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European ICT professional role profiles - Part 3: Methodology documentation

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European foreword

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0. Executive overview

This CEN Workshop Agreement (CWA) Part 3 **Methodology Documentation explains the overall methodological approach and main choices underpinning the European ICT Professional Role Profiles development**.

The main purpose of this Methodology Documentation is to provide confidence to users that the European ICT Professional Role Profiles have been developed applying a sound conceptual framework combined with in-depth ICT sector and HR development expertise, and with thorough and widespread stakeholder consultation.

As the ICT Profiles are based on the e-CF, the methodological approach is based on e-CF development methodology, details of which can be found in CEN TR 16234-3:2017 "Building the e-CF. A combination of sound methodology and expert contribution". Furthermore, the Profiles of this current version 2.0 are closely aligned to the method used in developing the first version of the ICT Role Profiles (CEN CWA 16458:2012). The aim of the update was to maintain consistency with previously established ICT Profiles concepts that had proved to be valuable. This included maintaining the close relationship to the e-CF and enhancing the methodology approach by updating the ICT Role Profiles in view of extensive stakeholder consultation. Details of stakeholders consulted are given in the acknowledgement section.

This document also provides a sound methodology approach to experts and stakeholders from other sectors who may wish to transfer the overall approach of European Role Profile creation for implementation in other, not-ICT specific environments.

The overall aim of developing the European ICT Professional Role Profiles and the underpinning concepts is to provide a means of summarising and organising the insights of experts and stakeholders into a reference tool. Although the profiles are focused upon ICT professional competence and performance the ultimate objective is to influence the ability of organisations to leverage ICT for better performance.

1. European ICT Professional Role Profiles basic principles

1.1. ICT professional role profiles versus competences and jobs

Jobs, roles and competences are terms commonly used when describing the actions, responsibilities, tasks and skills of people in the workplace. The terminology is often used interchangeably and in common use it requires limited explanation. However, when applying ICT Professional Role Profiles, it is useful to have a clear understanding of how these terms are defined in this CWA.

Competence is based entirely upon the e-CF definition; it is a demonstrated ability to apply knowledge, skills and attitudes to achieving observable results. ***e-CF competences are a key component of ICT Professional Profiles.***

Roles, in this case the European ICT Professional Role Profiles, provide a broad picture of the activities performed by individuals engaged in the multitude of positions that make up the ICT profession. These profiles reflect a collection of typical tasks, competences and responsibilities that are to be fulfilled and each profile is given a common use title for ease of identification. ***ICT Professional Role Profiles are key components of ICT jobs.***

Jobs of ICT professionals are normally described using job descriptions that are more detailed and are specific to an individual and the organisation. They contain personalised information such as terms and conditions of employment, remuneration and organisation cultural values. ***Jobs are detailed descriptions in context.***

The schematic below illustrates these relationships, it shows ***how a job incorporates roles and in turn roles incorporate e-competences.***

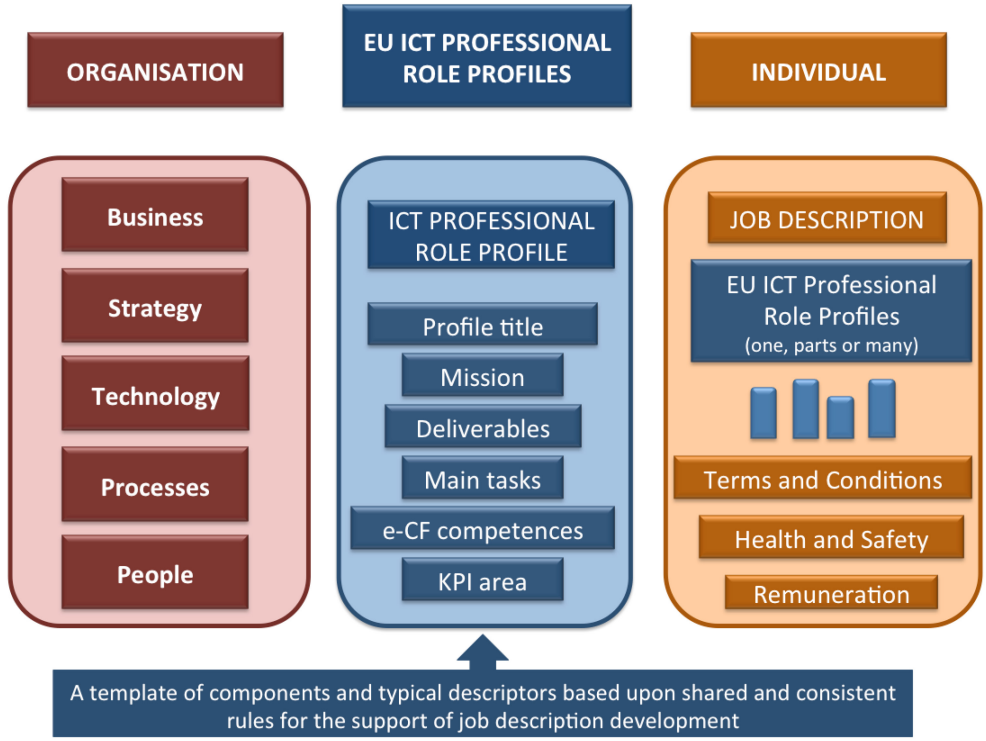

Figure 1: European ICT Professional Role Profiles implementation into the organisation – A job incorporates roles (one, parts of or many) and a role incorporates up to 5 e-Competences.

The function of European ICT Professional Role Profiles is to offer users structure and clarity for designing or identifying and clustering the multitude of activities that are essential to support the digital strategy of an organisation. They are less detailed and less specific than job descriptions and offer a simple but flexible start point. They also represent a European multi-stakeholder shared perspective and provide a common reference language and communication tool to support mutual understanding e.g. both between countries but also within organisations such as between HR and ICT departments.

There are a huge range of different job titles across the ICT profession and they are created for a variety of purposes including attracting new recruits and providing recognition for organisation loyalty through promotion and construction of enhanced job titles. Jobs are unique, but a similar title can be used to describe a widely different job, or similar jobs can be described by different titles. This can be confusing and prevent clear understanding between different actors and stakeholders of the job described and its associated tasks and responsibilities.

The European ICT Professional Role Profiles address this lack of clarity by clustering typical and common job role components into a consistent role profile template. These role profiles, built from an organisational perspective, may be adopted and used as a basis for many activities including, personal development, organisation and job family restructuring, curriculum and training course development. The profiles are designed to be consistent in structure but varied in content offering clear differentiation between each profile.

The European ICT Professional Role Profiles can be used in a multitude of environments and in a wide variety of ways, they can be broadly categorised in three application types;

- (A) Taking one or more of the 30 provided profiles (generation 2) with none or some minor changes by the user
- (B) Forming new profiles with greater granularity (generation 3) associated and derived from the 30 provided profiles
- (C) Adopting the structure and format of the professional profiles template but using different content to establish significantly different roles either related or even unrelated to ICT.

1.2. European ICT Professional Role Profiles identification

The objective of the „European ICT Professional Role Profiles“ CWA is to provide a generic set of ICT Role Profiles, using the e-CF as the basis for competence identification, applicable and adaptable at European and National levels, relevant to all organisation types and sizes.

The recommendation for version 1 was that a total of, approximately, 20 Profiles should be developed. It is probable that there are over 1000 ICT job titles and derivatives in use by organisations across Europe and therefore a

The expert team identified a non-exhaustive list of more than one hundred and forty titles from a variety of sources including corporate career paths, government advisory services, technical education pathways and SME representative structures.[1]

With a background of a large number of titles the approach adopted was to identify titles that are clear and easily understandable by all stakeholders. A spread sheet was created which consolidated the range and scope of identified roles and identified a range of granularity levels, for example, from Packaged Application Specialist (a specialist proprietary job title) – Technician (a very general title).

Clearly, a target group of 20 - 30 ICT Profiles needed to be of consistent granularity. This was achieved by establishing an essential connection with e-competences that provided a guide for granularity consistency.

In summary, the final profile titles needed to fit the requirements of being,

i) frequently used,

ii) easy to understand (plain language),

iii) generic and

iv) of similar granularity.

These essential characteristics were tested against selected profiles. Subsequently It was verified that each of the originally identified (over 140) titles could be represented by the selected role title profiles; all be it at a more generic level. [2]

The outcome of the expert's work was presented to a wider stakeholder and expert community to seek further opinion and refinement of the profile title selection.[3] As identifying titles is not an exact science, testing of the appropriateness and value of the selected titles was continued throughout the project life cycle.

The final outcome from the above described process and with multi-stakeholder agreement resulted in the establishment of 23 Profiles for the first version. Taking into account the level of granularity,

[1] In particular, the following frameworks were analysed: Michelin, international level - EUCIP, European level - AITTS, Germany - Airbus, international level - CIGREF, France - an SME framework from UK - an SME company framework from Germany - UK Government framework - Microsoft Technet, international level - IBM, international level, IWA Web Skills Profiles, international level

[2] See Annex 1 of the Interim report "Towards European ICT (e-Job) Profiles", April 2011 – ICT Profiles identification exercise

[3] See Interim Report: „Towards European ICT (e-Job) Profiles“, April 2011

the profile descriptions were developed as complementary and complete, covering the entire ICT Business Process.

