

Marco de e-Competencias (e-CF). Marco europeo común para los profesionales de las Tecnologías de la Información y la Comunicación (TIC) en todos los sectores de actividad. Parte 2: Guía del usuario (Ratificada por la Asociación Española de Normalización en abril de 2021.)

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e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors - Part 2: User Guide (Endorsed by Asociación Española de Normalización in April of 2021.)

Référentiel des e-Compétences (e-CF) - Référentiel européen commun pour les professionnels des technologies de l'information et de la communication dans tous les secteurs d'activité - Partie 2 : Guide de l'utilisateur (Entérinée par l'Asociación Española de Normalización en avril 2021.)

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English Version

**e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors - Part 2:
User Guide**

Référentiel des e-Compétences (e-CF) - Référentiel européen commun pour les professionnels des technologies de l'information et de la communication dans tous les secteurs d'activité - Partie 2 : Guide de l'utilisateur

E-Kompetenz-Rahmen (e-CF) - Ein gemeinsamer europäischer Rahmen für IKT-Fach- und Führungskräfte in allen Branchen - Teil 2: Nutzerleitfaden

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Content

	Page
European foreword	3
Introduction	4
1 Scope	6
2 Normative references	6
3 Terms and definitions.....	7
4 Main Principles.....	7
4.1 EN 16234-1 (e-CF) scope and target groups	7
4.2 EN 16234-1 (e-CF) a fundamental pillar of ICT professionalism for Europe	7
4.3 EN 16234-1 (e-CF) structure, content and application opportunities.....	8
4.4 The e-CF as a standard: normative versus informative elements.....	15
4.5 Entry start points for using the EN 16234-1 (e-CF)	16
4.6 Purpose and target groups of this user guide	20
5 e-CF for multiple application across multiple target groups.....	20
5.1 Applying the e-CF in the ICT organisation: HR and ICT departments.....	20
5.2 Applying the EN 16234-1 (e-CF) in an education and training context.....	25
5.3 EN 16234-1 (e-CF) application by individuals, ICT students and professionals.....	30
5.4 EN 16234-1 (e-CF) applied in ICT labour market research	31
5.5 EN 16234-1 (e-CF) in policy and digital skills strategy development.....	31
5.6 Making combined use of frameworks	34
Annex A (normative) e-Competence levels e-1 to e-5 from EN 16234-1 (e-CF).....	38
Annex B (informative) Examples of deliverables related to e-CF competences	39
Annex C (informative) Creating further framework interfaces: Example EN 16234-1 (e-CF) and Euro-Inf.....	47
Annex D (informative) Overview of CEN/TR 16234-4 - Case Studies illustrating e-CF usage in practice	52
Bibliography	57

European foreword

This document (CEN/TR 16234-2:2021) has been prepared by Technical Committee CEN/TC 428 "ICT professionalism and digital competences", the secretariat of which is held by UNI.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TR 16234-2:2016.

In comparison with the previous edition, the following technical modifications have been made:

- Review of all previously existing clauses and content in the light of the EN 16234-1:2019 and benefitting from multiple e-CF user experiences gathered and application feedback received.

This document for ICT professional competence outlines the minimum requirements of competence (i.e. a threshold) in the work context. It includes typical knowledge and skills examples that are not standardized but provided to support orientation and understanding. When applying the standard, this approach must be recognized to clearly distinguish between which elements are mandatory and which are merely examples (represented by, shall versus should/may/can, etc.).

This European standard is made up of four parts:

- EN 16234-1 e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors - Part 1: Framework. It provides the e-Competence Framework (e-CF) published as a European Norm (EN).
- CEN/TR 16234-2 e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors - Part 2: User Guide. It provides the e-CF User guide published as a CEN Technical Report (TR).
- CEN/TR 16234-3 e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors - Part 3: Methodology. It provides the e-CF Methodology published as a CEN Technical Report (TR).
- CEN/TR 16234-4 e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors - Part 4: Case Studies. It provides a series of Case Studies illustrating e-CF practical use from multiple ICT sector perspectives published as a CEN Technical Report (TR).

Part 1 is fully standalone, and part 2, 3 and 4 rely on part 1.

Introduction

EN 16234-1, e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors – Part 1: Framework was established as a tool to support mutual understanding and provide transparency of language through the articulation of competences required and deployed by Information and Communication Technology (ICT) professionals.

In the complex environment of ICT professional skills development and management there is a need for clarity and simplification. Existing organisational processes have often been established in an ad hoc way over many years and lack connectivity to the wider community. The e-CF offers a way out of this dilemma, providing a neutral solution to overcome inertia and to establish a structured approach to ICT professional competence development.

This document offers direction on how to adopt the e-CF approach from multiple user perspectives. Clause 4 provides the executive overview of e-CF scope, target groups, underlying principles, concepts and structure, including entry points for using the e-CF (4.5). Clause 5 provides practical guidance for multiple applications of the standard among multiple target groups and from different stakeholder perspectives. Compelling reasons for adopting the e-CF are given in 5.1.2 (basic factors for successful implementation). Annex D of this document gives an overview of Case Studies published in a complementary document illustrating examples of e-CF practical application.

To support users and guide developers of applications of EN 16234-1 (e-CF), the following narrative provides an overview of the underpinning philosophy and principles adopted during the document's construction and maintenance. Understanding these guiding principles is equally important for applying the EN 16234-1 (e-CF) across multiple environments concerned with ICT professionalism.

EN 16234-1 (e-CF) Guiding Principles:

EN 16234-1 (e-CF) is an enabler; it is designed to be a tool to empower users, not to restrict them. It provides structure and content for application by many users from organisations in the private and public sector, ICT user or ICT supply organisations, educational institutions including higher education and private certification providers, social partners and individuals. Across this broad application context, EN 16234-1 (e-CF) is designed to support common understanding, not to mandate the use of each and every word used within it.

EN 16234-1 (e-CF) expresses ICT competence using the following definition: 'Competence is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results'. This holistic concept directly relates to workplace activities and incorporates complex human attitudes and resultant behaviours. Behaviour and attitude are important influences that facilitate successful knowledge and skills application. Within each competence, embedded attitudes are reflected in behaviour and enable the successful integration of knowledge and skills.

Competence is a durable concept and although technology, jobs, marketing terminology and promotional concepts within the ICT environment change rapidly, EN 16234-1 (e-CF) remains durable requiring maintenance approximately every three years to maintain relevance.

A competence can be a component of a job role, but it cannot be used as a substitute for similarly named job titles, for example; the competence, E.2. 'Project and Portfolio Management' does not represent the complete content of a 'Project Manager's' job role. Competences can be aggregated, as required, to represent the essential content of a job role or profile. On the other hand, one single competence may be assigned to a number of different job profiles.

Competence is not to be confused with process or technology concepts such as, 'Cloud Computing' or 'Big Data'. These descriptions represent evolving technologies and in the context of EN 16234-1 (e-CF), they may be integrated as knowledge and skills examples in Dimension 4.

EN 16234-1 (e-CF) does not attempt to cover every possible competence deployed by an ICT professional nor are the included competences necessarily unique to ICT. EN 16234-1 (e-CF) articulates competences associated with ICT professional roles including some that may be found in other professions but are very important in an ICT context; examples include, C.4. 'Problem Management' or E.3. 'Risk Management'. However, to maintain an ICT focus, EN 16234-1 (e-CF) avoids generic competences such as 'Communications' or 'General Management'. Although very applicable these generic competences are comprehensively articulated in other structures. Selecting competences for inclusion within EN 16234-1 (e-CF) is therefore a pragmatic rather than an exhaustive process. The selection was based on engagement with a broad cross-section of stakeholders who prioritize competence inclusion based upon industry knowledge and experience.

EN 16234-1 (e-CF) is structured across four dimensions. e-Competences in Dimensions 1 and 2 are presented from the organisational perspective as opposed to an individual's perspective. Dimension 3 defines e-Competence levels and relates to the European Qualifications Framework (EQF), it provides a bridge between organisational and individual competences. Dimension 4 provides examples of knowledge and skills in the e-Competences of Dimension 2; they are not intended to be exhaustive but included for inspiration and orientation.

This latest version of the standard incorporates a new element, transversal aspects; these recognize the relevance of a number of important cross-cutting aspects and provide additional generic ICT related descriptors for successful application of e-CF competences in the workplace. Accessibility, Ethics and Security are examples of transversal aspects that may be applied flexibly to match the application context.

EN 16234-1 (e-CF) has a sector specific relationship to the EQF; competence levels within EN 16234-1 (e-CF) provide a consistent and rational relationship to levels defined within the EQF. The relativity between EQF learning levels and the e-competence work proficiency levels of EN 16234-1 (e-CF) has been systematically established to enable consistent interpretation of the EQF in the ICT workplace environment. It should be noted that an exact equivalency is not possible due to the different purposes and contexts of the EQF and the e-CF, but relevant relationship information is provided.

Continuity of EN 16234-1 (e-CF) is imperative; following maintenance updates, it is essential that users are provided with a simple upgrade path. Users of EN 16234-1 (e-CF) invest considerable time and resources to align processes or procedures to it. Organisations deploying these downstream activities are reliant upon EN 16234-1 (e-CF) and need to be confident of the continued sustainability of their processes. Updates EN 16234-1 (e-CF) must respect this requirement and ensure continuity by enabling continued use of the existing standard until convenient to upgrade to the latest version.

EN 16234-1 (e-CF) is neutral; it does not follow the specific interests of a few major influencers, it is developed and maintained through an EU-wide balanced multi-stakeholder agreement process, under the umbrella of the European Committee for Standardization. EN 16234-1 is a key component of the European Digital Agenda for ICT professionalism; it is designed for use by any organization or individual engaged in ICT Human Resource planning and competence development.

1 Scope

This document supports understanding, adoption and use of EN 16234 (all parts) e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors which provides a common reference of 41 ICT professional competences as required and applied in the Information and Communication Technology (ICT) professional work environment, using a common language for competences, skills, knowledge and proficiency levels that can be understood across Europe.

This document supports Information and Communication Technology (ICT) stakeholders dealing with ICT professional competences from multiple perspectives, in particular:

- ICT service, demand and supply organisations;
- ICT professionals, managers and human resource (HR) departments;
- educational institutions, learning program and certification providers of all types including Vocational and Educational Training (VET), Higher Education (HE) and Continuous Professional Development (CPD);
- social partners (trade unions and employer associations);
- professional associations, accreditation, validation and assessment bodies;
- market analysts and policy makers;
- other organisations and stakeholders in public and private sectors across Europe;

to adopt, apply and use the framework in their environment.

2 Normative references

The following documents are referenced in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16234-1:2019, *e-Competence Framework (e-CF) — A common European Framework for ICT Professionals in all sectors - Part 1: Framework*

CEN/TR 16234-3:2021, *e-Competence Framework (e-CF) — A common European Framework for ICT Professionals in all sectors - Part 3: Methodology*

CEN/TR 16234-4:2021, *e-Competence Framework (e-CF) — A common European Framework for ICT Professionals in all sectors - Part 4: Case Studies*

CWA 16458-1:2018, *European ICT Professional Role Profiles — Part 1: 30 ICT profiles*

CWA 16458-2:2018, *European ICT Professional Role Profiles — Part 2: User Guide*

CWA 16458-3:2018, *European ICT Professional Role Profiles — Part 3: Methodology documentation*

CWA 16458-4:2018, *European ICT Professional Role Profiles — Part 4: Case studies*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16234-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Main Principles

4.1 EN 16234-1 (e-CF) scope and target groups

The EN 16234-1 (e-CF) provides a reference of 41 competences as required and applied in the Information and Communication Technology (ICT) professional work environment, using a common language for competences, skills, knowledge and proficiency levels that can be understood across Europe.

The EN 16234-1 (e-CF) was created for application by:

- ICT service, demand and supply organisations;
- ICT professionals, managers and human resource (HR) departments;
- educational institutions, learning program and certification providers of all types including Vocational and Educational Training (VET), Higher Education (HE) and Continuous Professional Development (CPD);
- social partners (trade unions and employer associations);
- professional associations, accreditation, validation and assessment bodies;
- market analysts and policy makers;
- other organisations and stakeholders in public and private sectors across Europe;

to adopt, apply and use the framework in their environment.

4.2 EN 16234-1 (e-CF) a fundamental pillar of ICT professionalism for Europe

The EN 16234-1 (e-CF) provides a common European language for ICT workplace-related competences, skills and proficiency levels as required and applied by organisations and professionals. In this way, all sector stakeholders, including public and private sector and individuals, have access to a shared reference.

In particular, the e-CF supports the articulation, definition and description of:

- jobs, role profiles, recruitment offers and needs and other types of competence specifications;
- training courses, qualifications, certifications and higher education curricula;
- career paths and professional development needs;
- formal and non-formal learning paths;
- competence gaps analysis at the individual, team or organisational level;
- education and training needs at the individual, team or organisational level;
- criteria for competence assessment and market-trend analysis, etc.;
- a shared reference to gather and present ICT professional competence need information, e.g. at national or large corporation level.

The EN 16234-1 (e-CF) and its supporting documents are an integrated component of the four ICT professionalism pillars for Europe. Figure 1 positions this document with regard to the foundations required for the establishment of an ICT European Profession. It illustrates the connectivity between the four key elements; e-competences from the e-CF, education and training, professional ethics and the Body of Knowledge.

