towards greater convergence of the two frameworks as well as contribute to the development of a European framework for IT professionalism.

Another action that should be addressed when updating the e-CF to version 4.0 concerns matching of the knowledge items in e-CF with the knowledge areas in the fBOK. The fBOK already includes a mapping to e-CF, but it should now be used to at least ensure consistency but preferably also further fine tune the knowledge items in e-CF.

Suggested actions as regards 'Competences'
Further develop the framework by improving the level of granularity of description of competences. This would make the link between competences and role profiles easier to be defined and applied in HR processes (from recruiting to career development and re-skilling)
Add sectoral additions to the e-CF. There are many groups (e-healthy, data scientists) who are eager to see their specific competences introduced, and while this is perhaps not within the defined scope of the e-CF itself, it would be useful to develop a methodology that could be used to ensure sectoral 'additions' to the e-CF are completed in a systematic and consistent manner.
Motivate universities to adapt curricula of e-CF (e.g. Miages, CFA); Map certifications and education curricula against e-CF ¹⁸⁶
Raise awareness about e-CF complementary tools (self-assessment, benchmark, job profiles, etc.
Provide practical guidance as regards implementation of the e-CF
Align platforms such as LinkedIn with competencies used in e-CF
Stimulate take-up of European standards by asking for e-CF competencies in public procurement (by public authorities)
Explore collaboration and create 'one' mapping of e-CF and SFIA
Match the knowledge items in e-CF with the knowledge areas in the fBOK
Monitor take-up of e-CF in countries (through professional associations' report)
Promoting a clear differentiation between IT professional competences and IT user competences, and how to implement this in concrete activities (training, certification, enterprises etc.)
Through national professional associations list main professional IT profiles in a country and define/standardise them using CF
Integrate the e-CF into job profiles
Create the possibility to also 'register' yet unknown e-CF users on e.g. e-competences website

¹⁸⁶ For example in Spain: mapping the recommendations provided by the Spanish Council of Deans of Informatics Degrees – CODDII – on organising bachelor and master programmes to the e-CF in order to harmonise and make all degrees understandable in the context of IT professionalism developments in Europe.

I.1.3 Building block 3: Education and Certification

The importance of teaching both IT user skills, as well as basic IT practitioner skills, already in primary and secondary education is widely recognised. Countries like Israel, who are successfully teaching computer science to all young kids for over decennia, are not confronted with a shortage of supply. There are several actions related to this topic. Some of these go beyond the scope of this Professional Framework, and should be embedded in national policies for instance, but the Framework could be of support when such actions would be set up in practice. Specific courses for teachers could be very well founded on the basics of the fBOK and/or e-CF and/or Code of Ethics. Foundational courses about what IT comprehends could be useful for teachers, but also for other people who are increasingly confronted with IT in their workplace (such as in Health, Finance).

Another key element that is repeatedly mentioned concerns increasing the collaboration between industry and the academic world. This could help to further match supply of and demand for IT professionals.

Suggested actions as regards 'Education and training'

Adapting primary and secondary education in order to provide basic IT user skills at an early age and raise interest in continuing with computing related studies after secondary school

More computer science in school, change curriculum as well as the exams, incorporate knowledge and skills development in the curricula

Map education courses to the e-CF and audit the mapping process in order to improve the transparency, relevance and comparability of courses in terms of developed e-competences and associated proficiency levels

Train the trainer initiatives/ teach the teachers, funded by the government¹⁸⁷

Design a specific course for (IT) teachers

Foundational courses about what IT comprehends for teachers, but also for other people who are increasingly confronted with IT in their workplace. Possibly 'domain-specific' coursed for e.g. IT in Health, IT in Logistics, IT in Finance etc.

Stimulate collaboration between industry and education so both parties are involved in the curricula development.

Promote education and industry collaboration. Bring transparency in training courses. Quality benchmarking, invite industry to curricula development.