From European ICT Professional Role Profiles version 1 to version 2

Given that this was an update process there was a need to remain consistent, as far as possible, with the previous version of ICT Profiles. This was to be achieved whilst effectively responding to new ICT Profiles that have arisen and also significant changes in work practices, influencing previous ICT Profiles. Another methodological challenge was the question of whether changes in the ICT environment (such as the increase in the importance of data analytics) should be represented by new profiles or by recommending the creation of new competences in the next e-CF update. Alternatively, changing levels and/or assignment of current competences in existing Role Profiles was an option. The decisions taken were mainly informed by the impact of new or increased ICT activity on organisations and individuals:

- If it resulted in significant organisational change and the need for structural change then a new role was created within the ICT Professional Role Profiles.
- If it was more the case that organisations needed to address the workforce skill base by modifying or updating existing skill sets then the approach was to adapt and/or re-assign the e-Competence and level included in the existing Role Profile.

1.3. Underlying concepts: e-Competences and Deliverables

1.3.1. The European e-Competence Framework (e-CF)

The European e-Competence Framework (e-CF) standard EN 16234-1 is a main element of the ICT Professional Profiles description template. The e-CF provides a reference of currently 40 competences as required and applied at the ICT workplace, using a common reference language for competences, skills, knowledge and capability levels that can be understood across Europe/ internationally.

The e-CF is the result of 10 years continuing effort and commitment by the European ICT sector. As the first sector-specific and workplace oriented implementation of the European Qualifications Framework (EQF), the e-CF supports the definition of jobs, training courses, qualifications, career paths, formal and non-formal learning paths, certifications etc. In this way, ICT service in public and private organisations, ICT professionals, managers and HR departments, vocational education, higher education and other training, assessment and accreditation bodies, social partners, professional associations, market analysts and policy makers have access to a shared reference.

Dimension 1 5 e-CF areas (A – E)	Dimension 2 40 e-Competences identified	Dimension 3 e-Competence proficiency levels e-1 to e-5, related to EQF levels 3–8				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. IS and Business Strategy Alignment				■	■
	A.2. Service Level Management			■	■	
	A.3. Business Plan Development			■	■	■
	A.4. Product/Service Planning		■	■	■	
	A.5. Architecture Design			■	■	■
	A.6. Application Design	■	■	■		
	A.7. Technology Trend Monitoring				■	■
	A.8. Sustainable Development			■	■	
	A.9. Innovating				■	■
B. BUILD	B.1. Application Development	■	■	■		
	B.2. Component Integration		■	■	■	
	B.3. Testing	■	■	■	■	
	B.4. Solution Deployment	■	■	■		
	B.5. Documentation Production	■	■	■		
	B.6. Systems Engineering			■	■	
C. RUN	C.1. User Support	■	■	■		
	C.2. Change Support		■	■		
	C.3. Service Delivery	■	■	■		
	C.4. Problem Management		■	■	■	
D. ENABLE	D.1. Information Security Strategy Development				■	■
	D.2. ICT Quality Strategy Development				■	■
	D.3. Education and Training Provision		■	■		
	D.4. Purchasing		■	■	■	
	D.5. Sales Proposal Development		■	■		
	D.6. Channel Management			■	■	
	D.7. Sales Management			■	■	■
	D.8. Contract Management		■	■	■	
	D.9. Personnel Development		■	■	■	
	D.10. Information and Knowledge Management			■	■	■
	D.11. Needs Identification			■	■	■
	D.12. Digital Marketing		■	■	■	
E. MANAGE	E.1. Forecast Development			■	■	
	E.2. Project and Portfolio Management		■	■	■	■
	E.3. Risk Management		■	■	■	
	E.4. Relationship Management			■	■	
	E.5. Process Improvement			■	■	
	E.6. ICT Quality Management		■	■	■	
	E.7. Business Change Management			■	■	■
	E.8. Information Security Management		■	■	■	
	E.9. IS Governance				■	■

Figure 1: European e-Competence Framework Version 3.0 (Overview) – a key input to the European ICT Profiles creation

The European e-Competence Framework has proven in practice to be a successful ICT workforce planning and development tool. Many companies and associations including National Public Authorities in Europe and internationally currently use the e-CF.

Consequently, the e-CF is a primary reference used in the European ICT Professional Role Profiles description.

1.3.2. Deliverables identification and description methodology

Deliverables, together with e-CF Competences, form one of the main components defining the European ICT Professional Role Profiles.

Deliverables describe typical outcomes of a task in a working context. Each ICT Professional Role Profile is defined by a list of Deliverables, either in terms of being accountable, responsible or in terms of contribution.

To support European ICT Professional Role Profiles descriptions the three attributes are defined and applied as follows:

- Accountable (A): The individual ultimately answerable for the correct and thorough completion of the deliverable

- Responsible (R): The individual who performs the work to achieve the deliverable
- Contributor (C): The individual who contributes, due to their capability and knowledge

An ICT Profile includes a list of Deliverables applied as follows:

- Each profile incorporates up to six deliverables formed from a combination of accountable, responsible or contributor descriptions
- A deliverable may or may not be seen by users, may be intermediate or final, but must always be observable.

In general terms, a deliverable is the outcome of an activity. Profiles contribute in different ways towards the creation of a deliverable. It should be clear when creating or reviewing a Role Profile how the deliverables arise from the mission, tasks and competences within the profile.

Deliverables are an important attribute of Role Profile definitions; using them we can direct mission, tasks and competences to illustrate observable results.

However, a deliverable definition does not include quality attributes such as "good business relationships" or quantity values as these elements are context specific and will vary according to the environment in which the role is performed.

Deliverables identification in version 1

A complete list of deliverables was not required to meet the project aim, merely the identification of the most relevant, consistent with the overall level of granularity and applicability to the identified Profiles. Choices were made to identify relevant deliverables which added value to ICT Profiles. To better characterise the mission they were selected to illustrate observable results, whether tangible or intangible. The process for identifying the version 1 deliverables list was inspired by using the European e-Competence Framework (e-CF version 2.0), as the main source. Additional content was extracted from the Waterfall Development Process.

The following paragraphs describe in more detail how different deliverable sources were used for inclusion within version 1 of ICT Professional Profiles

i) Firstly, a set of deliverables were extracted from the e-CF taking them from dimensions 2, 3 and 4. As more than one competence can contribute to a deliverable, the same deliverable may be present in more than of one competence.

This extraction process guaranteed a high consistence with e-CF competence definitions. 49 Deliverables were defined using this process.

ii) Additionally, the Waterfall Development Process was used to extract further deliverables and provide additional content to complement the profiles.

The final result of this work produced 52 deliverables to support the 23 Profiles of the European ICT Professional Profiles version 1.

Deliverables update for version 2

To facilitate the European ICT Professional Role Profiles update, an on-line survey and user feedback workshops were conducted to enable systematic understanding of European ICT multi-stakeholder knowledge and experience of version 1 and to explore emerging business trends.

This intelligence showed how the deliverables, in addition to being a key component of the ICT Professional Role Profiles, are an easy-to-use, standalone tool useful for describing processes and relationships within the organisation. Furthermore, deliverables help to focus the definition of user constructed (third generation) profiles, making it easier to identify the competences that characterise the overall profile.

Taking this into account, European ICT Professional Role Profiles users suggested enrichment of the deliverables list to provide greater detail and, very importantly, to address current ICT trends such as Digital Transformation, Big Data and the implementation of the Agile Process.

To satisfy this requirement the number of deliverables has been increased by almost 50% from the original 52 to a current 76.

As the ICT Profiles version 1 deliverables were derived from the e-CF version 2.0 competences, the first task in developing this new version was to analyse the latest e-CF version 3.0. The e-CF 3.0 adds four new competences to the previous version: A.9. Innovating, B.6. System Engineering, D.11. Needs Identification and D.12. Digital Marketing. Furthermore, B.1. Design and Development has been divided into two competences: B.1. Application Development and B.6. Systems Engineering; and finally, further clarity and refinement of the design element were updated within A.5. Architecture Design (related to systems) and A.6. Applications Design (related to applications). In consequence, new deliverables were added to address these changes ensuring full compliance with the e-CF version 3.0. Parallel to this step a complete revision of the descriptions of each deliverable was made, with the aim of making them more effective.

The next step was to define new deliverables to cover current ICT trends and the new ICT Professional Role Profiles introduced in this version:

- Solution Designer Role
- Digital Transformation Leader Role
- DevOps Role
- Data Scientist Role
- Data Specialist Role
- Scrum Master Role
- Product Owner Role

The result was to account for Digital Transformation issues, to reinforce the Data Management area, including Big Data and to integrate Agile Process deliverables. Feedback from e-CF and ICT Profiles applying stakeholders confirmed that the e-CF competences, in dimension 1 structured by the 5 main business processes reflecting the waterfall approach, fit also into agile process structures namely an Agile/ DevOps lifecycle. Accordingly, the e-CF prooved to be also useful for new agile deliverable identification and related role definitions like DevOps or Digital Transformation Leader.