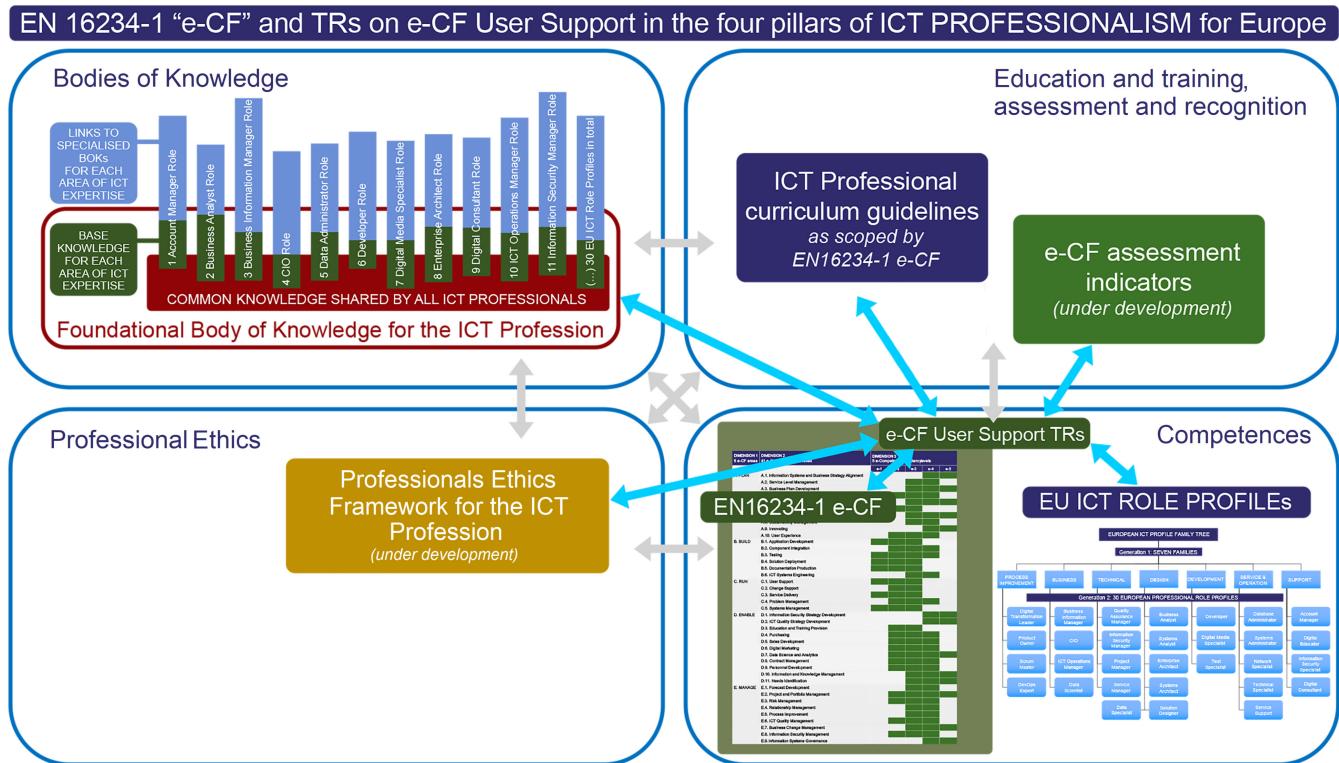


Figure 1 — EN 16234 (e-CF) series an essential pillar of ICT professionalism for Europe

CEN/TC 428 “ICT Professionalism and digital competences” is responsible for all aspects of standardization related to maturing the ICT Profession in all sectors, public and private. It harmonises activity related to the four major building blocks of ICT Professionalism: (1) competences represented by the e-CF (2) education and training, (3) Code of Ethics and (4) Body of Knowledge (BoK).

In the context of CEN/TC 428 continuous work is taking place to support the ICT Profession in Europe with solid references and standards around all four basic pillars of ICT Professionalism. The EN 16234 (e-CF) series is consistently connected in concept and definitions with all the other deliverables published in CEN/TC 428 context (e.g. WI00428010 “European Foundational Body of Knowledge for the ICT Profession”, the “ICT Professional Ethics Framework”), and the CWA 16458 European ICT Professional Role Profiles.

4.3 EN 16234-1 (e-CF) structure, content and application opportunities

4.3.1 EN 16234-1 (e-CF) overview: structure, content

The EN 16234-1 (e-CF) is structured across four dimensions. The dimensions reflect areas of business and human resource planning and incorporate job and work proficiency guidelines specified in the Table 1. EN 16234-1 (e-CF) is complimented by the inclusion of a component, the transversal aspect, that provides basic generic ICT descriptors for enhanced application of e-CF competences in a workplace context.

Table 1 — The EN 16234-1 (e-CF) four dimensions and transversal aspects

Dimension 1: 5 e-Competence areas <i>MAY APPLY</i>	Derived from the ICT macro processes PLAN – BUILD – RUN – ENABLE – MANAGE. The areas provide the entry point to e-Competences and reflect a process perspective based upon a waterfall approach. However, the e-CF is equally relevant to steps applied within agile process structures such as Agile/ DevOps lifecycles.
Dimension 2 41 e-Competences <i>SHALL APPLY</i>	41 e-Competences provide the European standard references for ICT professional competence as required and performed in an ICT work context. Each dimension 2 description contains a competence title and a generic competence description, defined from an organisational perspective.
Dimension 3 5 e-CF proficiency levels <i>SHALL APPLY</i>	5 e-Competence proficiency levels are characterised by increasing levels of context complexity, autonomy, influence and typical behaviour. Relevant proficiency levels are assigned to each competence description. Dimension 3 level descriptors provide individual competence performance indicators.
Dimension 4 knowledge and skills examples <i>MAY APPLY</i>	Examples of knowledge and skills relate to the e-Competence generic descriptions in Dimension 2. Examples are provided to add value to the competence descriptor but are not intended to be exhaustive. They offer inspiration and orientation for the identification of further specific knowledge and skills assignment according to contextual needs.
Transversal aspect components provide basic generic ICT related descriptors for successful application of e-CF competences in the workplace. <i>MAY APPLY</i>	

The four-dimensional structure plus transversal aspects of the EN 16234-1 (e-CF) offer comprehensive insight into the competence requirements of organisations and executed by ICT professionals. The core of the framework is the 41 competence descriptors found at the heart of the structure articulated in dimension 2. This dimension, complemented by the remaining three, provides a common start point for initial understanding of the EN 16234-1 (e-CF).

The 5 e-Competence proficiency levels in dimension 3 are characterised by increasing levels of context complexity, autonomy, influence and typical behaviour. Relevant proficiency levels are assigned to each competence description. The generic e-CF competence level descriptors are provided in Annex A.

Figure 2 illustrates the content of a typical competence, A.2. Service Level Management, it shows how the central dimension 2 provides the competence description and how this can be further articulated in dimension 3, at different proficiency levels 3 and 4 (in this example). Furthermore, examples of knowledge and skills listed in dimension 4, provide complimentary content to the core competence descriptions within dimension 2. Figure 2 provides an example of e-Competence description in all four dimensions.

Dimension 1 e-Comp. area	A. PLAN				
Dimension 2 e-Competence: Title + generic description	A.2. Service Level Management				
Dimension 3 e-Competence proficiency levels e-1 to e-5	Level 1	Level 2	Level 3	Level 4	Level 5
	–	–	Ensures the content of the SLA.	Negotiates revision of SLAs, in accordance with the overall objectives. Ensures the achievement of planned results.	–
Dimension 4 Knowledge examples <i>Knows/ aware of/ familiar with</i>	K1 SLA documentation K2 how to compare and interpret management data K3 elements forming the metrics of service level agreements K4 how service delivery infrastructures work K5 impact of service level non-compliance on business performance				
Skills examples <i>Is able to</i>	S1 analyse service provision records S2 evaluate service provision against SLA S3 negotiate realistic service level targets S4 use relevant quality management techniques S5 anticipate and mitigate against potential service disruptions				

Figure 2 — EN 16234-1 (e-CF) e-Competence example A.2. Service Level Management

The 41 competences defined by EN 16234-1 (e-CF) are constructed in the same way, consisting of 4 dimensions as described previously. Table 2 represents the e-Competence Framework overview, it demonstrates that although the format of each competence is similar, the quantity and level of dimension 3 descriptors vary according to workplace relevance.

Table 2 — EN 16234-1 (e-CF) table overview

DIMENSION 1 5 e-CF areas	DIMENSION 2 41 e-Competences identified	DIMENSION 3 5 e-Competence proficiency levels				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. Information Systems 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. Sustainability Management					
	A.9. Innovating					
	A.10. User Experience					
B. BUILD	B.1. Application Development					
	B.2. Component Integration					
	B.3. Testing					
	B.4. Solution Deployment					
	B.5. Documentation Production					
	B.6. ICT Systems Engineering					
C. RUN	C.1. User Support					
	C.2. Change Support					
	C.3. Service Delivery					
	C.4. Problem Management					
	C.5. Systems 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 Development					
	D.6. Digital Marketing					
	D.7. Data Science and Analytics					
	D.8. Contract Management					
	D.9. Personnel Development					
	D.10. Information and Knowledge Management					
	D.11. Needs Identification					
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. Information Systems Governance					

In addition to the four dimensions, transversal aspects provide basic generic ICT descriptors for successful application of e-CF competences in a workplace context.

Transversal aspects are represented by statements that complement the descriptors of dimension 2. Figure 3 illustrates the seven transversal aspects, which are applied to every competence either from the standpoint of being 'aware of' or 'behaving proactively' with regard to context.



Figure 3 — Transversal Aspects applying across the entire framework

4.3.2 EN 16234-1 (e-CF) alternative view – the conceptual perspective

The EN 16234-1 (e-CF) may be broadly considered from two perspectives, the conceptual viewpoint or the application viewpoint.

The conceptual perspective focuses upon the dimensional construct of the framework and the underpinning definitions of each component which may be used to understand the genesis of the e-CF and the relationships between each of its key elements as illustrated in Figure 4.

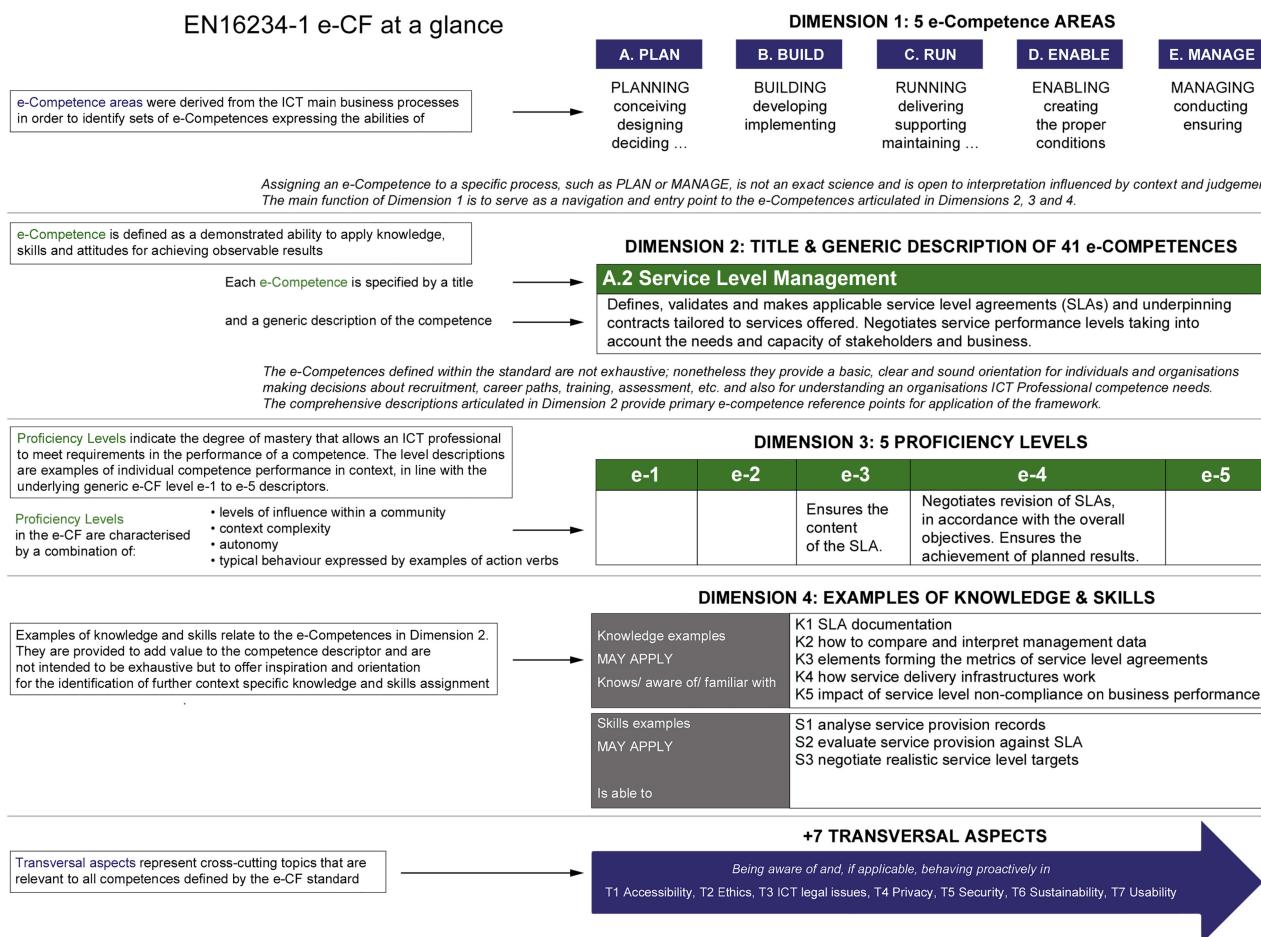


Figure 4 — Conceptual view of the EN 16234-1 (e-CF)

By addressing each dimension of the e-CF users are able to extract clearly articulated statements related to their requirements. For example, one of many possibilities, an HR department may select competence statements from dimension 2 to support the construction of job descriptions.

4.3.3 EN 16234-1 (e-CF) alternative view – the application perspective

An alternative viewpoint to that described in 4.3.2 is the application perspective. This holistic approach addresses the many ways of applying the EN 16234-1 (e-CF) for ICT professional competence development and planning in an ICT organisational or qualification/certification context. Figure 5 provides an illustration of how different process perspectives may be supported by the application of the EN 16234-1 (e-CF).