Introduce innovative learning and teaching (e.g. online courses, e-learning modules, tutorials and self-assessment tools) to stimulate students to acquire high level skills¹⁸⁸

With transparency being one of the underlying goals of maturing the IT profession, certification is certainly an area where progress can be made. Often referred to as the 'certification-jungle', both professionals as well as employers find it difficult to understand the real value of a particular certification. Initiatives have been set up with the aim of increasing transparency in this regard, but these would need to be scaled up to increase the impact and reach greater coverage across Europe.

Suggested actions as regards 'Certifications'

Diploma vs. recognition of skills by badges.

¹⁸⁷ Ireland has a very good example on this: see 3.3.4 for more information.

¹⁸⁸ EQANIE through the Euro-Inf label does quality assessment of HEI courses in informatics. There is perhaps a role for them in ensuring quality in teacher training in this domain.

Bring transparency in certification jungle, e.g. by publishing a quality labels tool.
Use the professional framework as basis for professional certifications
Create a IT certifications map at national levels and then possibly scale-up, and/or link to certification quality labels
Implement a chartered IT professionals certification model
Improve mutual recognition of qualifications/certifications across countries by stimulating take-up of the European e-Competence Framework

I.1.4 Building block 4: Ethics

The fourth building block of the framework is the one that is gaining attention globally. A defining aspect of any profession involves adhering to professional ethical conduct. Ethics in the IT Profession regulates the boundaries of relationships with customers, colleagues and society. A Code of Ethics functions as an ethical charter for the profession and the general acceptance provides an explicit standard against which current practices can be measured¹⁸⁹. It does not necessarily avoid undesirable behaviour – see infringements that occur in other professions such as Law¹⁹⁰ - but it does promote social responsibility in IT and contributes to a responsible culture within the working place. The creation of a first set of European Ethical Guidelines, as a fourth building block in the Framework, will be taken up as one of the implementation actions in this project. Please see paragraph 6.5.1 for more information.

Suggested actions as regards 'Ethics'
Create first version EU code of ethics that is in line with existing documents, and determine tasks that need to be further explored
Raise the awareness of IT Professionals' responsibilities and obligations towards society
IT services and activities evaluation (determining impact of IT products and services in the general interest; explore if regulation is needed)
Explore/start (voluntary) registration of IT professionals; Licensing / registering
Training modules and/or communication campaign with launch of Code of Ethics to increase awareness on this topic
Ethical principles included in certification or accreditation
Mandatory ethics and IT education at bachelor level IT professional studies but also through other activities (e.g. seminars on professional ethics, peer learning within companies and between computer society members, professional magazines, scientific journals or books);

I.1.5 Initiatives covering the Framework as a whole

The overview in this paragraph includes a valuable action that covers the Framework as a whole. One of these is the need to improve the IT image in career development and provide clear career paths. There is no unique career structure providing a clear orientation and idea of sequential steps needed to become a technical,

¹⁸⁹ Rogerson, S., IT Codes of Ethics, based on: Software Engineering Code of Ethics & Professional Practice. Available online here: <http://www.cepis.org/media/SimonRogerson-ICTCodesofEthics1.pdf>.

¹⁹⁰ For instance the role of notaries is criticised in the recent Panama Papers affaire: 'Little ethics notaries in tax structures', available online here: <http://nos.nl/artikel/2097489-weinig-ethiek-notarissen-bij-belastingconstructies.html>

super technical or managerial professional. Beyond the e-CF and to ensure career development, it is essential to tell people where they are/could be going depending on their background.

Another interesting idea links to mobility of IT professionals, and could possibly support a more effective process of matching demand and supply. It concerns the promotion of a European Professional Card for IT Professionals.