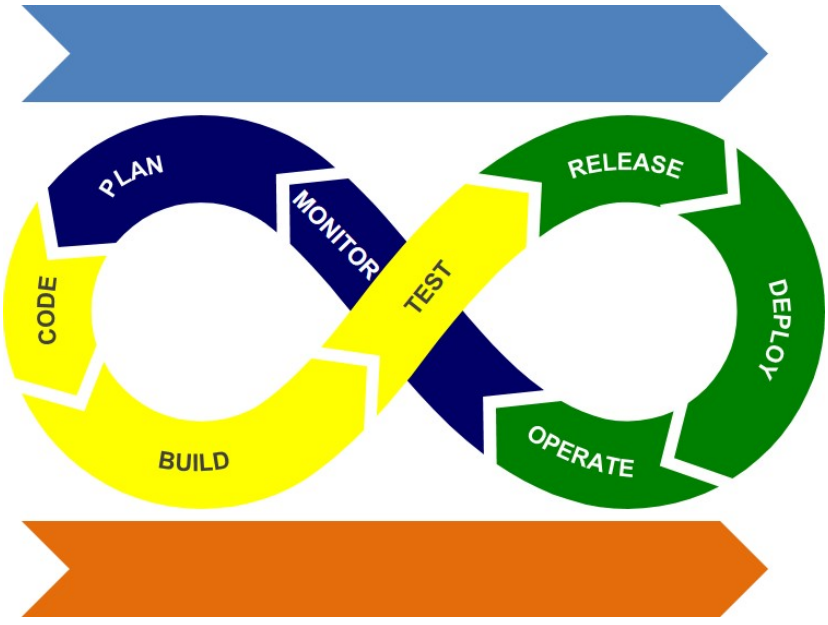

Figure 2: e-CF structure for an Agile/DevOps lifecycle (Source: DIGIFRAME Interim Report 2018)

Finally, a review was conducted to ensure coherence in the Role Profile definitions. The principle applied was that Task, Competences and Deliverables are linked together and must be related to each other.

Competences are needed to conduct a Task which produces one or more Deliverables.

N°	DELIVERABLE	e-CF COMP.	DELIVERABLE DESCRIPTION
1	**Budget Plan**	A.4	A description of the amount of money spent on an organisation's Information Technology systems and services, including compensation for IT professionals and expenses related to the construction and maintenance of enterprise-wide systems and services.
2	**Business Case (Lightweight Business Case)**	A.3	An explanation of why the investment should be made and how the business will see a return on that investment (ROI) at some point in the future. A well-considered business case provides decision makers with the information they need to decide if the investment should proceed.
3	**Business Plan (Strategic Themes)**	A.3	A formal statement of a set of business goals, why they are attainable, and the plan for reaching them. SAFe strategic themes provide business context for decision-making within the portfolio and influence investments in Value Stream. Strategic Themes provide the enterprise with the differentiators going forward from current state to future state; they help drive innovation and competitive differentiation that is achievable only via effective portfolio solutions.
4	**Business Process Definition**	E.5,E.7	A formal definition and description of related, structured activities that will accomplish a specific organizational goal.
5	**Business Relationship**	D.11,E.4	A relationship established to provide business services.
6	**Business Requirements**	A.1	A description of what a business needs so that it can operate successfully.
7	**Change Management Plan**	E.7	A plan which addresses the impact of change to an organization, easing the transition.

Table 1: Deliverables 1-7 with e-CF competences and full description. For full list see CWA Part 2 User Guide Annex B.

In general, the granularity level of deliverables is predicated on the European e-Competence Framework. Nevertheless, it should be noted that owing to the variance of ICT Profiles in terms of complexity and autonomy, not all deliverables identified can be of the same level of granularity.

In the following table RACI responsibilities for each deliverable are shown and are provided as a general reference. In some organisations, a job profile can be a subset of European ICT Professional Profile Roles or in others there may be a customised profile that can be defined by combining RACI responsibilities of more than one Role Profile. The table describes the entire set of possibilities and not only those assigned within the Role Profiles descriptions.

To enhance readability, deliverables assigned to Role Profiles are highlighted by a coloured border.

	DELIVERABLES	ACCOUNTABLE	RESPONSIBLE	CONTRIBUTOR	ROLE PROFILES: Account Manager Role	Business Analyst Role	Business Information Manager Role	Chief Information Officer (CIO) Role	Data Administrator Role	Developer Role	Digital Media Specialist Role	Enterprise Architect Role	Digital Consultant Role	ICT Operations Manager Role	Cyber Security Manager Role	Cyber Security Specialist Role	Digital Educator Role	Network Specialist Role	Project Manager Role	Quality Assurance Manager Role	Service Support Role	Service Manager Role	Systems Administrator Role	Systems Analyst Role	Systems Architect Role	Technical Specialist Role	Test Specialist Role	Solution Design Role	Digital Transformation Leader Role	Devops Expert Role	Data Scientist Role	Data Specialist Role	Scrum Master Role	Product Owner Role
1	Budget Plan	10												A																			
2	Business Case (Lightweight Business Case)		2			Ⓡ	A					Ⓡ																						
3	Business Plan (Strategic Themes)			2,3,8		Ⓒ	Ⓒ					Ⓒ																						
4	Business Process Definition			8								Ⓒ																						
5	Business Relationship		1,2,30		Ⓡ	Ⓡ																												Ⓡ
6	Business Requirements	2		9		A							Ⓒ																					
7	Change Management Plan			15															Ⓒ										Ⓡ					
8	Data Analytics		27	28			Ⓡ		Ⓒ																					Ⓡ	Ⓒ			
9	Data Collection and Representation	27																												A				
10	Data Management Plan			27																										Ⓒ				
11	Data Management System	5		27					A																					Ⓒ				
12	Data Model		2,28			Ⓡ	A																								Ⓡ			
13	Data Protection Policy		28	5					Ⓒ																						Ⓡ			
14	Data Selection	27																												A				
15	Development Process		25	20,29																			Ⓒ					Ⓡ				Ⓒ		
16	Digital Transformation Roadmap	25				Ⓒ	Ⓡ					Ⓒ																	A					
17	Digital Transformation Strategy		4,25					Ⓡ																					Ⓡ					
18	Documented Code	6								A																								
19	Enterprise Architecture	8										A																						
20	Escalation process			17																Ⓒ	Ⓒ				Ⓡ									
21	First Level Support		17																	Ⓡ														
22	Hardware Component	20								A														A										
23	HR Development Plan		10											Ⓡ																				
24	ICT Audit Report	16																		A														
25	ICT Department & Budget	4						A																										
26	ICT Governance Policy	4						A						Ⓡ	Ⓡ					Ⓒ														

Table 2: Deliverables n° 1-26 assigned to the European ICT Professional Role Profiles as Contributors, Responsible, Accountable. For complete list see CWA Part 2 User Guide section 2.2.2.

2. Some key aspects of the methodology discussion

2.1. Organisational capability and individual competence

The purpose of the European ICT Professional Role Profiles is to assist organisations to perform better by helping them to have the right people with the right skills and competences contributing to the right role by carrying out a particular job.

As such the place to start is at the organisational level in terms of what needs to be done. Once this is clear then it is very useful to examine what roles are needed and what competences will be required at what level to contribute to them. The overall aim of this whole activity is for the organisation to be more successful, so it is important to have some background context of how individual competences and organisational capability are related as this helps show the potential contribution of the ICT Role Profiles. It should be noted, to ensure clarity in terminology used, that in the e-CF the term organisation competence rather than organisational capability is used to describe competence from an organisational viewpoint in dimension 2 and competence from an individual perspective in dimension 3. (CEN, 2014b)

The concept of capability is multi-faceted and includes the contribution of people, processes and technology (Ross et al., 1996; Neely et al., 2001; Peppard and Ward, 2004) working in a coordinated fashion to enable positive change. It is nearly always used to describe how organisations operate rather than individuals and it implies the successful coordination of multiple factors. As an extreme example to illustrate this point, there is little value in a hospital having highly trained surgeons if it has failed to ensure that there is adequate lighting in the operating theatre or has failed to clean the theatre to the correct standard. All these aspects, amongst others, need to be performing well for the hospital to be successful.

Organisational capability is the ability of an organisation to manage all these resources in way which enables it to get the things done it needs to get done. It often involves the use of maturity frameworks (Curley et al., 2015; Young et al., 2014; Bushuyev and Wagner, 2014; Miklosik, 2015) to provide a means of assessing current state capability (how good right now are my people, processes and technology?) and desired state capability maturity (where do I need to be to meet my organizations aims?).

Improving employee knowledge, skills and competence without a clear plan and goal as to how that will contribute to organisational capability generally has very little effect or even a negative effect on organisational performance. Putting highly skilled people in an organisation without providing appropriate infrastructure and process support often has very negative consequences as does providing organisational support but failing to increase the skills of the staff.

Research since the 1990s has been found that for individual learning to translate to increased organisational capability, people must have shared goals rather than fragmented learning for no clear purpose (Kim, 1993) and that improved capabilities come about based on the extent to which expertise is structured, coordinated, and communicated (Zander and Kogut, 1995). More recently we see continued evidence of the theme in the work of (Nieves and Haller, 2014) on the importance of both individual and collective skills as a basis for developing dynamic capabilities, and by (Vargas et al., 2016) on the importance of deliberate intervention by management via enablers or drivers for individual learning to actually improve organisational performance. The effective use of individual learning requires strategic high-level input and it needs to be channelled towards important areas of the organisation that need to improve (Chen et al., 2014). It must also be coordinated in a holistic way to ensure it effectively supports the needs of the organisation (Fink, 2011).

Once an organisation has gained a clear picture of its current capability and its target capability it can then start to design its structure and workforce to work towards that objective. It is here that ICT Role Profiles can play a very useful contribution as they give organisations a useful starting point in this activity and can be seen as bridge or a connecting point between what the organisations need and how people can contribute to that. The ICT Role Profiles can provide a basis for a discussion as to which of those roles are needed by the organisation and this can be further developed into more detailed job descriptions including competence, knowledge and skill requirements of the people who will carry out those jobs. It also further facilitates effective use of the e-CF to help identify any gaps in skills and competences which need to be addressed to improve performance of employees and enhance their contribution. The table/figure below is a simplified version of questions that can be asked at different stages of an organisational improvement activity.