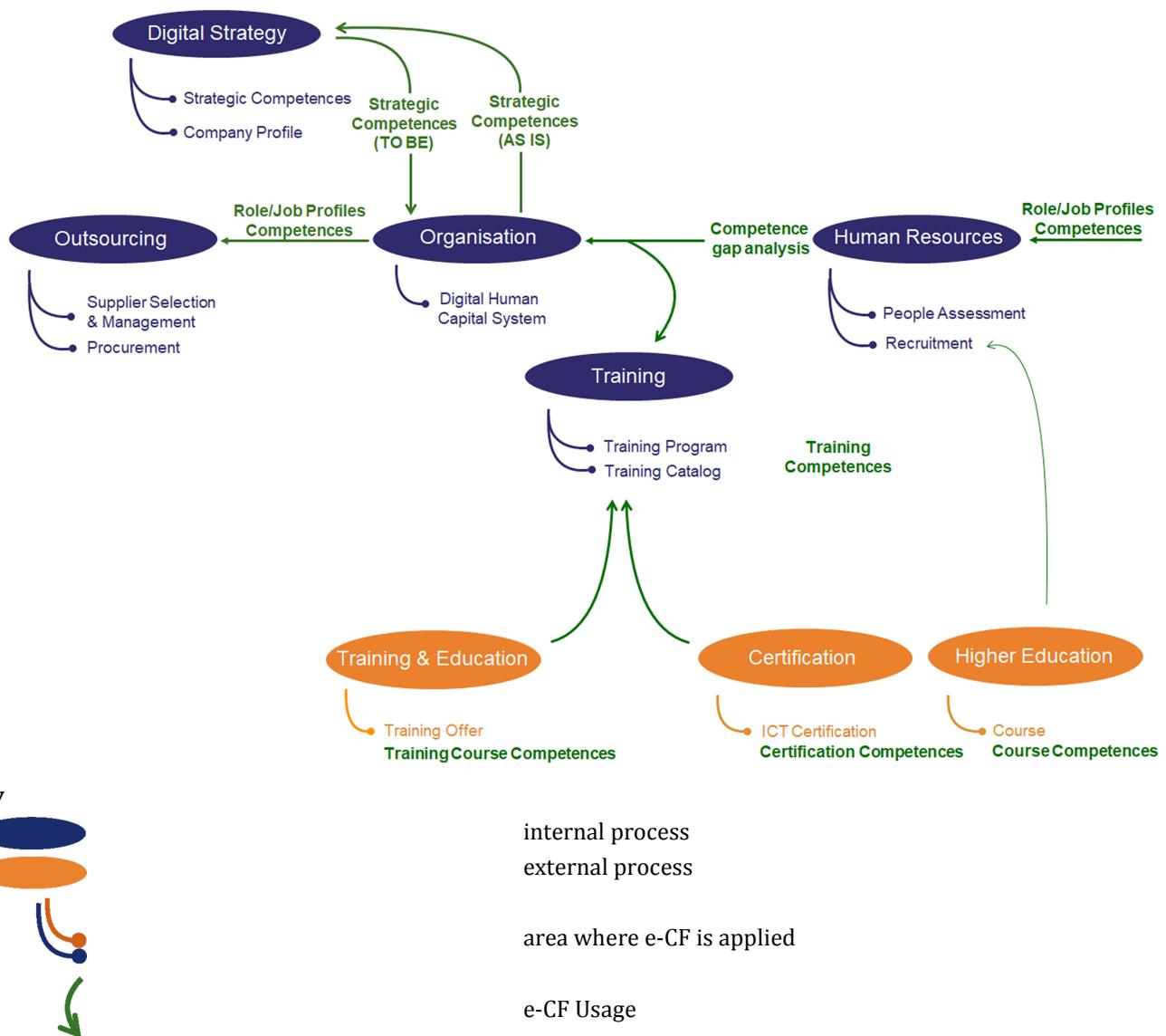


Figure 5 — EN 16234-1 (e-CF) application across processes in the ICT organization

The colour coding identifies the process elements under the control of the organization as opposed to those externally supplied. Dependent upon many factors including the organisations particular sector, its size and mission the scale and degree of process control will vary. However, the use of e-CF common language across all processes regardless, ensures effective process integration.

Figure 6 provides a complementary insight into the qualification/certification related processes revealing the use of the e-CF common language for the implementation of the key education, training, learning, assessment and recognition processes. As in Figure 5, colour coding identifies the internal process elements of the qualification/certification organization as opposed to those externally supplied.

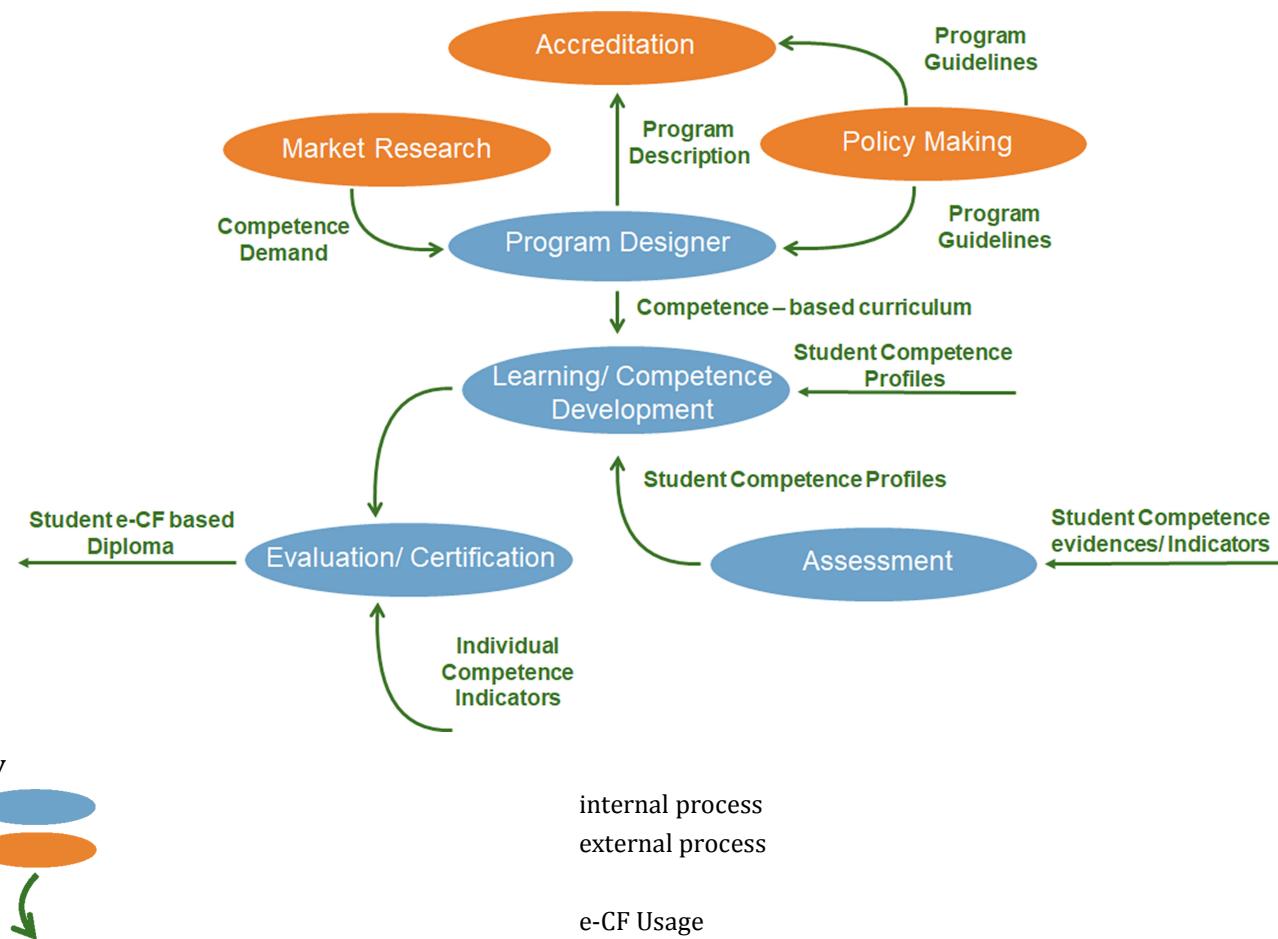


Figure 6 — EN 16234-1 (e-CF) application across processes in the ICT qualification and training environment

4.4 The e-CF as a standard: normative versus informative elements

The European e-Competence Framework (e-CF) is published as a European standard. The e-CF is a flexible tool and it is therefore important to differentiate between elements providing the normative element and informative elements provided for inspiration and optional further elaboration dependent upon application.

- **Dimension 1** structured by five main business processes PLAN – BUILD – RUN – ENABLE – MANAGE provides the entry point to the framework. The main purpose of this dimension is to provide navigation and structured access to the e-Competences articulated in dimension 2. Allocating an e-Competence to a specific e-Competence area is not an exact science. However, for pragmatic orientation and framework use, it is necessary to assign each competence to a logical area of the structure.
- **Dimension 2**, composed of a generic title and comprehensive description, provides the heart of the EN 16234-1 (e-CF) document.
- **Dimension 3**, level assignments, defined by the e-CF level table, provide the second element of the standard's definitions. However, it is necessary to understand that the text associated with each descriptor is derived from stakeholder agreed examples of competence performance. The normative definition of the dimension 3 is provided by the e-CF level table backing each level description.

- **Dimension 4**, knowledge and skills examples are an unstructured element of the framework and are provided as informative elements. Knowledge and skills examples arise from multi-stakeholder and expert views, they are provided to further illustrate, inspire and reflect typical competence content.
- **Transversal aspects** provide foundational elements of ICT professional competence performance. They offer generic references which may be exploited by framework users within a specific context.

Figure 7 illustrates mandatory content versus elements which are recommendations within e-Competence A.2. Service Level Management.

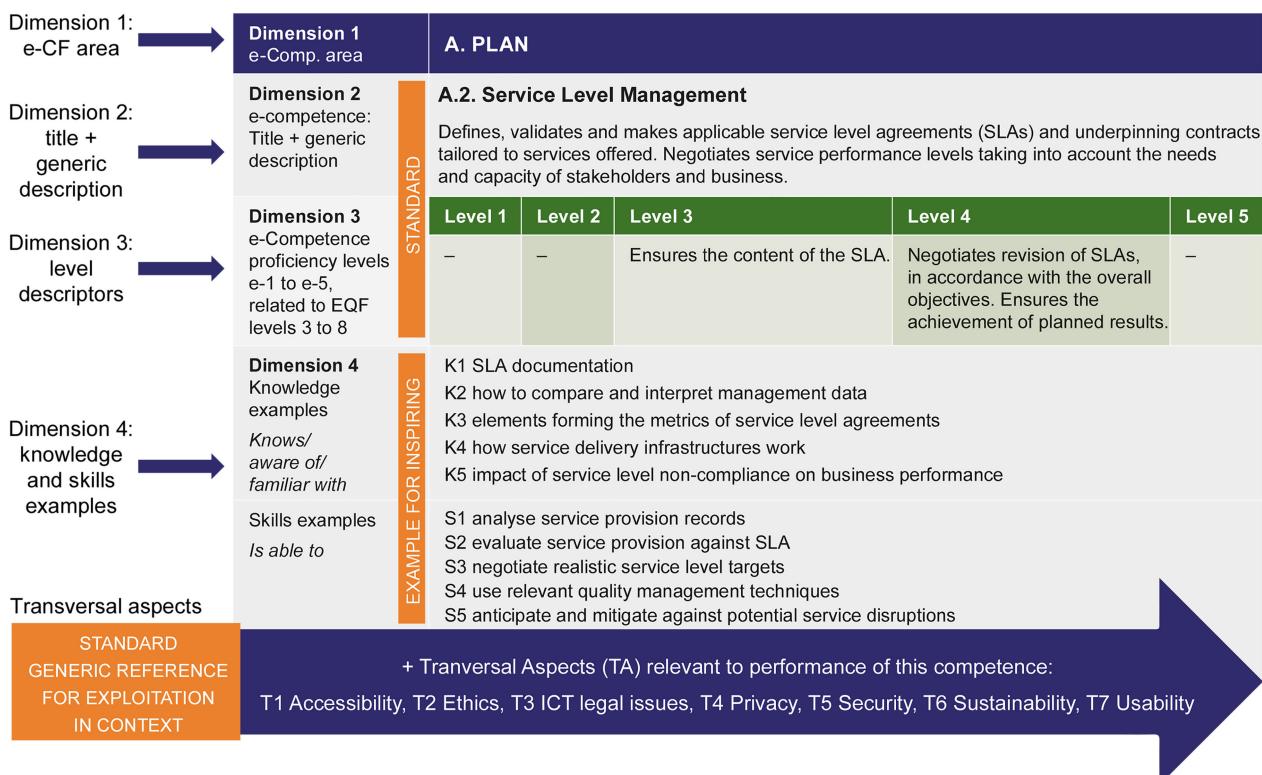


Figure 7 — e-Competence example – standard content versus example elements

4.5 Entry start points for using the EN 16234-1 (e-CF)

4.5.1 General

The e-CF is a valuable tool and standard that, by providing a common competence language, may be used to support multiple stakeholders from many and various backgrounds. Dependent upon context perspective and organisational requirements, the EN 16234-1 (e-CF) can be addressed from different starting points. Some possible potential entry points are described in the following clauses.

4.5.2 Competences

The core of the framework competence descriptions, articulated within dimension 2, provide clear definitions. The comprehensive nature of these descriptions makes them ideal for comparing and analysing commonalities and differences with broadly similar organisational/individual competences. In consequence examining the content of dimension 2 may offer users, with existing job/role structures, a suitable e-CF access point.

4.5.3 Transversal aspects

Transversal aspects are provided by EN 16234-1 as an addendum to dimension 2 competence descriptions. They consist of low granularity, generic statements describing the following essential ICT disciplines:

- T1 Accessibility;
- T2 Ethics;
- T3 ICT Legal Issues;
- T4 Privacy;
- T5 Security;
- T6 Sustainability;
- T7 Usability.

These common elements of ICT competence content can offer a route to link specific user requirements to e-CF content. Because transversal aspects such as security and sustainability are relevant to every organization, they bridge organisational processes with individual employee competences. This dual perspective is a consistent feature of the EN 16234-1 (e-CF) which from the outset was designed to address and link the competence of individuals and organisations.

A possible approach to deploying the EN 16234-1 (e-CF) can be to start from transversal aspects. Although these aspects play a role in every organization and for every employee, they need to be adapted to the context. Responding to the following questions may help in applying the e-CF, using transversal aspects as an entry point:

- What processes connect the organization with each transversal aspect? What depth and relevance of content relates to which process?
- What organisational objectives are associated with respective transversal aspects? Taking into account its culture, customer and employee responsibilities, what are the relative importance and priorities of the organization with regard to the transversal aspects?
- How do the requirements, responsibilities and individual priorities of employees relate to transversal aspects? For example, a Systems Administrator should have a high level of security awareness. In addition to the transversal aspect “T5 Security”, the competence description of E.8. Information Security Management is likely to be relevant. However, for all ICT professionals, a minimum level of security understanding is required. What does this mean in practice for each employee? Should the emphasis, for a particular individual, be awareness or is proactive action expected?

Answers to these questions will amplify an awareness of the culture and capability of the organization on one hand and the actions and competences of the employees on the other. It can also contribute to a higher Maturity Level by improving mutual understanding and enhancing the quality of products and services.

Addressing transversal aspects can also support introduction to other dimensions of the EN 16234-1 (e-CF), in particular competence descriptions in dimension 2, which in turn provide linkage to European ICT Professional Role Profiles (CWA 16458). As transversal aspects are related to each competence and each role, it is necessary to clarify where, in each circumstance, they are meaningfully defined either, from competence descriptions or role profile components. As transversal aspects are common to all organisations and to every ICT professional, wide ranges of capability are applicable which need to be explored to determine organisational and individual competence requirements.

Considering transversal aspects contributes to enhancing professionalisation of the organization and the expertise of ICT professionals. Transversal Aspects offer a comprehensive overview of topics beyond technology and incorporate broader concepts such as business management, legislation and customer support. Reference to transversal aspects, raises awareness and offers the potential to expand the knowledge and skills of ICT professionals beyond technology.

By implementing a comprehensive overhaul of transversal aspects, the effectiveness and professionalism of ICT practitioners can be enhanced, enabling them to take the right decision at the right time.

Further materials related to T2 Ethics will be found in a further Technical Report entitled 'European Professional Ethics Framework for the ICT Profession' (under development in CEN/TC 428). This is a complex, multidisciplinary topic and the framework offers guidance on the many facets that ethics impact ICT professional activities.