- The European professional card (EPC) is available from 18 January 2016 for five professions (general care nurses, physiotherapists, pharmacists, real estate agents and mountain guides). It might be extended to other professions in the future.
- In 2014, the Commission launched a public consultation on introducing the EPC for seven professions (nurses, doctors, pharmacists, physiotherapists, engineers, mountain guides and real estate agents)

As part of implementation of the Framework, it would require promotion of a European Professional Card for IT Professionals (at least for engineering) on level 7 of the European Qualifications Framework (EQF). The initiative could be implemented as a specific process or as part of the process of making the EPC for engineers:

- There are countries where engineering is a wide profession with different specialties or branches, such as IT engineering (for example Germany);
- And there are other group of countries where each engineering is an specific profession, also IT engineering (for example United Kingdom);

In any case, IT Professionals do comply with two important conditions for EPC implementation:

- High mobility and demand at European level;
- Different national regulations;

The EPC can hence be a useful tool for European IT professionals to increase their personal mobility, and for enterprises to comply with national regulations when implementing projects or contracts in different counties with different IT professionals.

Suggested actions that cover all building blocks of the Framework

Provide practical guidelines on how to use the framework

Describe career paths as part of the Framework to illustrate to students/career changers

Share practical use of the Framework e.g. by showing case studies, best practices, experiences

Align recognised knowledge foundations in specific IT areas with the building blocks of the Framework

Develop an assessment tool based on all building blocks of professional framework that includes peer review¹⁹¹

Make sure there are funding opportunities so small initiatives of implementation will have a chance

Develop a MOOC to inform segments of potential professionals about the Framework and engage them in using it (e.g. career changers, students)

¹⁹¹ Addressing comments that the verification of self-assessed competences by IT professionals cannot rely upon a tick box exercise but rather a neutral test is needed

Setting up experts pools in countries to promote Framework and specific building blocks
Create a single point of access to all IT professionalism and e-Skills related instruments, good practices and standards
Development of a European IT Professional Card: building on the EU decision to create professional cards for 5 professions, create a European Professional Card for IT Professionals, at least for engineering qualification level. This would imply a European Professional Card for IT Professionals on level 7 of the European Qualifications Framework (EQF).
Designing a logo for IT Professionals
New recruitment techniques for IT talent
Build on existing e-Government developments around creation of citizen service access points, as place for students to gain practical experience and train soft skills, and with start-up hubs as regards innovation, entrepreneurial skills and as place to inform start-ups about potential value of the Framework itself.

I.1.6 Promotion and Communication related suggestions

Clearly, developing the Framework is not enough in order to stimulate organisations to use it. At the same time, the Framework is part of bigger trend towards further maturing the profession and this brings various ideas around improving the image of the profession.

A particular positive idea that is being initiated by the Irish Computer Society is the Day of the IT professional. This event will be run as part of Tech Week on April 25th, Ireland's national festival of technology. IT Professionals Day is a dedicated day to celebrate the role and contribution that IT Professionals make in advancing business and society across Europe. It is intended as a platform to raise awareness of the IT profession, its importance, the potential within the profession, the need for continued professionalism, and the value of further contribution to society as an IT professional. The event will consist of a series of talks concerning the impact, influence and needs of IT professionals, as well as the initiatives that help promote IT skills within Europe (CEPIS, the e-Competence Framework, etc.). All IT professionals are asked to take part on the day by adopting the Three Cs: Commit, Connect and Contribute¹⁹².

Suggested actions as regards Communication and Promotion
Annual IT professional event to share practical use of the Framework, discuss improvements etc.
Communicate a clear business case: Why should I (employee/employer) invest in the development of IT related skills and knowledge?
Explain IT to non-IT professionals (use case?) and to professionals whose work is substantially impacted by IT
Target family life to promote IT profession. Use the influence of family by promoting the IT job as a promising job. The media could tell a clear, simple and positive story about this.
Mentoring and role models to promote the positive image of the IT professional.
Share practical use of the Framework e.g. by case studies, best practices, experiences.
Add the 'IT Profession Pride Day' in a e-Skills week.
Think global, act/ implement local

¹⁹² Source: <https://www.ics.ie/news/it-professionalism-a-it-professionals-day> and <https://techweek.ie/it-professionals-day/>

Promote use of tools of self-assessment
Recruit digital champions to help to raise awareness
New recruitment techniques for IT talent

Appendix J: Literature list

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