1. Organisational Capability: what do we need to be able to do ?
2. Roles: what roles/types of activities does this require?
3. Competence: what types of competence are needed to fulfil those roles?
4. Jobs: how can be these roles be split up into specific jobs at specific levels?
5. Competence: what competences at which level are needed to do these specific jobs well?

Table 3: Questions supporting different stages of an organisational improvement activity

Impact of Digital Transformation

The research literature indicates that in order to improve an organisation needs to both focus on the skills of its individual employees and also focus on the organisational supports necessary, such as processes and technology, to coordinate and deploy those skills for the benefit of the whole organisation. Digital transformation is impacting on both the importance and nature of this activity.

Work by (Schumann and Tittmann, 2015) argues that digital transformation requires a re-orientation of learning culture and the acquisition of new fundamental concepts. If these are successfully integrated into the processes and the vision of the company, then this creates enormous potential value. Getting this right will become more important within the digital context with the increased pace of change requiring both continual learning by employees and continual flexible methods of managing this by the organisation to facilitate dynamic capabilities.

2.2. The level of abstraction and granularity in the European ICT Professional Role Profiles

The aim of the ICT Profiles is to provide a high-level view of ICT Roles, which can be adapted, as and if needed, by organisations, rather than detailed specific job descriptions. An important guiding principle is that they contain levels of granularity consistent with that of the e-CF, to support understanding, ease of use and being complementary between the two concepts.

Another guiding principle was to include only key and important competences in each Role Profile to provide focus and avoid confusion that would arise by listing all relevant but less essential competences. Most importantly, competences were chosen to effectively differentiate between different profiles. Competences for each Role Profile are chosen because they are essential and distinctive. They represent core competences of a Role Profile and distinguish one from another.

The final outcome of the European ICT Professional Role Profiles version 2 development and consultation processes resulted in the creation of 30 Profiles. Taking into account the necessary low level of granularity, the role profile descriptions may be viewed as complementary and complete.

Given the challenge of condensing the wide variety and large number of ICT job roles/ titles into a manageable quantity of ICT Role Profiles, the consistency of granularity was compromised in some cases. This was a necessary trade off to ensure that the complete breadth of ICT Role Profiles was covered and, in particular, to recognise some of the new roles emerging within ICT.

This limitation is mitigated by applying and further maturing the method developed in version 1 of the ICT Professional Role Profiles by providing guidance on the structuring of user generated/ tailored profiles in generation 3. This provides the opportunity to construct profiles of consistent structure that relate to generation 2 and are of an appropriate level of detail to meet organisational needs. For more detailed guidance see European ICT Professional Role Profiles User Guide Chapters 3 and 4.

2.3. Link with educational theory

There is long history of research and debate on the nature of skills, knowledge, competence and their role in professions (Eraut, 1994). The European e-Competence Framework and the ICT Professional Role Profiles are primarily based on the role of these elements in the workplace and how they can help people be better at their jobs.

The different levels are informed by well-known educational models such as Bloom (1956). Bloom's taxonomy of learning includes remember, understand, apply, analyse, evaluate and create (note create is in more recent revisions only). It should be clarified that the 'hierarchy' of levels as discussed in e-CF and used in the Role Profiles in no way indicate the value of the levels as in organisations a mixture of all the different levels will be needed for effective performance. The emphasis in the creation of e-CF and the Role Profiles is to enable and develop effective competence in the workplace.

2.4. Links to other frameworks

In order of the European ICT Professional Role Profiles to be easily accepted and recognised by users it is important that its relationships with existing frameworks and tools in the competence and skills area are clear. This also aids implementation as organisations who are already using other tools can see how the Role Profiles can be combined with current approaches. In terms of the wider goal of maturing ICT as profession it is important that all efforts and resources in this area are as coordinated as possible. We mention other frameworks/ standards we have referred to so the user can find out more details if needed and also have confidence in how the Role Profiles can be used with multiple frameworks/ standards as needed for particular organisations.

- some links are established to frameworks as a part of the concept (e-CF and EQF)

The link with e-CF has already been discussed but a link with e-CF also provides a relationship with EQF as e-CF is aligned with EQF. This can be important particularly when the Role Profiles are being used in curriculum design. The graphic below shows the relationship.

e-CF Level	***related to* EQF Level**
e-5	8
e-4	7
e-3	6
e-2	4 and 5
e-1	3

Table 4: e-CF and EQF level relationship table. For full e-CF – EQF level table see Annex A of the User Guide

- some links to other framework for contextual relevance (ESCO)

The European Skills, Competences, Qualifications and Occupations (ESCO) is an important deliverable to support the Europe 2020 strategy and the New Skills Agenda for Europe by providing a multilingual classification of European Skills, Competences, Qualifications and Occupations.

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 is designed to facilitate job searching and job matching and in addition it can play a significant role in career management and labour market analysis Europe-wide.

In relation to European ICT Professional Role Profiles it is important to recognise that ESCO encompasses the vast array of occupations prevalent across the EU, a much wider scope than the ICT Profiles, and it is elaborated at a higher level of granularity in job profiles identification.

However, it is logical and useful that although the two constructs differ in scope and application there must be a consistent and understandable relationship between them. Cooperation between the ESCO project development team and the European ICT Professional Role Profiles team has enabled constructive discussions to create linking tables in support of cross-reference between the two structures. Taking into account the differences between each structure, the occupation table within ESCO identifying over 100 ICT occupations is used as a reference point to connect to the 30 European ICT Professional Role Profiles.

Additionally, European ICT Professional Profile users may wish to understand how each profile can be related to an ESCO defined Occupation and for this purpose a further table is provided in Annex C of the CWA Part 2 User Guide.

In this way both structures do not only relate to each other, but each will add value to the other.

For ease of reference an example relationship map between ESCO Occupation titles and ICT Professional Profiles in both directions is provided below. It is important to note that the relationship between the two structures does not represent an equivalence, it offers a best fit approximation that readers may wish to investigate.

MAPPING EUROPEAN ICT PROFESSIONAL ROLE PROFILES TO ESCO OCCUPATION TITLES	
European ICT Professional Role Profile Title	**ESCO Occupation Title**
Business Analyst Role	ICT business analyst
Business Information Manager Role	ICT business analysis manager
Developer Role	ICT application developer
MAPPING ESCO OCCUPATION TITLES TO THE EUROPEAN ICT PROFESSIONAL ROLE PROFILES	
ESCO Occupation Title	**European ICT Professional Role Profile Title**
ICT system administrator	Systems Administrator Role
ICT network administrator	Network Specialist Role
IT auditor	Quality Assurance Manager Role

Table 5: Mapping European ICT Professional Role Profile Titles to the relevant ESCO Occupations Titles and vice versa – example. For full relationship overview see Annex C of the CWA Part 2 User Guide

- some links for sectoral relevance and technical richness (e.g.ITIL, SAFE, EDISON)

There are a wide number of different IT frameworks which can be used when improving the organisational use of IT. These can be relevant to particular Role Profiles as they provide further detailed guidance on practices and activities that are relevant to that role. They can also be relevant on an organisation wide basis or useful for a particular group of roles. Many of these operate at the process level, for example ITIL an acronym for Information Technology Infrastructure Library ("ITIL | IT Service Management | ITSM | AXELOS", 2017), is a set of detailed practices for IT service management (ITSM) that focuses on aligning IT services with the needs of business. Others, such as the IT Capability Maturity Framework (IT -CMF) (Curley et.al, 2015), focus more on the management and business value of IT. Some have been more recently developed in response to changes in how IT is managed, for example SAFE ("About – Scaled Agile Framework", 2017), the Scaled Agile Framework and software development management.

There has also been some specific EU projects that have created profiles for particular areas of ICT such as the EDISON professional profiles around Data Science. These were consulted when developing the European ICT Professional Role Profiles and they can also be used as a potential useful tool for generating more detailed and specific data-science roles. Currently (2017-2019) there is a EU project on Digital Organisational Frameworks and IT Professionalism (EASME/COSME/2016/016) which aims to develop a reference framework (draft name is DIGIFRAME) to facilitate the coordinated use of organisational IT capability frameworks and skills frameworks, primarily e-CF.

The use of European ICT Professional Role Profiles is seen as useful potential bridging point between the organisational perspective, as shown in the mission and tasks, and the individual skill perspective, as shown in the competences and knowledge. For more detail see section 4.5. of the CWA Part 2 User Guide.

3. European ICT Professional Role Profiles description method

3.1. The template and description rules

For this CWA a template was developed which can be used to show how all 30 European ICT Professional Role Profiles were defined and how they can be further adapted in a specific context by individual users. This template is of generic value and can in principle be applied to any sector.

To continue increasing transparency it is recommended to follow this outline format for both role and job profile descriptions in other profile description activities. By using the same basic template ,it becomes easier to compare and contrast different profiles within the same or different industry sectors.

Influenced by job roles used in ICT organisations across Europe and by considering practicalities to be taken into consideration, the template specification for each profile contains definitions as follows:

- A **title** to give a name to the profile;
- A **summary** statement to indicate the main purpose of the profile;
- A **mission** statement to describe the rationale of the profile;
- A list of **deliverables** up to six, with mention of the level of responsibility – accountable, responsible or contributor) to be carried out by the profile;
- A list of typical **tasks** to be performed by the profile;
- A list of necessary **e-competences** (from the e-CF) to carry out the mission;
- A **KPI** (Key Performance Indicator) **area** to inspire how to deduce specific KPIs allowing the measurement of the mission performance and its outputs.

3.2. Key principles applied for Profile description

The version 2 update allowed to validate and continue maturing the overall European ICT Professional approach, developed in its essential features in version 1 creation.