4.5.4 CWA 16458 European ICT Professional Role Profiles

The CWA 16458 European ICT Professional Role Profiles provides a generic set of typical roles performed by ICT Professionals in any organization, covering the full ICT business process:

- using the EN 16234-1 (e-CF) as the basis for competence identification;
- illuminating and structuring each ICT Professional Profile with a number of components including work outcomes or "Deliverables".

The CWA 16458 series provides a sound starting point and inspiration for the flexible creation of more context specific profiles, based upon organisational roles or individual job descriptions from a broad variety of contexts.

EN 16234-1 (e-CF) competences are embedded within the European ICT professional profiles which represent 30 typical roles conducted by ICT professionals, covering all ICT disciplines. These profiles describe general roles using a consistent format incorporating the following elements:

- a summary statement;
- a mission statement;
- deliverables;
- main tasks;
- **e-Competences;**
- KPI areas.

By applying EN 16234-1 (e-CF) competences to ICT profile construction, the European ICT Professional Role Profiles also provide a tool and entry point for e-CF application to individuals and organisations who wish to work with the EN 16234-1 (e-CF).

Table 3 provides as example the European ICT Professional Role Profile “Information Security Manager Role”.

Table 3 — EU ICT Professional Role Profile example (11) Information Security Manager Role

Profile title	INFORMATION SECURITY MANAGER ROLE (11)		
Summary statement	Leads and manages the organisation information security policy.		
Mission	Defines the information security strategy and manages implementation across the organisation. Embeds proactive information security protection by assessing, informing, alerting and educating the entire organisation.		
Deliverables	Accountable	Responsible	Contributor
	<ul style="list-style-type: none"> — Information Security Policy 	<ul style="list-style-type: none"> — Knowledge of Information Base — Information Security Strategy 	<ul style="list-style-type: none"> — Risk Management Policy — New Solution and Critical Business Integration Proposal
Main task/s	<ul style="list-style-type: none"> — Define the information security strategy and standards — Contribute to the development of the organisation’s security policy — Manage security audits — Evaluate risks, threats and consequences — Establish and manage prevention, detection, correction and remediation plans — Inform and raise awareness among general management and across all ICT users and professionals — Conduct information security operations 		
e-Competences (from e-CF)	A.7. Technology Trend Monitoring	Level 4	
	D.1. Information Security Strategy Development	Level 5	
	E.3. Risk Management	Level 4	
	E.8. Information Security Management	Level 4	
	E.9. IS Governance	Level 5	
KPI area	Security policy effectiveness		

The consistent connection between the competences of the e-CF and the European ICT Professional Role Profiles offer a further route for accessing the e-CF. Comparing existing organisational roles with the CWA 16458 series may, in turn, enable e-CF users to link them to their own environment.

CWA 16458-2 European ICT Professional Role Profiles – Part 2: User Guide and CWA 16458-4 European ICT Professional Role Profiles - Part 4: Case studies provide pragmatic explanations on how to apply the European ICT Professional Role Profiles from multiple stakeholder perspectives and for a broad range of application purposes, such as, for example, HR planning, recruitment, digital transformation process support, curriculum design and qualifications promotion, including transfer of the concept to other sectors.

4.5.5 Deliverables

The language used in the EN 16234-1 (e-CF) may at first sight be unfamiliar to some e-CF users and present a barrier to entry. To mitigate this perspective, deliverables, as the outputs of competence, in specific situations, can be linked to e-CF defined competences. Simple, deliverable statements help provide additional clarity between workplace activities and the full descriptors of the e-CF.

Deliverables, alongside e-CF competences, are key components of CWA 16458 (ICT Profiles) descriptions. This association offers a common entry point to both concepts, e-CF and European ICT Profiles. By reflecting the output of competence, deliverables offer an insight, dependent upon context, into a more detailed dimension 2 competence descriptor.

The list of deliverables, see Annex B, offer an abbreviation for competence and by addressing a limited, context related, perspective they should not be used as a substitute for the full competence description, however, they provide practical examples of competence in practice. They are offered as examples as they are not exhaustive and do not cover every aspect of the full competence description. Likewise, dimension 4 of the e-CF also offers examples: these are of knowledge and skills.

Deliverables offer linkage to the e-CF from a workplace perspective by relating job requirements to competence, in a similar way, dimension 4, knowledge and skills offer connection to competences from an educational perspective.

In consequence, the process for deploying the e-CF using deliverables is similar to working with e-CF dimension 4 where users from an education perspective link skills and knowledge to a competence description. From a workplace perspective, using deliverables can help users to identify the activities of ICT professionals through recognition of work outputs which in turn link to full dimension 2 competence descriptions.

4.6 Purpose and target groups of this user guide

This document provides guidance on how to apply EN 16234-1 (e-CF) from multiple ICT stakeholder perspectives. It addresses the fact that a European reference set of ICT competence definitions is unlikely to match all organization's or individual's needs in the same way. EN 16234-1 (e-CF) is intended for guidance and is designed to provide a common shared reference tool, which can be implemented, adapted and used in accordance with ICT stakeholder requirements. The following implementation guidance is structured by target groups.

5 e-CF for multiple application across multiple target groups

5.1 Applying the e-CF in the ICT organisation: HR and ICT departments

5.1.1 People are more important than things: The e-CF giving shape to the value and investment in human capital

EN 16234-1 (e-CF) gives shape to the value and investment in human capital. This is illustrated in Figure 8.

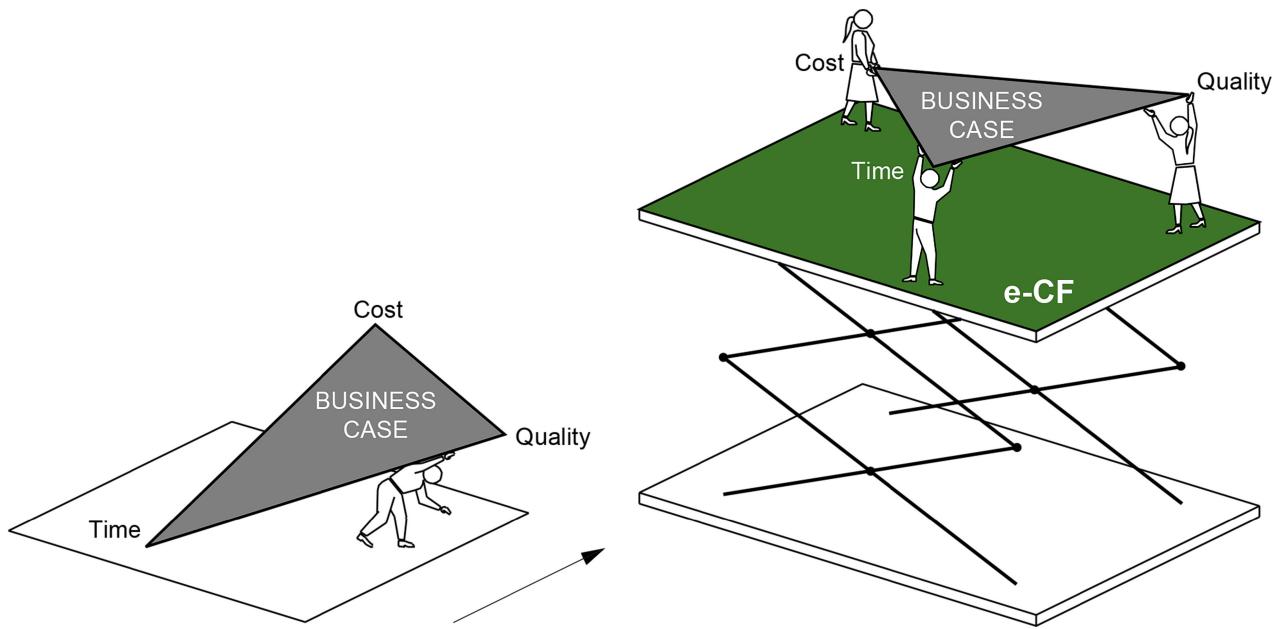


Figure 8 — EN 16234-1 (e-CF) giving shape to the value and investment in human capital

As in any business case, the relationship between time, cost and quality plays a decisive role in the development and use of new technologies. To gain the full positive impact of digital technologies, organisations need to understand the possibilities of these technologies. Understanding, in this case, means that within the organisation the leadership, the business units, and the ICT staff have a common understanding and agreement on the purpose of implementation of new digital initiatives. All need to know why, what and how to develop and use digital technology and to agree on the balance between time, cost and quality. However, there are usually different viewpoints; digital development typically takes time to deliver the required quality, whilst management and business units drive to keep costs under control. Within this background the importance of human capital can be overlooked.

To come to a common understanding in such situations, the e-CF can assist by bringing together the necessary and desired organisational capabilities, these can be identified through the IT-CMF model [11], with the necessary competences of the people engaged in the implementation. The e-CF can help to identify the competences needed, the roles required and the knowledge and skills to be applied. It can also help to understand the gap between the competences available to the organisation and the competences needed. If people within a new digital initiative have the right skills and competences to address the challenges, there is a positive impact upon organisational capability, through effective management of time, cost and quality.

5.1.2 Basic factors for successful implementation

5.1.2.1 A good case: Positive arguments to persuade internal departments: What makes the EN 16234-1 (e-CF) a good investment and a success

- The EN 16234-1 (e-CF) is a standard developed by the European Committee for Standardization (CEN) the public standards agency fostering the economy of the European Union in global trading. In consequence, the EN 16234-1 (e-CF) is a sustainable structure, neutral and independent of commercial interests.
- The e-CF provides a common language for use by multiple stakeholders including ICT organisations, education, central and regional governments and information and communications technology professionals. It provides a universal tool to support understanding and communication of digital competences.

- The breadth of coverage and scope of the EN 16234-1 (e-CF) includes not only technical but also business and process perspectives providing comprehensive coverage relevant to the application of Information and Communication Technology by organisations and individuals from a broad spectrum. To enable common understanding across this universal network the granularity of language provided is appropriate to a wide audience; it avoids technical jargon and uses common English language throughout. The EN 16234-1 (e-CF) has been translated into several European languages and each national standardization body has the structures to publish local language versions if found appropriate.
- Despite the rapid pace of digital disruption and transformation, the e-CF, by focusing upon competence and adopting appropriate granularity of language, is able to provide a stable background to underpin change management. By supporting the understanding of existing capability, the EN 16234-1 (e-CF) provides a base for further innovation.
- Organisations are able to empower themselves to management change, without external support, by clearly articulating the existing competences of their workforce. The required competences can also be identified, and skills gaps managed through training and development, recruitment or sub-contracting.
- Rather than starting with a ‘blank sheet’ the e-CF provides a fast start to skills management by capitalising on the experience of the many contributors to e-CF development whilst retaining the flexibility to customise it to local needs.
- Existing skills/competence management approaches can be benchmarked to access the added value of EN 16234-1 (e-CF) adoption.

5.1.2.2 How to make the EN 16234-1 (e-CF) successful in your organization

Gaining support from many parts of an organization, including senior management, is required to make a success of deploying the e-CF. Gaining support can be helped by sharing the benefits outlined in 5.1.1.

Although tactical use of the EN 16234-1 (e-CF) is possible, it is more likely that the e-CF will form an important component of an organisations wider strategic plan. Consequently, senior management support is essential for successful implementation. This requires concise communication of the anticipated outcomes and strategic benefits of deploying a structured approach to human resource development.

Communication cannot be over emphasized as an essential ingredient in deploying the e-CF. Although a straight-forward structure, it is still necessary to ensure full understanding of the e-CF construct and be able to explain it across all departments. Recognizing that different departments have different perspectives it can be beneficial to present the e-CF as a unifying framework that saves time and effort. Examples of ease of use can be supplied by providing byte sized examples such as a relevant role profile.

It is important to share a common vision of the aims, the tactical plans and the strategic benefits of deploying the e-CF with the entire organization.

5.1.3 Roles and job profile building

The CWA 16458 European ICT Professional Role Profiles offers an alternative perspective and complementary access point for the implementation of the e-CF.

EN 16234-1 (e-CF) provides the ICT professional competence standard and CWA 16458 European Role Profiles provides a tool based upon the e-CF to use this (see 4.5.3 for further details and an example).

CWA 16458, the ICT Profiles, provides useful building blocks for the construction of organisation specific jobs and associated competences. Similar to the e-CF, use of European Profiles offers a fast start to the identification and construction of roles by using a preformatted structure that can be modified to meet local requirements.

See also 4.5.3 and the CWA 16458-2 “User Guide” for details on how to use and construct context specific profiles, e.g. for job and qualification environment.

5.1.4 Support ICT strategy development with personnel and competence planning

Competence management is not an isolated activity, on the contrary, it is an integrated organisational process; within the knowledge economy it is closely linked to the success or failure of the enterprise.

Digital transformation is dependent upon the availability of appropriately skilled personnel at the right place and at the right time. The EN 16234-1 (e-CF), by offering concise competence descriptions, supports the implementation of strategic change and empowers organisations to take control of essential competences and make informed decisions about future recruitment and/or outsourcing policies.

The following outline provides an example of how the e-CF can support strategic development through competence planning.

1. Adopt EN 16234-1 (e-CF) (and CWA 16458 (ICT profiles)) language;
2. Create an organization-based model on competence and profile requirements linked to the business and company strategy;
3. Establish a process to identify competences and profiles within the organization;
4. Identify actions to address identified requirements (training, recruitment);
5. Create a feedback process for continuous review.

5.1.5 Competence gap analysis and identifying training needs

A major application of the EN 16234-1 (e-CF), is to identify gaps between existing and required skills, knowledge and competence either from the organization or individual standpoint. By using the common language of the e-CF it is possible to match requirements with the current state.

A common process adopted to expose gaps is to set up a process of self-assessment where individuals evaluate their own levels of competence. This is obviously prone to variability and inconsistency as it is based upon personal opinion. By deploying the language of the e-CF, self-assessment is often moderated by knowledgeable colleagues or management to improve the quality of results. The use of e-CF levels within dimension 3 are an essential component of competence identification and must be fully understood by all individuals engaged in competence evaluation if useful results are to be obtained.

Equally important is the identification of required competence and associated levels of individuals and the organization. This information will be derived from the organisations strategic plan and departmental tactical requirement.

Aggregated individual results are used to provide the overall organisational picture which is typically facilitated through the use of either in-house or commercially available software, to record and calculate gaps.

Competence gaps can be further analysed to reveal knowledge and skills deficiencies aided by the examples found in dimension 4. Knowledge and skills offer a link between competence and learning outcomes which are often used to identify the content of training and education programs. In this way training pathways can be established to address current skills deficiencies or prepare for a new strategic direction.