The application of BREVITY and DIFFERENTIATION (between each profile) provide the overall guide to European ICT Professional Role Profile description.

Further guiding rules applied to standardise all profile content:

- Summary statement – One sentence only
- Mission length – Maximum of three sentences
- Tasks volume – six to eight
- Competence volume – 4 or 5
- Competence levels – one only for each competence (as opposed to either/or in previous version) – like all content levels are for guidance only
- Deliverables volume – up to 6

The following table provides all description rules in detail.

Profile title	Gives a commonly used name to a profile. **Identification exercise and multi-stakeholder agreement as described in 1.2.**		
Summary statement	**Indicates the main purpose of the profile.** The purpose is to present to stakeholders and users a brief, concise understanding of the specified ICT Profile. It should be understandable by ICT professionals, ICT managers and Human Resource personnel. The structure should consist of a short sentence (up to approximately 15 words). It should not repeat the entire ICT Profile name. It should provide a statement of the job's main activity.		
Mission	**Describes the rationale of the profile.** The purpose is to specify the designated job role defined in the ICT Profile. It should provide the performance context of the job within an organisational structure. The following verbs may be used within the description or at least for structuring the thinking about how to express the mission: *Guarantees, Ensures, Contributes*. It should contain no more than 3 sentences.		
Deliverables	**Accountable (A)**	**Responsible (R)**	**Contributor (C)**
	Specifies the Profile by key deliverables. The purpose is to illuminate the ICT Profiles and to explain relevance including the perspective from a non-ICT point of view. Also add the dimension of responsible following the RACI model Select only the most important deliverables, which help to illustrate the ICT Profile, not more than 6 in total (A,R,C together). Mention the level of responsibility – A accountable, R responsible, C contributor – to be carried out by the profile.		
Main task/s	**Provides a list of typical tasks to be performed by the profile.** A task is an action taken to achieve a result within a broadly defined context. Tasks may be associated with deadlines, resources, goals, specifications and/or the expected results. These elements depend upon the context of the task and may be omitted; however the action must always be described. A task is defined by a short description using a verb and the objective or goal of the action. List between 6 and 8. SELECTION CRITERIA: A task contributes to define a Profile.		

e-CF competences assigned	**Provides a list of necessary competences (from the e-CF) to carry out the mission.** Must include 4 or 5 competences. Level assignment is important and a single value is assigned SELECTION CRITERIA: A competence is a consequence of the previously derived Profile definition and helps to separate profiles one from another.
KPI Area	**Based upon KPIs (Key Performance Indicators) KPI area is a more generic indicator, congruent with the overall profile granularity level. It is deployed to add depth to the mission.** Not prescriptive. Non-specific measurements. Use general examples. The principle is to provide KPI areas (which are stable, general and long lasting) providing users with an inspiration to enable development of specific KPI's for specific roles (such KPI measurements can be more short-term oriented). Must be related to the key deliverables in order to measure them. Focus on long-term deliverables (Profile), not short term (Job position). Be described in a single sentence. The KPI area should always be translatable into detailed measurable KPI examples.

Table 6: The European ICT Profile description template and rules

3.3. Profiles update and consistency cross-check

Since version 1 of The European ICT Profiles CWA (year 2012) there have been rapid advances in organisation processes and consequently the role requirements of ICT professionals determining the profile update.

The original, 23 profiles have been updated in content, based upon user experience and feedback.

Additional structural rules have been applied, such as number of competences and tasks, to provide even more consistent profile descriptions.

Seven new profiles have been added to the portfolio, again influenced by industry changes and feedback from existing and potential users. These new roles are intended to reflect innovations in the workplace and are designed to co-exist with more traditional roles that are still relevant and prevalent across the ICT workforce. All seven are customer-focused roles and although contemporary they are added to complement traditional roles. Furthermore, the roles have been created to address significant workplace process and subsequent job structure changes.

A consistency cross-check was carried out once all Profiles were fully updated:

- Have all items described been identified in a coherent and consistent way?
- Is there a clear distinction between all profiles and have overlaps been avoided?
- On the assigned level of granularity; are all relevant missions and deliverables of the ICT business process covered?

The technical interim and final results were presented at several occasions to the wider European experts and stakeholders community, seeking further feedback and final improvement, see chapter 5.2. complemented by the acknowledgement section for all detail. The outcome of this process, all 30 European ICT Professional Profiles with full descriptions, including profile interrelationships and further illustrative overview schemes, are presented CWA Part 1.

4. The ICT Profiles Family Tree concept (generation 1, 2 and 3)

The European ICT Professional Role Profiles provide a consistent structure and offer a base to facilitate the creation of further and more detailed Profiles. In version 1 they were structured in six families and the ICT Profiles provided the genesis for new profiles designed to meet user requirements.

4.1. Generation 1: ICT Profiles Family identification

Structuring the currently 30 European ICT Professional Role Profiles by families significantly facilitates navigation and enriches an initially flat structure with orientation guidance. In this way ICT Profiles can be divided into family groups of related profiles. In identifying groups, different options of similarity can be considered; for example:

- ICT Profiles could be arranged according to hierarchical roles, like *manager* or *specialist*
- ICT Profiles could be arranged according to similar fields, like *business* or *database*
- ICT Profiles could be arranged according to other similarities such as *functions* or *deliverables*

However, it was agreed that **patterns of competence** are the most helpful arrangement of European ICT Profiles for enterprises, human resources department and professionals involved in competence and skills development. The assigned competences of all European ICT Profiles are gathered from the e-Competence Framework. Thus every European ICT Profile is characterised by a set of competences at specific levels that form a typical pattern.

Based on the pattern of competence it is possible to locate each European ICT Profile on a map, built from Dimension 1 of the e-Competence Framework which reflects the five main ICT business processes PLAN, BUILD, RUN, ENABLE and MANAGE:

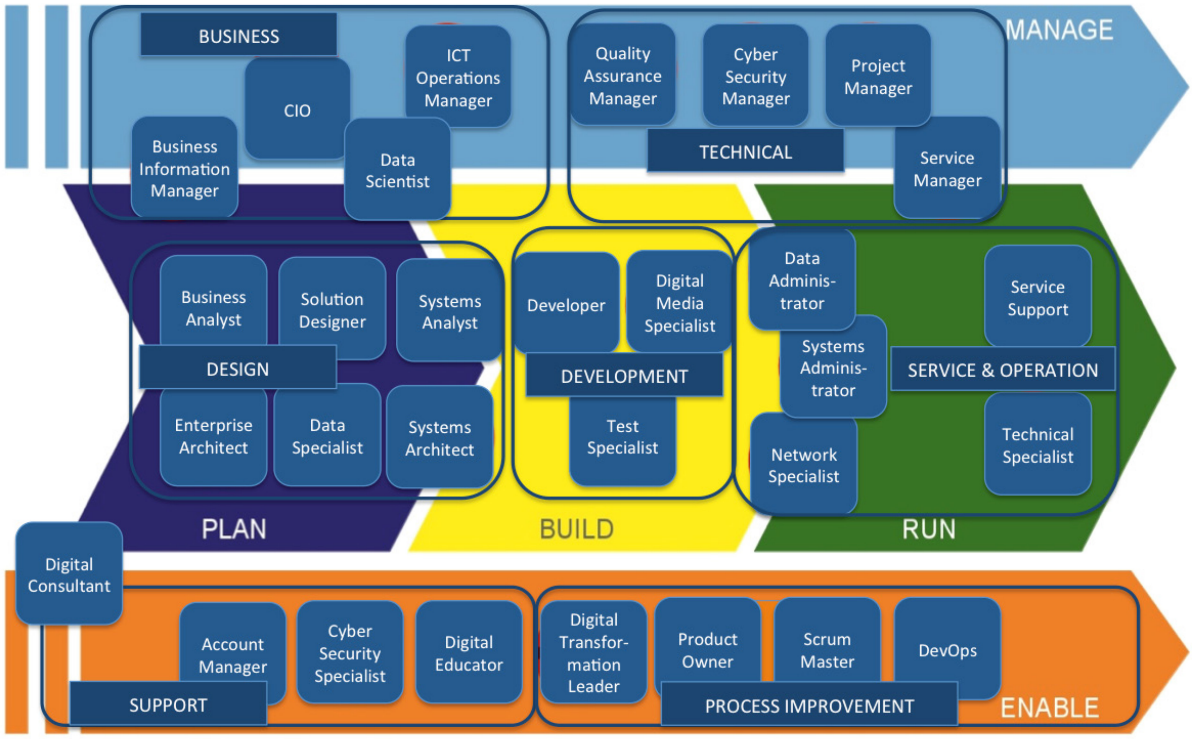

Figure 3: The 30 European ICT Professional Role Profiles structured by seven families and positioned in the five main business processes (e-CF Dimension 1)

Most ICT Profiles are located in one e-CF dimension, for example, CIO in MANAGE, Enterprise Architect in PLAN or Technical Specialist in RUN. This means, that all or most important competences of the profile are related to this ICT business process. A minority of ICT Profiles are located on borders, e.g. Business Information Manager in MANAGE and PLAN or the Systems Administrator in BUILD and RUN. This means, that these profiles typically combine competences (and also tasks) from two ICT business processes.

To build families, it was necessary to associate the profiles. Again, different possibilities were available.

- The first and most obvious possibility is to group profiles within the ICT Business Processes and create a MANAGE-family, a PLAN-family and so on. This approach adds little as families fail to add any additional information than the profiles on their own.
- Another possibility was to build families within similar fields of action, integrating some specialisations, and forming groups such as an analyse-family or a service-family. This option may work in some ICT contexts, but it mainly relates to enterprise organisations and fails to be relevant to SMEs.

To ensure maximum added value, it was decided to provide seven families combining similar patterns of competence with similar tasks and work relationships. This final result is illustrated in above figure 3.

It is useful to repeat that the e-CF competences in dimension 1, structured by five main business processes reflecting the waterfall appraoch, also fit into agile process structures, namely an Agile/ DevOps lifecycle. The e-CF can therefore also be used for new agile roles like DevOps or Digital Transformation Leader as incorporated in the latest European ICT Professional Role Profiles update, see figure 2 in section 1.3.2.

4.2. Generation 2: 30 ICT Professional Role Profiles assigned to the seven families

The prime objective of the presented 30 European ICT Professional Profiles is to increase transparency and to continue the convergence of the European ICT Skills landscape, as initiated in the origins of the European e-Competence Framework (e-CF).

As a response to the vast number of ICT Profiles Frameworks and Profiles descriptions used today in European ICT Business and Qualification practice, it was decided to create a reasonable number of representative ICT Profiles which cover the whole ICT Business process reflected by e-CF Dimension 1 and which can be used for reference or further development by stakeholders Europe-wide.

Structured in seven main **ICT Profile families**, the philosophy behind these reference Profiles is to reflect the top of a **European ICT Profiles family tree**.

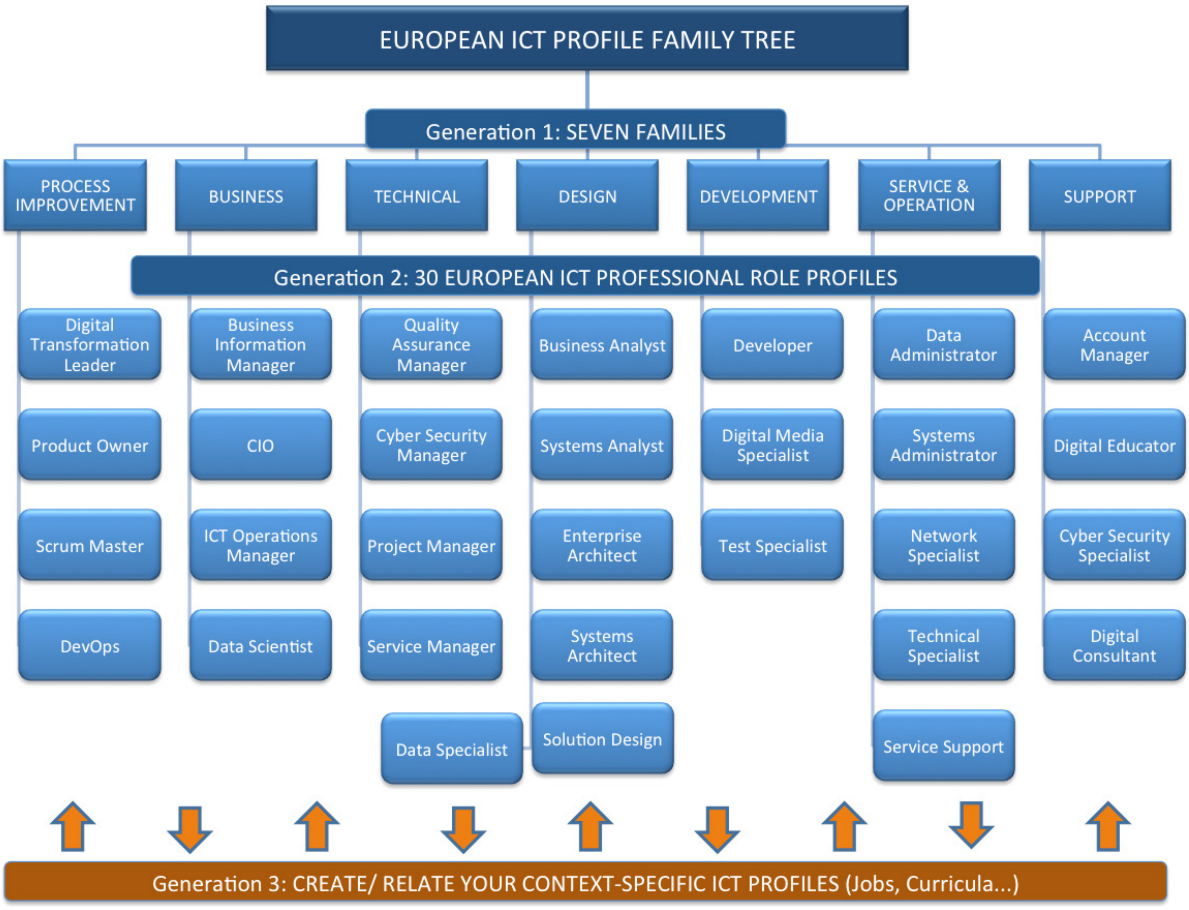

Figure 4: 30 European ICT Professional Role Profiles (generation 2) in seven families (generation 1) at the top of the European ICT Profile Family Tree

Originally depicting this analogy for 23 profiles and now incorporating seven additional roles, the family tree it is still a valid (although not perfect) viewpoint which can be used to navigate through the content and demonstrate relationships between profiles.

4.3. Generation 3: Customised ICT Profile adaptation in context

As described in the CWA Part 2 User Guide, the profiles may be used for reference or alternatively as a base to develop further profile generations. Structured from six main ICT Profile families, these profiles reflect the top of a European ICT profile family tree. The concept is broadly analogous to a human family where characteristics from one generation pass down and are also re-configured

from one generation to the next. In a similar way, it is envisaged that the core components of the now 30 generation 2 profiles may be passed down and adapted as needed to user generated profiles with higher granularity.

To assist the development of user created profiles, the thinking behind the original concept can be extended to incorporate an additional perspective. When viewing a subject from a distance through a camera lens we can make out a silhouette, or a general outline of what we are seeing. As we gradually focus the lens we can see progressively and more sharply and can better understand the detail of the subject we are viewing.

Likewise, the 30 European ICT Profiles provide a distant viewpoint with a clear outline but with inner details that are deliberately generalised and of consistent granularity. To customise profiles in a next generation 3, users have the option to modify content, inspired by the original and to incorporate detailed granularity to meet specific requirements yet retain the original profile outline.

5. ICT Profiles update data collection and agreement process

5.1. Systematic gathering of input from other EU e-Skills activities and tools

Intelligent links to other relevant frameworks and concepts in the field are key for a European ICT Professional Role Profile Framework seeking large acceptance and implementation.

Several e-skills initiatives exist in Europe, under the umbrella of the Digital Agenda for Europe and the Digital Skills and Jobs Coalition[4]. Their relevance to the ICT Role Profiles is to provide a context to where they fit in with the wider agenda of maturing ICT as a profession in terms of the four building blocks as shown in graphic below.

Figure 5: The four main building blocks of ICT Professionalism

In particular, it should be noted that the development and use of competence frameworks and related tools, such as the ICT Role Profiles, progresses all four building blocks of ICT Professionalism. It provides a structured view of competences but it also includes parts of a Body of Knowledge, it can be used to develop education, training and certifications and its competences and tasks (in terms of Role Profiles) can be used to embed ethics into professional activities.

It is crucial, in the updating of ICT Professional Profiles, to take in consideration the main results from these e-Skills initiatives, in order to:

- reinforce the existence of a European embedded environment on this topic, providing a common view and synergy, maximizing the results and investment from many stakeholders;

[4] The Digital Skills and Jobs Coalition brings together Member States, companies, social partners, non-profit organisations and education providers, who take action to tackle the lack of digital skills in Europe.
https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition

- facilitate the common use of concepts and giving, whenever possible, clear evidence of the existing relationship between different sources, documents and perspectives;
- increase the quality of ICT Profiles content, by assuring they are in line with all the recognized relevant trends for market and the profession development needs such as e-leadership and data science.

The below figure 6 shows the main elements, concepts and tools currently available at the European level and their interrelationships.

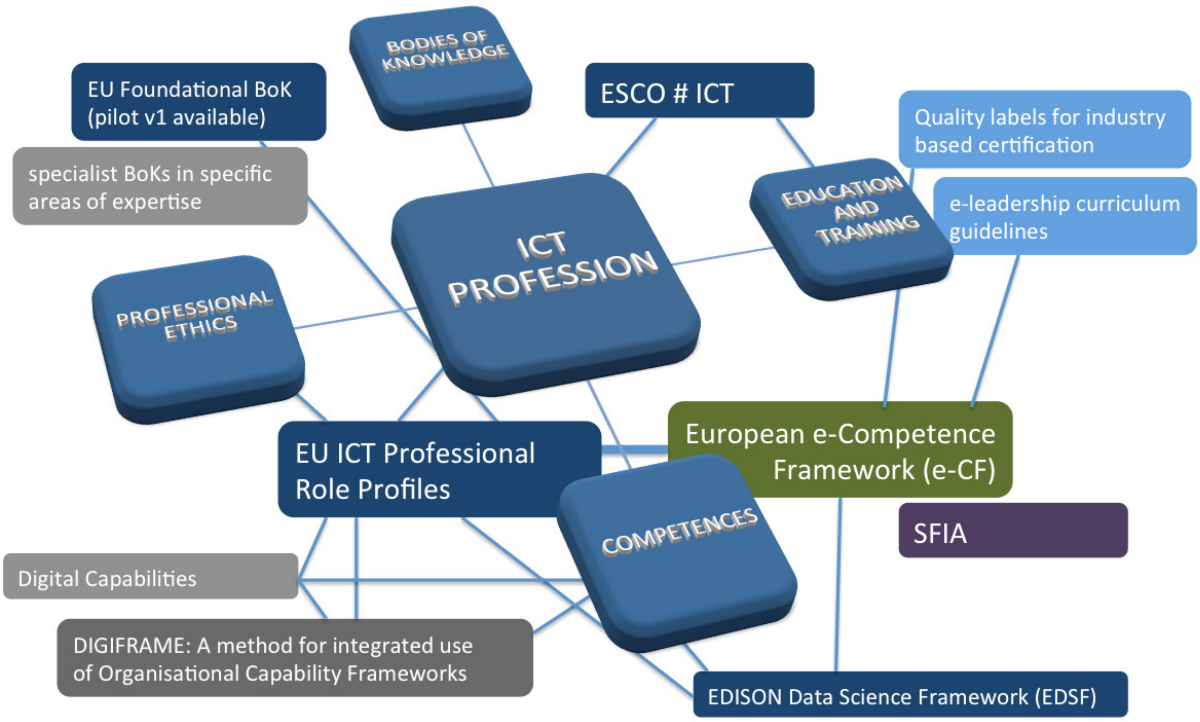

Figure 6: The four main building blocks of ICT Professionalism supported and inter-connected by European standards, references and tools