Further knowledge and skills elements are to be found within transversal aspects (see 4.5.2) which are related to every competence. They are of value in identifying additional learning requirements that contribute to the professional identity of ICT practitioners.

Furthermore, the WI00428010 European ICT Foundational Body of Knowledge for the ICT Profession (EU ICT BoK) embodies essential knowledge areas and units that support the common and specialized knowledge requirements of ICT professionals.

5.1.6 Personnel/talent development and learning

Although the EN 16234-1 (e-CF), is a valuable tool for supporting organisational change it can also play an important role in individual personal development. Continuous self-development contributes to the career success of many ICT professionals. In a fast-changing technological environment, it is necessary to build on experience and adapt to change and state of the art developments. Using the e-CF and its associated profiles can assist an individual to evaluate competence and explore personal development requirements. Furthermore, the e-CF enables clear articulation of their training and educational requirements which can be communicated to management or educational institutions.

Owing to the specialist nature of ICT roles individuals may have limited insight into alternative disciplines and career path opportunities. European ICT role profiles give this insight into many roles and opens the horizon for possible career path changes into adjacent ICT disciplines.

Focusing upon individual skills development and talent management are essential business processes that contribute to organisational success. People are at the core of any process and they provide the innovation required to flourish in an information economy. Identifying, supporting and monitoring of employee skills and progression can all be facilitated by adopting the e-CF as the shared language of competence.

5.1.7 Recruitment support

Recruitment of new staff is often an uplifting and motivational management task which brings with it many opportunities but equally many challenges. Recruitment is not a science but an art, but it can be enhanced through the application of consistent procedures and practices. A key success factor is knowing what is required of the candidate to fill the vacancy and the EN 16234-1 (e-CF), can play an obvious part in the construction of an ideal profile.

Again, it cannot be stressed enough, access to a clear common language is the answer to good communication. By expressing the vacancy in e-CF terminology the organization can clarify its requirements and the candidate can identify the content of the job prior to interview. This saves time and offers clarity which benefits both parties before and during the interview process.

5.1.8 Enhancement of communication internal and externally

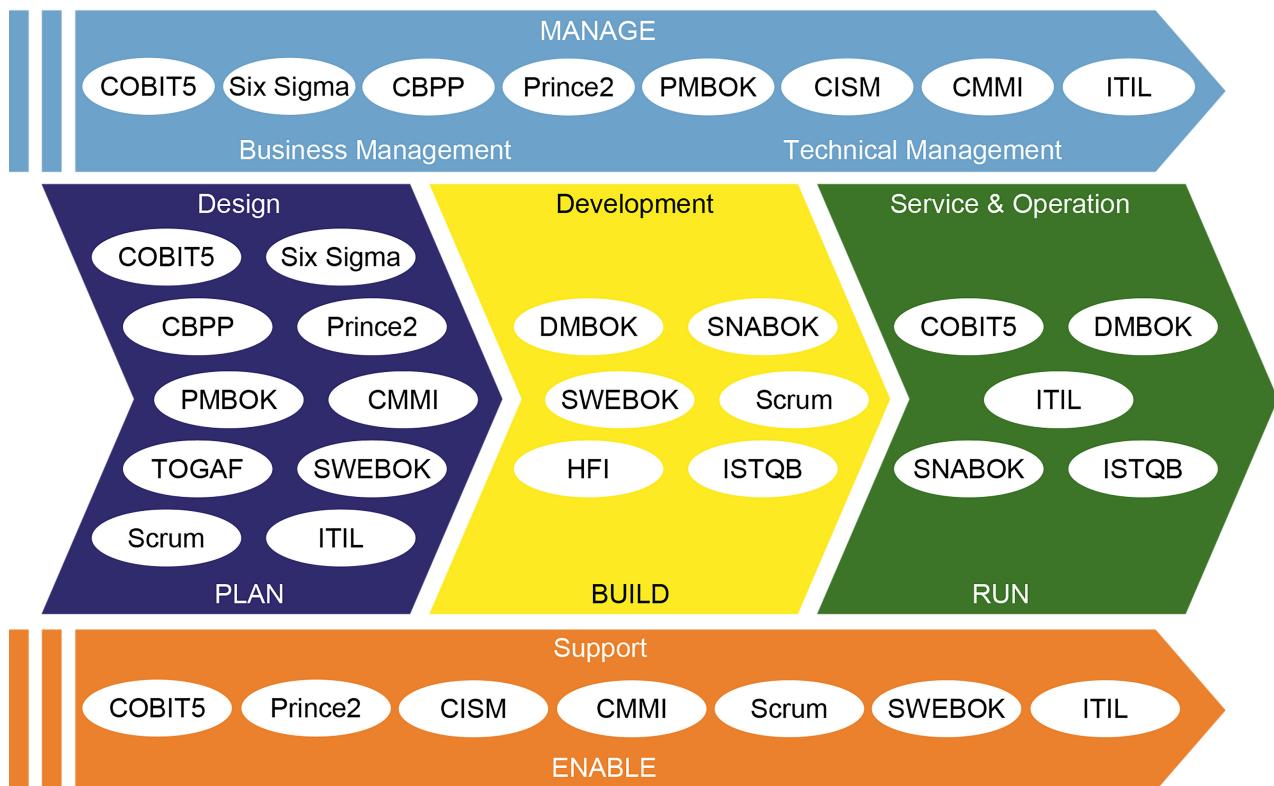
As stated, many times in this document, the EN 16234-1 (e-CF), provides a common language for communicating competence and its components, knowledge, skills and attitude.

This adds value within an organization to support clear understanding of roles, capabilities, responsibilities and continuous development. It enhances interdepartmental discussions and improves common understanding between Human Resources (HR) and ICT departments, and between management and employees.

Of equal value is the benefit obtained from mutual understanding of suppliers, education providers and clients. Not all external organisations will be familiar with the EN 16234-1 (e-CF), but by presenting them with specifications based upon e-CF language, as an example, knowledge and skills needs to a college, the benefits will be apparent. The organization will save time in presentation of the specification and the supplier will be able to arrive at a common understanding of the specification content which on some occasions will be shared with down-stream third parties.

5.1.9 EN 16234-1 (e-CF), related to other ICT frameworks and standards

The EN 16234-1 (e-CF), provides a universal model covering ICT processes at a level of granularity which is generic enough to provide a holistic picture, vision and overview of the entire business but also specific enough to be of practical in-depth usage varying context. Numerous ICT sub-process specific frameworks are available and commonly used in industry and qualification practice. Figure 9 gives a comprehensive overview of more specific ICT frameworks and standards that are commonly used, allocating them across e-CF dimension 1 and the functional areas identified by the CWA 16458 European ICT Professional Role Profiles families.



Source: Digiframe Report 2019 [1]

Figure 9 — e-CF related to other ICT frameworks and standards – a comprehensive overview

5.2 Applying the EN 16234-1 (e-CF) in an education and training context

5.2.1 General

This clause explores the relationship between education and training structures and the EN 16234-1 (European e-Competence Framework). The aim is to demonstrate how to bridge workplace competence and formal education programs using the e-CF as a catalyst. It illustrates how new curriculum can be specified in compliance with the e-CF and how existing curriculum can be related to the e-CF.

When referring to this environment, where the e-CF is applicable, it is relevant to clarify that education programs alone are unlikely to ensure entire coverage and achievement of associated competence. This is because of the breadth of competence descriptions and the requirement to demonstrate practical application of skills and knowledge. Education programs usually have limited exposure to such situations and lack the mechanisms for performance evaluation. This does not mean that competence is excluded from formal learning environments, on the contrary knowledge and skill development is often more suited to an ‘off the job’ environment, but it is of a different nature to that developed in the workplace.

For example, after completion of relevant courses, a student may be able to ‘create and manage a test plan’ which is a typical skill (S1) of competence B.3. However, the competence statement “Constructs and executes systematic test procedures for ICT systems or customer usability requirements to establish compliance with design specifications” is only part of B.3. To meet the entire competence criteria the student would need to be able to demonstrate this skill in an uncontrolled environment where there may be limitations of resources or stakeholder influence and other factors requiring an adaptation to meet circumstances. For pragmatic reasons, these factors may prove difficult to imitate or experience in a classroom environment.

Nevertheless, it is possible and feasible to develop curricula for VET, Continuous Professional Development or Higher Education, based on the e-CF, either as a contribution towards competence development or more comprehensively in a work-based learning program or internship.

5.2.2 Comparing the e-CF to the EQF

In the European Qualification Framework (EQF) [2], the term qualification is understood as the formal outcome (certificate, diploma or title) of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards. A qualification confers official recognition of the value of learning outcomes in the labour market and in education and training.

The EQF is a common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems. Although, EQF criteria are not mandatory they are regularly used by education and training stakeholders. The core of the EQF is the eight reference levels defined in terms of learning outcomes, i.e. knowledge, skills and autonomy-responsibility. Learning outcomes express what individuals know, understand and are able to do at the end of a learning process. This concept has become a basic block for educational and training program descriptions in recent decades. However, it is also common for skills, competences and knowledge descriptions to be used within program descriptions, goals and guidelines, for some programs.

Within the EQF, “knowledge” means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the EQF, knowledge is described as “theoretical and/or factual”.

The EQF defines “skills” as the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

In the context of the EQF, competence is described in terms of “responsibility and autonomy”.

In contrast, the core of the e-CF is based upon competence and competence is defined as a “demonstrated ability to apply knowledge, skills and attitudes for achieving observable results”. The e-CF does not use responsibility as a defining characteristic but uses, influence, complexity, autonomy and behaviour to identify competence proficiency levels. Within the e-CF knowledge and skills are not exhaustively identified but are incorporated as examples only.

5.2.3 Relevance of EN 16234-1 (e-CF) to Vocational Education and Training (VET), Higher Education (HE) and private training providers

5.2.3.1 General

The motivation for connecting qualification contexts to the e-CF are evident from policy strategic priorities and operational frameworks at European and global levels. Education and training systems of the future need to be flexible and prepare individuals for continuous learning throughout life. The target being to reduce skills and knowledge gaps demanded by the labour market. To have a lasting impact on skills mismatch, to the benefit of national economies, requires active collaborative of all stakeholders (Higher Education, VET, private certification and training) with continuous intervention during the employment life cycle.

Despite policy targets and sectoral instruments such as the EQF and the e-CF, education and training stakeholders have different reasons for mapping programs to the e-CF.

5.2.3.2 Vocational Education and Training (VET)

Traditionally the European Union has distinguished between the more formal iVET (initial Vocational Education and Training, mainly formal education within the educational system) and the cVET (continuous VET or life-long learning programs). Although iVET has been the focus of EU attention, coordination at the EU level has lacked the detail provided by structures such as ECVET [3] or EQAVET [4].

This is not surprising given the existence of sophisticated European national systems where the degree of description and regulation of VET programs is very detailed. VET is by nature oriented towards employment and the job market with education providers establishing strong links with employers and using employer language.

VET programs encompass learning outcomes as recommended by CEDEFOP [5] as well as expressions of acquired skills and competence, this terminology offers a direct route to the mapping of e-CF competences.

When referring to VET the degree of structure is often less owing to its flexible and sometimes more informal nature, seeking fast adaptation to meet different circumstances and immediate upskilling/reskilling needs determined by the job market. This environment is similar to that of private training providers (see 5.2.3) from the e-CF mapping perspective.

The benefit of using the e-CF to VET is that their learning programmes are very practical and the e-CF offers many practical handles/descriptions to build curricula/courses upon.

5.2.3.3 Higher Education (HE)

The main motivation of Higher Education (HE) to map programs to the e-CF is to enhance links to the ICT employment and job market. Current higher educational policy strongly promotes linking university programs to employers' needs. This connection enables faster incorporation of graduates into the job market and better employer understanding of job seeking graduate profiles.

Training programmes such as degrees or master programs are strictly regulated by educational authorities specifying organisational, pedagogical and content aspects in a structured and specific format. This facilitates detailed articulation of program content and makes it easier to map to e-CF competences. Recent trends towards expanding content information to include expressions of skills, competences and above all descriptions of learning outcomes, support mapping of higher education programs to e-CF competences.

Higher education qualifications are highly structured and regulated, not only at national but especially at the European level as exemplified by EU schemes emerging from the EHEA (European Higher Education Area) [6]. Within this panorama, EQANIE, the European Quality Assurance Network for Informatics Education [7] promotes the implementation of quality assessment practice for informatics education systems in Europe and beyond. In particular, EQANIE builds confidence in systems of accreditation of informatics degree programmes within Europe. The EQANIE approach addresses organisational and educational aspects and guidelines on required competences recommended for ICT graduates. Those guidelines can be considered as a reference for specific mapping between degrees and e-CF competences (See also Annex C).

In addition, HE is influenced by other sources of skills and recommendations formally described by relevant organisations such as e.g. ACM curricula guidelines [8], SWEBOK (Software Engineering Body of Knowledge [9] or national guidelines of specific countries. The mapping of these sources to e-CF competences can greatly help HE to map their overall programs to e-CF competences. Furthermore, higher education career centres, missioned to support students to enter into employment, can benefit from the e-CF by using it as a connection between education and employment.

Within higher education learning outcomes were introduced as essential building block for quality and transparency in education systems and have driven educational change from the perspective of 'teaching' to 'learning'. Learning outcomes and 'outcomes-based approaches' have significant implications for curriculum design, teaching, learning and assessment, as well as quality assurance. Learning outcomes are important tools clarifying the results of learning for all stakeholders and of the learning process.

Learning outcomes provide a language structure allowing educators and labour market stakeholders to clarify skills needs and appropriate learning provision. If used systematically, this allows consistent review of the quality and relevance of education and training, highlighting differences between intended and actual learning outcomes. The definition of learning outcomes requires systematic assessment of labour market intelligence and how it can be balanced with the requirements of the education and training system.

Figure 10 illustrates a relationship between education and the workplace; learning outcomes derived from knowledge and skills of the EN 16234-1 (e-CF) provide a language to support this continuous process.

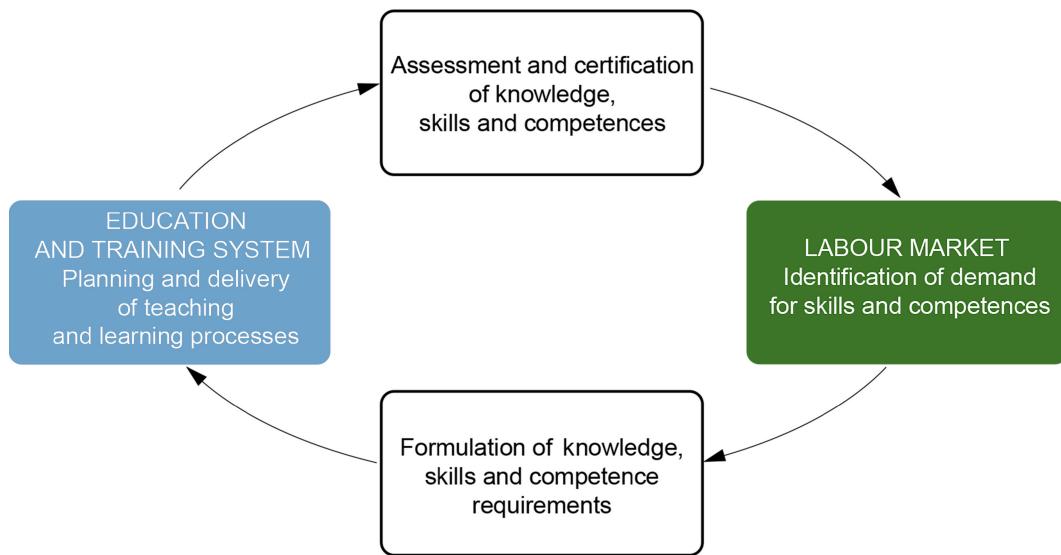


Figure 10 — Educational/training and workplace feedback

Learning outcomes-based language offer an instrument that can be applied systematically to strengthen the relationship between ICT learning programs and e-CF competences, to support existing and inspire new education and training processes. This in turn promotes mutual understanding and communication between industry and education and training systems.

Learning outcomes derived from the EN 16234-1 (e-CF) can be applied in two ways either/or:

- applied to existing learning programs to establish verifiable links to the e-CF specification;
- as guidance for the development of new competence-based learning programs.

Detailed instructions on how to apply the e-CF using learning outcomes for curriculum development are elaborated by WI 00428012 “Guidelines for developing ICT Professional Curricula as scoped by EN 16234-1 (e-CF)”.

5.2.3.4 Private training providers

Private training providers offer flexible provision as facing limited regulation or content restrictions from national or European levels. This provision may be provided in-house or on the open market from commercial training organisations. The structure descriptions of private training courses vary from one program to another and from one provider to another. These training activities are normally flexible in content and are developed within a short lead time to address immediate market needs.

The motivation of training providers to map their programs to the e-CF directly links to their drive to address market needs in a language understandable by their clients. Equally, deploying the e-CF as a tool to identify competence gaps supports the consequent identification of training needs that can be fulfilled by training programs. Employers and private training providers may independently use the EN 16234-1 (e-CF) to identify training requirements and by using e-CF language, find a common way in which to articulate needs and potential training solutions.

Training methodologies and content vary between providers ranging from traditional knowledge-based techniques to hands-on practical experience provision. This fast-moving market, characterised by limited common standards, leads to a lack of homogeneity in content descriptions. Given this variability, mapping to the e-CF provides a consistent reference and language to clarify the content of private training programs.

Additionally, e-CF based training offers a promotional tool to attract customers. As the e-CF represents an internationally recognised standard, ICT professionals participating in such training enlarge their chances in the international job market.

5.2.4 Developing curricula based on the EN 16234-1 (e-CF)

This clause offers an overview and rationale for using the EN 16234-1 (e-CF) at the core of curriculum development. The topic is of such significance to the overall concept of European ICT professionalism, it has been addressed separately within WI 00428012 ‘Guidelines for developing ICT Professional Curricula as scoped by EN 16234-1 (e-CF)’. Complementarily, a WI 00428010 “European Foundational Body of Knowledge for the ICT Profession (ICT BoK)” has been created to provide further insight into the knowledge content of the e-CF. In consequence curriculum designers can benefit from both, the WI00428012 Curriculum Guidelines (Technical Specification) and the WI 00428010 ICT BoK for comprehensive coverage of this topic.

Educational institutions of all types, Higher Education, Vocational Education and Private Training providers are increasingly aiming to prepare students for professional practice. In particular, in the areas of ICT and digitalisation, they are faced with major challenges. ICT as a technology is developing very dynamically and more and more areas and processes are being digitalised. Students must therefore simultaneously acquire broad, solid foundations and in-depth specialist knowledge as well as the skills necessary for their field (e.g. system/software design or project management). At the same time, it is becoming increasingly important to prepare them for the various areas of professional practice, which includes appropriate attitude and responsibilities (e.g. ethics or security awareness) as well as social (e.g. ability for interdisciplinary cooperation or leadership) and individual skills (e.g. reflection capability or self-learning capability). The EN 16234-1 (e-CF) integrates all of these demands and aspects in the e-Competences as applied at the ICT workplace, complemented by 7 Transversal Aspects relevant to ICT professional competence performance. The e-CF can therefore be used to design and develop modern study programmes with new competence-oriented curricula and appropriate learning environments.

However, this is not an easy task as many aspects must be taken into account in order to move from traditional, knowledge-based structures, to contemporary competence-oriented approaches.

The ICT curriculum guidelines specification provides educationalists with documentation to support the design of curricula and learning programs aligned with the e-CF. They include:

- how to design and develop e-Competence-orientated ICT curricula and learning outcomes, including maintenance and evaluation of the curricula and building relationships to industry certifications;
- how to design and develop competence-oriented institutional learning environments, courses and the relationship between learning and teaching, students and teachers/professors/tutors;
- practical, supporting information, such as curricula and learning outcome examples, checklists.

5.2.5 Recognition/validation

Within a qualification context, learning outcomes provide a reference point for mapping to competences and therefore promote recognition and validation of learning. In formal educational settings the recognition of learning outcomes is meant as the process of attesting 'officially achieved' learning outcomes through the award of credits, units or qualifications. However, the validation and recognition process also requires continuous dialogue between intended and actual outcomes. Learning outcomes need to be a 'living thing', continuously reviewed and improved, involving all relevant stakeholders (education, training, the industry and society at large) through the integration of experiential learning and evidence-based approaches. Competences acquired through non-formal and informal activities also need to be recognised and validated as they often represent a significant part of a 'job-seekers' competence portfolio.

EN 16234-1 (e-CF), as a common European framework, allows a shared understanding of the meaning and implications of ICT professional competences, components and proficiency levels. This facilitates the recognition and validation of ICT competences acquired in either formal or non-formal settings. Adoption of e-CF as a common language between education and employability in the ICT sector, and its application for the description of professional profiles and competence-based learning programs, constitutes the basis for the creation of solid schemes for both formal and social recognition and validation.

5.3 EN 16234-1 (e-CF) application by individuals, ICT students and professionals

5.3.1 CV and self-promotion

Individuals, ICT students and professionals may benefit from adding references to e-CF competences in their documents and evidence related to a professional career. Any item referred to in the CV may be directly mapped to the corresponding e-CF competences to provide a reference to the target audience of the document: recruiters, employers, etc. The mapping to the e-CF might be applied to any typical merit or evidence of career achievement such as training courses and qualifications (see 5.2), job experiences documented by deliverables (see Annex B) or testimonial letters of managers and colleagues, or specific diagnostic/assessment of competences through different mechanisms (see 5.3.2).

The ePortfolio is an electronic resource to record personal milestones as e.g. education and/or position or professional activities. It demonstrates personal and professional growth, as it provides evidence for each achieved milestone adding supporting documentation or information.

Linking e-CF to personal ePortfolio would provide the evidence that the individual is looking for to demonstrate that milestones have been reached. The e-CF provides a valuable link to the work experience, as the framework comprises of dimensions, levels and skills/competences for each field related to ICT. e-CF and e-Portfolio linkage will also contribute to describe, recognize and understand competences acquired in another country, as this linkage is based on a "common language".

The following example illustrates how a CV may be connected to the e-CF:

"I worked for company XX as Quality Assurance specialist and tester supporting the system development process YYY from March 2016 to August 2017. My job required the construction and execution of independent systematic test procedures for the system to validate compliance with requirements specification. I was in charge of organisation of test suites and I also needed to develop scripts for automating execution of test cases, especially for stress test and workload check. One relevant deliverable I generated was the test case specification and the corresponding automation scripts. I also had to check that the system documentation and user manual were complete, correct and with appropriate format by integrating all the information and checking compliance and update. This was part of the general system validation both for traditional documents and associated online documentation. My name appears in the system documentation information as reviewer."

According to the analysis of the description which can be evidenced through the deliverables, this individual shows a capacity of practical application of competence B.3 Testing at level 2 and competence B.5 Documentation Production at level 2.

5.3.2 Assessment and recognition of competences

Assessment and recognition of e-competence is made more transparent by the EN 16234-1 (e-CF). The framework provides the basis for a number of different methods that can be applied:

- **Self-assessment:** it is a process of self-analysis of competence by the individual. This may be an effective way of assessment, but it is generally recommended that it is used alongside other assessment methods. Users may have difficulty in objectively linking their skills to the e-CF.
- **Experts' assessment:** experts in the relevant domain can evaluate the competences possessed by an individual considering their ePortfolio, CV and general evidences in conjunction an interview. This supports identification of competences in dimension 2 and corresponding proficiency levels of dimension 3.
- **Practical case study:** case studies or practical exercises, involving different scenarios to be solved by an individual related to a specific competence of dimension 2. This could be facilitated by an interactive online platform.
- **Presentation:** presentation by a candidate given a free choice to select a topic that demonstrates their experience and capability to address problems and provide solutions related to their acquired competences from dimension 2. This method can be extended to incorporate expert questions and answers but obviously this involves additional resources and expenditure.

In support of the identification and assessment of EN 16234-1 (e-CF) competence WI 00428011 “e-Competence Performance Indicators and Common Metrics” discusses this topic and provides examples of how competence may be assessed.

5.4 EN 16234-1 (e-CF) applied in ICT labour market research

5.4.1 A common reference for market observation

Accurate and credible market research about the ICT labour market relies upon access to consistent and well-defined ICT roles and skills. In a fast-changing labour market it is necessary to reference requirements in a language understandable by all interested parties to track changes in supply and demand over time.

The EN 16234-1 (e-CF) and interdependent CWA 16458 European ICT Professional Role Profiles provide the sustainability and commonality required to support accurate observations, using e-CF common language, tracking of ICT skill and role requirements. Historic, current and predicted supply and demand needs, can be consistently monitored.

5.5 EN 16234-1 (e-CF) in policy and digital skills strategy development

5.5.1 Setting digital skills priorities

Europe's digital transformation is accelerating due to rapid advances in new ICT techniques and technologies such as big data, artificial intelligence, robotics, cloud computing and blockchain. Digitisation influences how people live, interact, study and work. The need for more ICT skilled professionals and their lack of availability is a major issue for Europe. Verifiable data highlights that ICT skilled professionals are in high demand, across all industry sectors. Digital skills are essential components of many job roles, highlighting the utmost importance of strategic approaches to the development of professional ICT competence at national and European policy levels.

The two existing complementary reference frameworks for digital skills, the European Digital Competence Framework for citizens DIGCOMP (for digital users) [10] and EN 16234-1 (e-CF) (for ICT professionals), offer valuable strategic planning instruments for enabling and prioritising the development of critical digital skills and e-competences required by citizens in their everyday lives and workers employed in jobs requiring digital competence. This is in addition to ICT professionals deployed to enable change and digital innovation and who are increasingly critical to the productivity and ultimate viability of their organisation. In EN 16234-1:2019 Annex B.4 the complementary and mutually enriching relationship between both frameworks is discussed in more detail.

5.5.2 Procurement processes

Recruitment of ICT professional staff is a specialised purchasing task requiring common understanding of the knowledge, skills and competence of applicants compared to the knowledge, skills and competence requirements of job vacancies. This is obviously made easier by the use of a common ICT competence language applied by applicants, recruitment agencies and employers. The EN 16234-1 (e-CF) supports human matching of ICT professionals to vacant jobs by providing a neutral, up-to-date and recognised standard reference. Furthermore, increased application of artificial intelligence (AI), to this matching task, requires access to curated data to ensure efficacy; the e-CF offers this necessary clean data source.

Beyond recruitment, public and private sectors procure ICT services such as ICT education and training, consultancy in support of professional competence development and ICT management continuous professional development (CPD). Applying the e-CF or the CWA 16458 series to the acquisition of ICT related service requirements provides clarity within the tendering and contracting processes.

5.5.3 EN 16234-1 (e-CF) adoption as an indicator of digital maturity

Digital transformation of an organisation is a pervasive issue requiring in-depth understanding and attention across a wide spectrum of activities including strategy and vision, people and culture, process and governance, and technology and capability.

These complex internal processes and relationships can be described by a digital maturity model to support identification and improvement of processes to achieve an established goal.

In general, maturity models include assessment criteria and methods to evaluate efforts relative to the criteria. The metaphor often used to describe progress is: "you are here". A digital maturity model is a business planning tool that supports an organisation in assessing digital processes against an established standard, it provides a roadmap towards digital transformation achievement.

By knowing where you are today, you are better able to decide where you could be in the future, and how you will get there. Assessing digital maturity helps visualise a pathway towards digital process improvement by defining priorities on route.

Improving digital maturity requires new competences, capabilities and approaches, and strong digital skills embedded in all strategic areas across the organisation to achieve big changes with a completely new set of tools and techniques. Consequently, a key priority of the digital maturity model is having people with the right competences in the right place. For example, planning to achieve the highest levels of e-CF competence for every employee is not generally a useful or desirable goal. It is more effective and efficient to target the right mix of competences, at the appropriate level, in the correct part of the organisation.

In the digital maturity context, a Capability Maturity Framework is a very effective tool for monitoring and driving progress. The e-CF is a valuable tool that can be integrated into the model providing a consistent ICT Competence description language and acting as an indicator for maturity evaluation [1].

Resources which can help with this are the IT Capability Maturity Framework (IT-CMF) which is integrated with e-CF and also the High-Tech skills industry final report which focuses on integrating competence frameworks with a range of ICT related organisational capability maturity frameworks [11].

5.5.4 Implementing EN 16234-1 (e-CF) in European instruments: Europass, Desi, Ovate

5.5.4.1 General

Existing European instruments which support the management and analysis e-competences and skills may benefit from the adoption of e-CF as a reference for their work as it represents a traditional European standard and is relevant to ICT professionals in the workplace.

5.5.4.2 Europass

Europass is a European portal aiming at making people's skills and qualifications clearly and easily understandable across Europe. Europass can be used by citizens looking for a job or recruiters seeking to understand skills and qualifications of candidates and also by educators and training authorities to define curricula content.

Europass works with five main documents:

- Issued by education and training authorities: **Europass, mobility, certificate supplement and diploma supplement**. Mobility is a record of the knowledge and skills acquired in other European countries. Certificate supplement is a document describing the knowledge and skills acquired by holders of vocational training certificates providing additional information to that already included in the official certificate and/or transcript. Diploma supplement is a document describing the knowledge and skills acquired by holders of higher education degrees, providing additional information to that included in the official degrees/diplomas and/or transcript.
- Freely accessible: **curriculum vitae** and **language passport**. Curriculum vitae helps users to present their skills and qualifications effectively and clearly, while language passport is a self-assessment tool for language skills and qualifications which helps users to determine language level.