The most relevant links are of concepts to the European ICT Professional Role Profiles are described in section 2.4 of this Methodology Documentation. In addition, Annex A provides a non-exhaustive list including the main initiatives and key publications that have been taken in consideration as input for the ICT Professional Profiles creation and updating.

5.2. A European multi-stakeholder process – parties and resources involved

Significantly benefitting from the practical success of e-CF implementation, the European ICT Professional Profiles first release development quickly gained the active support of experienced and qualified contributors from the European ICT business and HR environment. Many stakeholders and experts contributed on a voluntary basis as they anticipated that the output would provide clear added value to their daily business and work activities. Contributors to the ICT Professional Profiles development came from multiple work perspectives and countries across Europe. Contributors came from companies, associations, research, qualification and certification institutions. A detailed list of organisations involved can be found in the Acknowledgement section.

This strong expert and stakeholder involvement on multiple levels, for profile construction, was consistent with the very high levels of ICT multi-stakeholder feedback received on practical application since the first publication of the European ICT Professional Profiles in 2012. It also provided an excellent basis for further engagement with the European ICT multi-stakeholder community for the ICT profiles update in the context of this project.

Project progress and verification checks of quality and market relevance of work in progress, in close cooperation with ICT and HR business representatives and further interested European multi-stakeholders, was assured by a four level approach to technical CWA development and multi-stakeholder approval:

1. The CEN nominated expert team, composed of 6 members in total, was responsible for CWA development.
2. The expert team was supported by several highly qualified external experts coming from ICT business and the HR environment; enriching the expert team perspectives on a voluntary basis by additional insight, experience and expert opinion. They joined the expert team members in expert workgroup meetings and also contributed to work in progress between meetings, depending on their level of interest and availability.
3. Based on the input above the CEN nominated expert team was enabled to develop mature proposals to the CEN ICT Skills Workshop. This initiates the next important process step of further commenting and results optimization in close interaction with the CEN ICT Skills Workshop Community.
4. Finally, dissemination support by CEN Workshop members and interaction of the project leader with around 500 stakeholders from Europe and also some from overseas participating on various occasions (invitation to participate in the ICT Professional profiles user feedback on-line survey, CWA commenting phases) assures an interaction that goes beyond the ICT Workshop members for largest possible consolidation and acceptance of results.

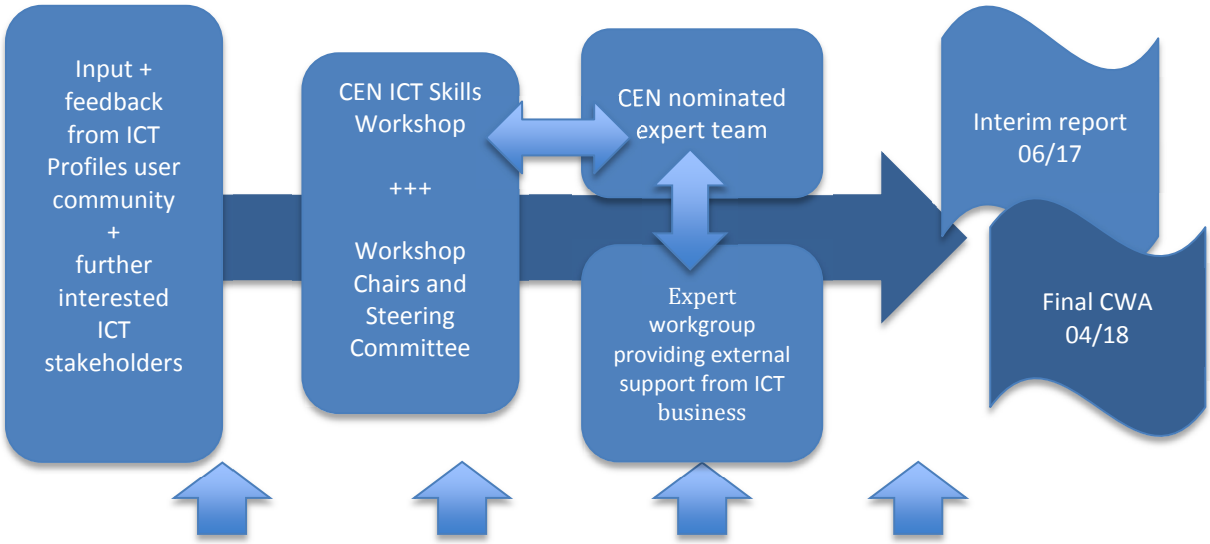

Figure 7: The "European ICT Professional Profiles in action" project – Working structure, meeting and interaction platforms, experts and stakeholders involved

The on-line survey, CEN nominated expert team and expert workgroup meetings, CEN ICT Skills Workshop meetings and further technical multi-stakeholder feedback gathering workshops were visible milestones and important steps for overall project progress.

6. Glossary – terms and definitions

TERM	DEFINITION	SOURCE/ EXAMPLE
competence	Demonstrated ability to apply knowledge, skills and attitudes to achieve observable results Competences form part of the Role Profiles. *Source: e-CF EN 16234-1*	Competences defined by EN 16234-1 European e-Competence Framework (e-CF)
job description	A detailed description of what a person does so that the particular job holder can have no doubt of their tasks, duties and responsibilities and who they report to. It contains precise information about competences, skills and knowledge required as well as practical information about health and safety and remuneration. Job Descriptions are not included in the ICT Role Profiles but they can be developed from the Profiles, such as generation 3 level profiles.	An example may be a job description developed from a generation 3 profile.
knowledge	Body of facts, principles, theories and practices that is related to a field of work or study. An employee needs to know the relevant selection of these to successfully perform in their job. Sample or indicative knowledge example are included in the Role Profiles based on the e-CF.	knowledge examples provided by EN 16234-1 European e-Competence Framework (e-CF)
role	A role derives from an organisational need to get something done. It is an organisational requirement that can be met by assigning employees to carry out all or part of the tasks required to ensure that role is carried out. One person or team may have multiple roles. In terms of the ICT Role Profiles it is often the case that an actual job carried out by an employee would consist of parts of a number of the Role Profiles. *Source: ITSM Academy*	Example is the role of risk management. This can be implemented by a range of different employees with varying degrees of responsibility and types of tasks at different levels within the organisation
role profile	An outline or general document which demonstrates clearly the relationship between specific activities/tasks in a role and the individual skills, competences and knowledge required to undertake them.	European ICT Professional Role Profiles CWA
skill	The ability to use know-how and expertise to complete tasks and solve problems.	Skills examples provided by EN 16234-1 European e-Competence Framework (e-CF)

ANNEX A: Look at other e-Skills and ICT Professionalism initiatives

The following, non-exhaustive, list includes the main initiatives and key publications that have been taken in consideration as input for the ICT Professional Profiles updating.

- Development and Implementation of a European Framework for IT Professionalism (2017 Capgemini, EY and IDC)[5]

  The project was carried out for European Commission, Directorate General Internal Market, Industry, Entrepreneurship and SMEs to achieve three objectives:

  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, the situation concerning IT industry training and certifications and the evolution at international level including an analysis and comparison of the situation for Canada, Japan, USA, Germany, France and UK.
  2. Provide a clear view for development and implementation of the four foundational building blocks[6] that provide a first comprehensive European framework for IT professionalism:
     - Body of knowledge;
     - Education, Training and certifications;
     - Competences;
     - Professional Ethics.
  3. Establishment of a group of leading European 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.

- High-Tech Leadership Skills for Europe (2017, by Empirica, pwc and IDC)

  The document provides a summary of the state-of-the-art of high-tech leadership skills in Europe, and it highlights concrete proposals for action and how best to implement an EU-wide agenda at Member State and European level. These proposals are based on the results of a consultation process in which experts shared their experiences and their visions on high-tech leadership skills towards 2020 and beyond.

- e-Skills: European Foundational ICT Body of Knowledge (2015, by Capgemini and EY)

  This European Foundational ICT Body of Knowledge serves as an entry point for anyone contemplating a career in ICT, and entering from other professions; facilitates communication between and understanding of ICT professionals in Europe in whatever sector they are active, thereby reducing risks and strengthening ICT professionalism; and helps to increase the supply and pool of ICT professionals by contributing to a better perception of ICT jobs.

- e-Leadership: e-Skills for Competitiveness and Innovation March 2013, Empirica, IDC, INSEAD

  This is the final report of the study: 'Vision, roadmap and foresight scenarios for Europe 2013-2020' (eSkills Vision). The key objective of this study is to help reduce innovation skills shortages, gaps and mismatches in Europe, by providing sound, unbiased empirical evidence

[5] Service contract EASME/COSME/2014/012

[6] The four building blocks have firstly been defined in the report "e-Skills and IT professionalism: Fostering the IT profession in Europe" (2012). The document is the final report of a project carried on by CEPIS and the Innovation Value Institute that may be considered as one of the key milestone to take in consideration on IT professionalism. The main results from the project have been the starting point for taken in consideration by succeeding projects.

on how the supply and demand for different types of ICT-related skills is evolving in Europe under different socio-economic scenarios. A sufficient skills base in this domain is an important enabler for competitiveness and innovation in Europe. The evidence delivered by this study shall encourage and facilitate the dialogue and cooperation between policy makers and relevant stakeholders at the EU and national levels about the implications and required actions to be taken to address current as well as anticipated skills gaps and shortages. A special focus of the study is on higher-level innovation skills (which are called “e-leadership skills") next to the analysis of the supply-demand developments for ICT practitioner and ICT user skills.

- Towards European Quality Labels for ICT Industry Training and Certification (Empirica, EXIN 2013)

  This document is the Report of the project ‘Quality Labels for Training Fostering e-Skills for Competitiveness and Innovation’ The ultimate objective of the study is to develop quality labels for industry-based training and certification (IBTC). Providing a road map towards quality labelling in the IBTC domain is expected to support further integration of industry-based training into vocational education and training systems, improving transparency and transferability of qualifications in Europe. The study also provides a reliable picture of e-Skills IBTC supply and demand across Europe, map IBTC offers to the European e-Competence Framework and provide the prototype of an online service to stakeholders.

- e-Skills and ICT professionalism: Fostering the ICT profession in Europe (2012, by CEPIS and the Innovation Value Institute)

  This project reflects parallel efforts to mature the ICT profession in other parts of the world, such as TechAmerica in United States and ITA in Japan. This project aimed to supporting the development of a European framework for ICT professionalism, with the goal of enhancing professionalism and mobility across Europe. The project also incorporates proposals to support the development of a European training programme for ICT managers.

- e-CF COUNCIL (e-CF Alliance)

  The project, funded by ERASMUS+ program and led by Fondazione Politecnico di Milano[7], intends to establish a stable alliance in the ICT sector gathering the key market players across Europe, i.e. social partners, regulatory bodies, VET organisations, research centres. The e-CF COUNCIL specific goals and outcomes are:

  - The design of a common reference scheme (e-CF COUNCIL scheme) for vocational qualifications and certifications, including prior learning recognition;
  - The design of a set of EQF-based Learning Units related to about 15 e-competences selected from the e-CF 3.0 e-competences;
  - The design of a pilot joint vocational qualification based on the e-CF COUNCIL scheme, identified within the ESCO IT Occupations, and including a subset of the selected e-competences with the properly related reference learning units;
  - The development of the related learning/training content for each selected learning unit, feeding the e-CF COUNCIL open content repository;
  - The development of a transnational pilot blended training initiative focused on the pilot qualification’s targeted e-competences and learning units, using the e-CF COUNCIL open content;

[7] The e-CF COUNCIL project is delivered by: Fondazione Politecnico di Milano, CEFRIEL, CNA-ICT, ADFOR S.p.A., FIOM Lombardia (Italy), ESI Center Eastern Europe, Bulgarian Association of Software Companies – BASSCOM, National Agency for Vocational Education and Training – NAVET (Bulgaria), bITa Center, CIONET, EXIN (Netherlands), University of Alcalá – UAH, Services Federation of CCOO, DG Formacion – Comunidad de Madrid (Spain), PIN-SME, DIGITAL EUROPE (Belgium).

- The development of the assessment process for each e-competence included in the pilot qualification.

The project is expected to end in November 2018.

- E-SKILLS MATCH

  The project is funded by Erasmus+ Program and delivered by a Consortium[8] led by Stockholm University. The general objective is to develop and demonstrate a European-wide learning technology system, dynamically adapted to changes occurring in job labour market classifications that will support (re)- training for acquiring the necessary e-Skills and digital competences to access the desirable jobs within the ICT sector.

  The project will develop a system that classifies ICT skills and digital competences achieved through formal, non-formal and informal learning and enable them to be related to qualifications and occupation in the ICT sector and to open learning and training systems that provide these skills and competences. Final report is expected in Autumn 2017.

- The EDISON project

  Edison is an initiative designed to accelerate the creation of the data science profession. Supported by the European Commission the project has a core consortium of seven partners, University of Amsterdam, University of Southampton, University of Stavanger, EGI, Delta Engineering, FTK and Inmark Europa.

  An output of the initiative is the development of the EDISON collection an expanding volume of reports and descriptions, including specific data science role profiles that collectively make up and support the EDISON Data Science Framework (EDSF).

  Given the increasing relevance of data management to the ICT domain (see 3.2.2) EDISON has informed the update of ICT Professional Role Profiles. In consequence representatives of each project have attended each other's project. This exchange of ideas and concepts enriches each initiative and facilitates alignment and common technical understanding. www.edison-project.eu

Relevant Global e-Skills initiatives and projects

- Japanese i-Competency Dictionary Japan, Information Technology Promotion Agency (IPA) i-CD)

  IPA released "i Competency Dictionary (iCD) "as a structured dictionary composed of the "Task Dictionary" and the "Skill Dictionary". The iCD is the result of the IPA investigation about the ideal way of the skill standard in the IT human resource development. The iCD suggests Tasks, Skills, Roles, and Jobs needed for not only the conventional business model such as system integrator but also the new age business models such as security, cloud, and data science. https://www.ipa.go.jp/english/humandev/icd.html

- Skills Framework for the Information Age (SFIA)

  A skills framework with an eco-system of partners who help develop content and implement in organisations. It also has value add components, SFIA***Plus*** that includes the capacity to develop job profiles and career pathways**.** https://www.sfia-online.org/en/reference-guide

- Canada

[8] Following organization are part of the Consortium: Stockholms Universitet, Fondazione Politecnico di Milano, Universidad de Alcalá, Adfor, Government To You Aisbl

The ICTC Information and Communications Technology Council has an IT occupational framework (e talent). Under each of the categories is a long list of sample job titles and a link to where current employment is (sector plus geography) and also to current vacancies and relevant courses (post-secondary). http://www.etalentcanada.ca/occupation-overview/

Relevant policy reports

- DIGITALEUROPE AND THE EC'S SKILLS STRATEGY 2016 - Recommendations from DIGITALEUROPE - Boosting the skills for the future of digital Europe (January 2016, Digital Europe)

  This position paper articulates recommendations to the European Commission for closing the digital skills gap. Concrete recommendations for actions that could be included in the European Commission's Skills Strategy to be published in May 2016.

  These recommendations reflect, among others, Digital Europe's work under the Grand Coalition for Digital Jobs and the e-Skills for Jobs campaigns, two European Commission initiatives that have already contributed to reduce the digital skills gap in Europe.

- The Future of Jobs Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution (2016, World Economic Forum)

  The Future of Jobs Report is a first step in becoming specific about the changes at hand. It taps into the knowledge of those who are best placed to observe the dynamics of workforces—Chief Human Resources and Strategy Officers—by asking them what the current shifts mean, specifically for employment, skills and recruitment across industries and geographies. In particular, the initiative has introduced a new measure—skills stability—to quantify the degree of skills disruption within an occupation, a job family or an entire industry. The report provides also an outlook on the gender dynamics of the changes underway, a key element in understanding how the benefits and burdens of the Fourth Industrial Revolution will be distributed.

Relevant ISO standards

There are a number of ISO standards that are particularly relevant to ICT and there are also more generic ISO standards, for example around management and quality management that are relevant, to the ICT Profiles. A selection that have been identified so far are indicated below at the level of a reference to the appropriate standard rather than a detailed analysis of the particular sections.

Standards of direct relevance to ICT

- ISO/IEC 27000 family - Information security management systems

  Within this group (family) of standard there a range of standards of relevance to ICT security management. ISO/IEC 27001 is the best-known standard in the family providing requirements for an information security management system (ISMS).

- ISO/IEC TR 19759:2015 Software Engineering - Guide to the software engineering body of knowledge (SWEBOK)

  This standard characterizes the boundaries of the software engineering discipline and provides topical access to the literature supporting that discipline. This is interesting as it is a standard that has a direct link to an existing Body of Knowledge.

Standards of general relevance to ICT

- ISO 9001:2015 Quality management systems – Requirements

This standard specifies requirements for a quality management system when an organization:

- needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and
- aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.

It also includes, which is new for this latest version a new clause, 7.1.6, on organizational knowledge and its management.

Relevant bodies of knowledge

- Enterprise Information Technology Body of Knowledge (EITBOK).

  This has been developed by IEEE and ACM (http://eitbokwiki.org/Main_Page)It has fourteen chapters organised under two main sections, the Enterprise Perspective and the Life Cycle perspective. Each chapter is linked to the relevant sections of the e-CF and other frameworks including SFIA and IT-CMF.

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Complementary to this section see ANNEX A: Look at other e-Skills and ICT Professionalism initiatives, including a non-exhaustive list of the main initiatives and key publications that have been taken in consideration to analyse the current ICT Professionalism landscape as another important input for the ICT Professional Profiles update.

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