Considering the above description of Europass modes, the e-CF competences could be linked to Europass in two ways:

- a) Issued by education and training authorities as a certificate or diploma supplement: e-CF is a key option for describing the competences which a student may have developed and shown during an ICT learning program. Applying the common language of the e-CF, these certificates can be more easily understood in all EU countries offering homogeneous interpretation of content.
- b) e-CF directly applied by the user in CV creation. When filling their own CV, users find a section called "personal skills" containing subsections such as "organisation/managerial skills", "job-related skills" and "digital skills". The digital skills section is linked to ICT user skills and offers a fixed format based on DigComp. It would be helpful if Europass offered support (similar to DigComp) to help users record acquired ICT Professional competences as defined by the e-CF.

5.5.4.3 Ovate

The Ovate tool offers detailed information on jobs and skills employers demand as they are expressed in online job vacancies. The tool presents data from tens of millions of online job vacancies, arising from thousands of sources (including private job portals, public employment service portals, recruitment agencies, online newspapers and employer websites) collected from many European countries.

In summary, this tool shows the analysis of information gathered from job vacancies in different ways such as skills required within selected occupations, most requested skills and top 10 occupations where the selected skill is present and skills-sets that are common across different occupations. Skills and occupations are based upon ESCO labour classifications.

The interlink of e-CF and Ovate would be possible if linkage between ESCO skills and the e-CF competences were established (considering the explanation of EN 16234-1:2019, B.3). This would open up an option of applying e-CF language to Ovate skills analysis. In general, refining the linkage between e-CF and ESCO may allow the exploitation of this and other powerful tools developed by the European Union (such as Skills Panorama of CEDEFOP) for the practical implementation of the e-CF.

5.5.4.4 DESI

The Digital Economy and Society Index (DESI) is a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital competitiveness. The "Human Capital, Digital Inclusion and Skills" report covers 'internet user skills' and 'advanced skills and development'. The former draws on the European Commission's Digital Skills Indicator, which is computed based on the number and complexity of activities involving the use of digital devices and/or the internet. Although there is reference to DigComp there are some advanced skills which could be linked to e-CF competences (prior analysis is pending). The latter includes indicators on ICT specialist employment and ICT graduates. Here some segmentation using e-CF competences could be useful for a more precise description of the situation.

5.6 Making combined use of frameworks

5.6.1 Some basics for introduction

This EN 16234-1 (e-CF) addresses generic global digital competences that apply to ICT professionals and organisations. However, there are numerous frameworks available across Europe and globally each created and driven by different motives and designed to address different specific issues. Providing intelligent links between frameworks that are of relevance to each other is a vital component of e-CF principles and philosophy and, if fully understood, it is often the case that frameworks are mutually enriching and supportive.

Looking into existing frameworks was an essential first step when creating the EN 16234-1 (e-CF) structure. Since inception, the e-CF provides systematic relationships with CMMI and ITIL and three national/international ICT professional job and skills frameworks.

- CIGREF nomenclature of job profiles (France),
- SFIA skills for the Information Age (UK),
- The German Advanced IT Training System (AITTS) and VET Professions.

These relationships have been updated and continuously enriched by the creation of interfaces to other relevant frameworks from the digital landscape, or by e-CF initiative or initiated by the framework owners themselves.

5.6.2 e-CF interfaces provided by EN 16234-1:2019, Annex B: EQF, ESCO, DigComp, SFIA, P21, CWA 16458 series, ISO standards

The EN 16234-1 (e-CF) identifies generic global digital competences that apply to ICT professionals and organisations. However, there are numerous frameworks available across Europe and globally each created and driven by different motives and designed to address different specific issues. The disparate nature of these structures is, in most cases, a positive attribute that makes each unique framework fit for its intended purpose. Some frameworks with extensive scope and coverage may converge with the perimeters of others or may at first sight be perceived to cover similar topics. This can be viewed negatively owing to the risk of confusing potential users, however, if fully understood, it is often the case that frameworks are mutually enriching and supportive.

The value that can be leveraged by extracting relevant information from different frameworks is the subject of EN 16234-1:2019 Annex B which devotes 7 clauses to comparing, relating and/or positioning the e-CF to:

- European Qualifications Framework (EQF);
- ESCO, the European Classification for skills, competences and occupations;
- DigComp, the Digital competence Framework for Citizens;
- P21's Framework for 21st Century Learning as an example of making behavioural skills in connection with the e-CF explicit;
- SFIA, Skills for the Information Age;
- CWA 16458 European ICT Professional Role Profiles including update of the latest ICT Profiles version by the EN 16234-1:2019 competences;
- Related ISO standards and standardization initiatives.

Each clause of Annex B highlights the value that can be gained from understanding the different purposes and underpinning principles of each structure. The comparisons that follow are presented in the knowledge that equivalence is subjective and that both differences and similarities have the potential to offer benefits to the users of EN 16234-1 (e-CF).

5.6.3 EN 16234-1 (e-CF) connecting with multiple ICT market standards: DIGIFRAME

Additional to the systematic links outlined above, a recent study on Digital Organisational Frameworks and ICT Professionalism provides a very useful overview of how the e-CF embraces and connects with current ICT industry standards, many of them related to e-CF sub-processes, specific competences, etc. Figure 10 - e-CF as a major umbrella interface to multiple ICT industry standards is provided in 5.1.9.

5.6.4 How to create further framework interfaces: the general approach

The common practice used in describing framework relationships is referred to as mapping whereby elements of one framework are compared to the elements of another, attempting to establish an equivalence of content. This can be useful when there is considerable content overlap and comparisons are required to support integration of results.

Mapping is particularly useful when it has the potential to add detailed content to the e-CF. There are two approaches that can be taken to achieve this outcome:

- On one hand, connections can be established at the ICT-technical level. As ICT professionals deal with ICT technology, they need to take corresponding ISO standards into account. Therefore, dependent upon the relevant e-competence and working environment, standards can underpin and expand competence content (Dimension 2), Knowledge and Skills (Dimension 4) and/or the transversal aspects (see Clause 5 and EN 16234-1:2019, B.8);
- A further possibility is to map results based upon framework structures/process such as dimension 1 of the e-CF. If the framework to be mapped is based on a similar construct, connections can easily be established. This has been achieved for important ICT organisational and management frameworks such as CMMI, Agile/DevOps, TOGRAF, and ITIL, PMBOK (see [1], Annex B and p. 51 ff). In addition, a meta model has been created ("Digital Capability Reference Framework" – "DIGIFRAME") that combines organisational capabilities, individual e-Competences and roles and ICT organisational and management frameworks in an applicable way [1].

However, in other cases, mapping between the e-CF and other frameworks produces more tenuous results or is not possible as the relationships between each of the selected structures are too complex. This is particularly relevant where the framework to be mapped also refers to ICT-skills or qualifications. Typical examples are:

- Qualification and training frameworks (like EQF, National and other Qualification Frameworks);
- ICT/digital related competence/skill frameworks (like DigComp, SFIA);
- Labour market frameworks, especially ESCO.

When relating such frameworks or identifying interfaces between them, their particular aims and purposes (e.g. orientation towards workplace or education or technology or organisational capability), concepts, target groups, perspectives, particular framework underpinning philosophy and principles, become crucial to overall feasibility of the undertaking.

In general, it is relatively easy and straight forward to relate two frameworks with similar philosophy yet different levels of abstraction, e.g. a national qualification framework with the EQF or a company specific competence matrix with the e-CF.

However, relating two frameworks with different underpinning philosophies and principles is complex and produces inconclusive results. This is even more the case when both frameworks are on a high level of abstraction.

5.6.5 How to create further framework interfaces: practical steps

Despite the challenges highlighted in 5.6.4, it is very useful to explore and elaborate specific inter-relationships to reveal the overall orientation and application of different frameworks. The following steps are offered as a practical approach:

- highlight the main differences between philosophy and principles of the two (or more) frameworks;
- define connecting points and interfaces between them (if they exist); and
- explore the opportunities to learn one from the other.

A template has been established to position the e-CF in relation to other frameworks and to identify interfaces. Table 4 serves as a tool for comparison. Annex D gives a practical example of relating the e-CF with EuroInf, the European Quality label providing Accreditation criteria for Informatics Degree programs.

Table 4 — Comparison of principles applied by framework NN and of the EN 16234-1 (e-CF)

Philosophy and principles	EN 16234-1 (e-CF)	Other Framework
Scope	ICT Professionals	(...)
Target groups	<p>Stakeholders dealing with ICT Professional competences from multiple perspectives, in particular:</p> <ul style="list-style-type: none"> — ICT service, demand and supply organisations; — ICT professionals, managers and human resource (HR) departments; — educational institutions, learning program and certification providers of all types including Vocational and Educational Training (VET), Higher Education (HE) and Continuous Professional Development (CPD); — social partners (trade unions and employer associations); — professional associations, accreditation, validation and assessment bodies; — market analysts and policy makers; and — other organisations and stakeholders in public and private sectors across Europe. 	(...)
Aims and purposes	“a common European language for ICT workplace-related competences, skills and proficiency levels as required and applied by professionals of the sector.”	(...)
Basis structure	business processes deal with ICT systems: plan, build, run, enable, manage.	(...)
Understanding of ...		
competence	<p>“Competence is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results”.</p> <p>“This is a holistic concept directly related to workplace activities and incorporating complex human behaviours ...”</p>	(...)
levels	<p>“Five e-Competence proficiency levels [...] focus specifically on “demonstrated abilities” in practical work experiences.”</p> <p>“... levels can be defined through three dimensions:</p> <ol style="list-style-type: none"> 1. Autonomy [...] 2. Context complexity [...] 3. Behaviour here representing an observable outcome ...” 	(...)
(...)	(...)	(...)

Annex A (normative)

e-Competence levels e-1 to e-5 from EN 16234-1 (e-CF)

The 5 e-Competence proficiency levels in EN 16234-1:2019 (e-CF) dimension 3 are characterised by increasing levels of context complexity, autonomy, influence and typical behaviour. Relevant proficiency levels are assigned to each competence description. The generic e-CF competence level descriptors are provided in Table A.1.

Table A.1 — e-Competence levels 1 to 5 from EN 16234-1

Levels	e-CF Level descriptor				Behaviour
		Influence	Complexity	Autonomy	
e-5	Overall accountability and responsibility; recognized inside and outside the organization for innovative solutions and for shaping the future using outstanding leading edge thinking and knowledge.	Determines strategy	Unpredictable – unstructured	Demonstrates substantial leadership and independence in contexts which are novel requiring the solving of issues that involve many interacting factors.	Conceiving, transforming, innovating, finding creative solutions by application of a wide range of technical and/or management principles.
e-4	Extensive scope of responsibilities deploying specialized integration capability in complex environments; full responsibility for strategic development of staff working in unfamiliar and unpredictable situations.	Provides executive leadership		Demonstrates leadership and innovation in unfamiliar, complex and unpredictable environments. Addresses issues involving many interacting factors.	
e-3	Respected for innovative methods and use of initiative in specific technical or business areas; providing leadership and taking responsibility for team performances and development in unpredictable environments.	Consults	Structured – unpredictable	Works independently to resolve interactive problems and addresses complex issues. Has a positive effect on team performance.	Planning, making decisions, supervising, building teams, forming people, reviewing performances, finding creative solutions by application of specific technical or business knowledge / skills.
e-2	Operates with capability and independence in specified boundaries and may supervise others in this environment; conceptual and abstract model building using creative thinking; uses theoretical knowledge and practical skills to solve complex problems within a predictable and sometimes unpredictable context.	Applies and adapts	Structured – predictable	Works under general guidance in an environment where unpredictable change occurs. Independently resolves interactive issues which arise from project activities.	Designing, managing, surveying, monitoring, evaluating, improving, finding non standard solutions. Scheduling, organizing, integrating, finding standard solutions, interacting, communicating, working in team.
e-1	Able to apply knowledge and skills to solve straight forward problems; responsible for own actions; operating in a stable environment.	Implements instructions		Demonstrates limited independence where contexts are generally stable with few variable factors.	Applying, adapting, developing, deploying, maintaining, repairing, finding basic-simple solutions.

Annex B (informative)

Examples of deliverables related to e-CF competences

The list of deliverables provided in this Annex offer an abbreviation for competence and by addressing a limited, context related, perspective they should not be used as a substitute for the full competence description, however, they provide practical examples of competence in practice. They are offered as examples as they are not exhaustive and do not cover every aspect of the full competence description. Likewise, dimension 4 of the e-CF also offers examples: these are of knowledge and skills.

Depending on complexity and size of a competences, at least 1, maximum 3 examples of deliverables are provided per competence.

Table B.1 provides examples of deliverables related to e-Competences.

Table B.1 — Examples of deliverables related to e-CF competences

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
A.1 Information Systems and Business Strategy Alignment	Business Requirements	A description of what a business needs so that it can operate successfully.
	ICT Department & Budget	The organisation, processes, human resources, infrastructure and budget needed to implement IS Strategy.
A.2 Service Level Management	Service Level Agreement	A service level agreement (SLA) is a contract between a service provider (either internal or external) and the end user that defines the level of service expected from the service provider.
A.3 Business Plan Development	Business Case (Lightweight Business Case)	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.
	Business Plan (Strategic Themes)	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.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
A.4 Product/ Service Planning	Budget Plan	A description of the amount of money spent on an organisation's Information Technology systems and services, including compensation for ICT professionals and expenses related to the construction and maintenance of enterprise-wide systems and services.
	Product or Service Description	A set of Documents which describe the Product or Service to be developed/planed/delivered/maintained.
A.5 Architecture Design	Enterprise Architecture	An ICT plan which applies architecture principles and practices to guide organizations through the business, information, process, and technology changes necessary to execute their strategies.
A.6 Application Design	Solution Specification	A set of Documents which define in detail the Solution to be developed.
	Team Backlog	A set of user and enabler stories that originate from the Program Backlog, as well as stories that arise locally from the team's specific context. It can contain other work items as well, representing all the things a team needs to do to advance their portion of the system.
A.7 Technology Trend Monitoring	Solution based on emerging technologies	A solution based on new technologies that takes advantage of its features to innovate or improve business.
	New technology integration proposal	A document which illustrates possible goals, benefits and strategy for integrating new technologies in products, solutions, services or own business processes.
A.8 Sustainability Management	Sustainable Policy	An IT Policy built on the principles of Green IT – reducing the environmental impact of IT products and infrastructure adding aspects of social responsibility such as working environment and socially responsible manufacturing of IT products.
A.9 Innovating	Proof of concept	A demonstration, the purpose of which is to verify that certain concepts or theories have the potential for real-world application. POC is therefore a prototype that is designed to determine feasibility.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
	Product innovation plan	A Plan that involves the idea generation and opportunity recognition needed to take advantage of market opportunities to introduce a new business, product or service. Any type of business, product or service may be used.
A.10 User Experience	User Experience Design	A set of product specifications to enhance user satisfaction by improving the usability, accessibility, and pleasure provided in the interaction with the product. User experience design encompasses traditional human-computer interaction design, and extends it by addressing all aspects of a product or service as perceived by users.
B.1 Application Development	Software/Hardware Component	A Software/Hardware module that encapsulates a set of related functions (or data).
	SW Design Description	A description which shows how the software system will be structured to satisfy the requirements. It is the primary reference for code development and, therefore, it must contain all the information required by a programmer to write code.
	Documented Code	Self-documenting code is ostensibly written using human-readable names, typically consisting of a phrase in a human language which reflects the symbol's meaning. The code must also have a clear and clean structure so that a human reader can easily understand the algorithm used.
B.2 Component Integration	Integrated Solution	A solution in which all components and sub-systems are integrated and tested.
B.3 Testing	Test Procedure	A set of tests which addresses homogeneous/ similar solution areas.
	Test Plan	A document describing the scope, approach, resources and schedule of intended test activities.
	Validated Solution	A solution at the end of Test and Validation Phase.
B.4 Solution Deployment	Release	A result of activities including Solution verification and validation, documentation and supporting activities to make a solution available.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
	Release Plan	A plan of activities including solution verification and validation, documentation, and supporting activities to make a solution available.
B.5 Documentation Production	Solution Documentation	A set of documents which illustrate all aspects related to the Solution.
B.6 ICT Systems Engineering	Digital Infrastructure (Systems, Network, Cloud etc.)	The whole of network, compute, and storage functions required for the successful delivery of applications and services in all-IP connected economy.
C.1 User Support	First Level Support	A service to support customers to identify system, network and application problems and advising on the solution; where required activate 2nd and 3rd level for specialist support.
C.2 Change Support	RFC (Request for Change)	A formal proposal for a change to be made including details of the proposed change.
	Up-to-date Solution	An updated Solution during the Maintenance Phase.
C.3 Service Delivery	Service Catalogue Information	A service catalogue information includes ordering and requesting processes/prices/deliverables/contract points.
	Solution in Operation	A solution deployed and running in the actual operational environment.
	Capacity Plan	A plan to manage the resources required to deliver IT services that describes the current and historic usage of IT services and components, and any issues that need to be addressed. The plan also contains scenarios for different predictions of business demand and costed options to deliver the agreed service level targets.
C.4 Problem Management	Solved Incident	An incident at the stage where a Solution to address the problem has been applied.
	Escalation Process	A process which defines what to do, in terms of, for example, who to inform and what will then happen, when a problem reaches a defined level of difficulty or scale.
C.5 Systems Management	System/Network Configuration	The settings or the hardware-software arrangement and how each device and software or process interact with each other based on System/Network settings created automatically by the system or defined by the user.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
	Monitoring Report	A regularly created document that provides information about the status of the monitored IT services and the necessary systems.
D.1 Information Security Strategy Development	Information Security Risk Assessment	An identification, monitoring and analysis of vulnerabilities and data privacy issues and how to manage them; an effective plan of prioritized solutions based on specific goals, schedule and budget.
	Information Security Policy	A set of principles/rules to guide decisions and achieve optimal outcome(s) in Information Security.
	Information Security Strategy	A description of the goals and strategy for Information Security policies, activities and processes.
D.2 ICT Quality Strategy Development	QMS (Quality Management System)	A set of policies, processes and procedures required for planning and execution in the core business area of an organization (i.e. areas that can impact the organization's ability to meet customer requirements).
	ICT Quality Policy	A set of principles/rules to guide decisions to achieve optimal IT outcome(s) in term of quality.
D.3 Education and Training Provision	Training Program	A program for the acquisition of knowledge, skills, and competences.
	Training Policy	A set of principles/rules to guide decisions and achieve optimal outcome(s) in ICT training.
D.4 Purchasing	Order	A stated intention to engage in a commercial transaction for specific products or services.
	Procurement Process	The way a company goes about making necessary purchases of materials and services to facilitate its continued operation. It involves the specific identification of those needs, a detailed examination of options, and all successive steps necessary to find and obtain required goods and services.
D.5 Sales Development	Technical Proposal	A document that defines the technical requirements of a project, and explains the plan formulated to address them.
	Sales Plan	A strategy that sets out sales targets and tactics for your business, and identifies the steps you will take to meet your targets.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
	Sales Strategy	Planned approach to account-management policy formation, prospect identification and qualification, sales presentation, and order generation aimed at achieving a firm's sales quotas or targets.
D.6 Digital Marketing	Digital marketing plan	A document sharing the details for all the planning for your digital marketing campaigns or actions.
D.7 Data Science and Analytics	Data Selection	The result of the process of determining the appropriate data type and source, as well as suitable instruments to collect data.
	Data Collection and Representation	The result of a process where specific, structured information are gathered in a systematic fashion, subsequently enabling data analysis to be performed on resulting information.
	Data Analytics	A method of Data, Information and Knowledge management which use data aggregation and data mining to provide insight into the past and answer: "What has happened?" This take the form of reports, dashboards, etc.
D.8 Contract Management	Contract	An agreement between two or more parties to perform a service, provide a product or commit to an act and is enforceable by law.
D.9 Personnel Development	Competence Assessment	A Process for measuring people competence.
	Training Course	An event with the aim of the acquisition of knowledge, skills, and competences.
	HR Development Plan	A systematic process of matching the interests, skills and talents of employees/staff/personnel with organisational goals.
D.10 Information and Knowledge	Knowledge Information Base or Data Model	An organized repository of knowledge consisting of concepts, data, objectives, requirements, rules, and specifications.
	Data Management Plan	A description of data and relations in terms of dependency, consistency and integrity.
		A plan by which the required data is acquired, validated, stored, protected, and processed and by which its accessibility, reliability and timeliness is ensured to satisfy the needs of the data users.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
D.11 Needs Identification	Solution Requirements	A software requirements specification is a description of a software system to be developed. It lays out functional and non-functional requirements, and may include a set of use cases that describe user interactions that the software must provide.
	Non Functional Requirements	A description of attributes such as security, reliability, maintainability, scalability and usability which are not core to the specific function but necessary for effective software.
	Program Backlog	A prioritized list of features that have been analysed and are intended to address user needs and deliver business benefits for a single Agile Release Train (ART).
E.1 Forecast Development	Production Forecast	A projection of achievable/likely production volumes, based on market needs, historical sales data and current production capacity.
E.2 Project and Portfolio Management	Project Plan	A formal, approved document used to guide both project execution and project control.
	Project Portfolio	A formal approved document for analysing and collectively managing a group of current or proposed projects.
E.3 Risk Management	Risk Management Plan	A formal document that describes how to deal with specific risks and what risk managing actions can be taken in order to mitigate or remove threats.
	Risk Management Policy	A set of principles/rules to guide decisions and achieve optimal outcome(s) in Risk Management.
E.4 Relationship Management	Business Relationship	A relationship established to provide business services.
	Communication plan	A road map for getting your message delivered to your audience. It's an essential tool for ensuring your organization sends a clear, specific message with measurable results.
E.5 Process Improvement	Business Process Definition	A formal definition and description of related, structured activities that will accomplish a specific organizational goal.
	Process KPI	A Process Key Performance Indicator is a measurable value that demonstrates how effectively a process objective is achieved.

COMPETENCE	DELIVERABLE	DELIVERABLE DESCRIPTION
E.6 ICT Quality Management	ICT Audit Report	An examination and evaluation of an organization's information technology infrastructure, policies and operations. The evaluation of obtained evidence determines if the information systems are safeguarding assets, maintaining data integrity, and operating effectively to achieve the organization's goals or objectives.
	Quality Performance Indicators	A set of indicators measuring how quality policy is implemented on IS projects and ICT solutions in operation.
	Quality Plan	A definition of the activities which will deliver solutions achieving customer's quality expectations on the basis of the quality standards.
E.7 Business Change Management	Change Management Plan	A plan which addresses the impact of change to an organization, easing the transition.
	Digital Transformation Roadmap	A sophisticated project plan that details durations and dependencies of all the initiatives in the Digital Transformation. The roadmap also provides checkpoints for assessing the progress and success of the Digital Transformation down the road.
E.8 Information Security Management	Data Protection Policy	A set of principles or rules to guide decisions and achieve optimal outcome(s) in Data protection.
	Security Assessment	An explicit study to locate IT security vulnerabilities and risks.
E.9 Information Systems Governance	ICT Governance Policy	A principle or rule to guide decisions and achieve optimal outcome(s) in ICT Governance policy.

Annex C (informative)

Creating further framework interfaces: Example EN 16234-1 (e-CF) and Euro-Inf

5.6.4 of this document and CEN/TR 16234-3:2021, 7.1 provide guidance and methodology principles from a more generic viewpoint on how to create interfaces between the EN 16234-1 (e-CF) and other frameworks of interest to the sector. In this clause, another relationship is elaborated as an illustrative example between e-CF and Euro-Inf, supplementary to the informative Annex B of the EN 16234-1:2019 (e-CF).

EQANIE [7] promotes the implementation of quality assessment practice for informatics education systems in Europe and beyond. In particular, EQANIE builds confidence in systems of accreditation of informatics degree programmes within Europe. The EQANIE approach addresses organisational and educational aspects and guidelines on required competences recommended for IT graduates. Those guidelines can be considered as a reference for specific mapping between degrees and e-CF competences.

The e-CF is based on competence defined as demonstrated ability to apply knowledge, skills and attitudes for achieving observable results. Within the e-CF, knowledge and skills are identified as examples only.

In view of the definitions provided in EN 16234-1:2019, Annex B, and taking into account the nature of the EQANIE Programme Outcomes for Informatics Degrees documented for each category, the following inferences/mapping can be observed:

1. The “Underlying Conceptual Basis for Informatics” category is related to knowledge aspects and scientific principles required to support skills and competence development at the corresponding level of studies. Therefore, it is not used as a mapping source to explicit e-CF constituents.
2. The “Analysis” category can be related to specific e-CF PLAN competences, especially those defining lower proficiency levels (Level 1 - Level 3) e.g. the A.6. Application Design competence. This is due to the fact that HEI Programmes of study are not expected to provide higher level professional experience and expertise usually acquired within employment practice.
3. The “Design and Implementation” category relates to most competences in the e-CF BUILD area of competences, most of them involving lower proficiency levels, corresponding to intended first and second cycle degree programmes learning outcomes defined by Euro-Inf.
4. The “Economic, legal, social, ethical and environmental context” category directly corresponds to the e-CF transversal aspects T1 Accessibility, T2 Ethics, T3 ICT Legal issues, T4 Privacy, T5 Security, T6 Sustainability, and T7 Usability.
5. The “Informatics Practice” category relates to competences of the RUN and ENABLE areas, e.g. E.2. Project and Portfolio Management and E.3. Risk Management.
6. The “Other Professional Competences” category addresses important soft skills, necessary for personal and career development e.g. communication, self-organization, demonstration of initiative, responsibility, teamwork, leadership, self-learning, etc.

EQANIE defines Programme Outcomes for Business Informatics Degrees, which can be mapped to the e-CF accordingly.

The development of the programme learning outcomes has been informed by the report 'A Framework for Qualifications of the European Higher Education Area' agreed by the Ministerial Conference in Bergen in May 2005, and by the Dublin Descriptors referred to therein. Furthermore, it has been informed by the European Qualifications Framework for lifelong learning proposed by the European Commission for a Recommendation of the European Parliament and of the Council.

As stated in Euro-Inf, "*it is planned that additional sets of intended learning outcomes for informatics-related subject areas will be added*". On this basis, it could be proposed that the Euro-Inf specification is enriched with explicit e-CF competences, which would lead to shaping a more tangible connection and strengthening of the qualification context and ICT professionalism in Europe.

The EQANIE Programme Outcomes can be described as quality standards for knowledge, skills and competences that graduates of an accredited course should have achieved as the educational base for practising their profession or for post-graduate studies. They will vary in extent and intensity in accordance with the differing objectives of First and Second Cycle degree (FCD and SCD) programmes. The EQANIE categories are the following:

- Underlying Conceptual Basis for Informatics;
- Analysis;
- Design and Implementation;
- Economic, Legal, Social, Ethical and Environmental context;
- Informatics Practice;
- Other Professional Competences.

The first category "Underlying Conceptual Basis for Informatics" therefore identifies capabilities that are essential to satisfying the other programme outcomes, independently from the specific informatics specialization and application context. "Analysis" involves the application of informatics concepts and tools to the analysis of both problems and their solutions, while "Design and Implementation" involves the creation and development of an economically viable product, process or system to meet a defined need. These involve significant technical and intellectual challenges and can be used to integrate informatics knowledge and skills to the solution of real and complex problems. Computing activity can have impacts on individuals, on commerce, on society and on the environment. The "Economic, legal, social, ethical and environmental context" category identifies the skills that graduates need to manage their activities and to be aware of the various legal and ethical constraints under which they are expected to operate, including an understanding of the need for a high level of professional and ethical conduct in relation to activities in informatics and a knowledge of professional codes of conduct. "Informatics practice" identifies the practical capabilities that graduates should have demonstrated through the application of informatics skills in a variety of situations. They should have demonstrated that they have an understanding of the contexts in which informatics knowledge can be applied (e.g. development and application of hardware and software, operation and management of informatics systems, etc.).

The EN 16234-1 (e-CF) is structured across four dimensions. The dimensions reflect areas of business and human resource planning and incorporate job and work proficiency guidelines specified as follows. Complementary, the EN 16234-1 (e-CF) incorporates a transversal component which provides basic generic ICT descriptors for successful application of e-CF competences in a workplace context.

Table C.1 serves as a tool for revealing relationships between the two frameworks and guide an initial mapping process and conclusions for their potential complementary functioning.

Table C.1 — Comparison of principles applied by e-CF and Euro-Inf/ EQANIE

Philosophy and principles	e-CF	Euro-Inf
Scope	ICT professionals	Quality of Higher Education Informatics Qualifications
Target groups	<p>Stakeholders dealing with ICT professional competences from multiple perspectives, in particular:</p> <ul style="list-style-type: none"> — ICT service, demand and supply organisations; — ICT professionals, managers and human resource (HR) departments; — educational institutions, learning program and certification providers of all types including Vocational and Educational Training (VET), Higher Education (HE) and Continuous Professional Development (CPD); — social partners (trade unions and employer associations); — professional associations, accreditation, validation and assessment bodies; — market analysts and policy makers; and — other organisations and stakeholders in public and private sectors across Europe. 	<p>Stakeholders dealing with Informatics Higher Education from multiple perspectives, in particular:</p> <ul style="list-style-type: none"> — higher education institutions; — students and graduates; — accreditation agencies, validation and assessment bodies; — ICT professionals, managers and human resource (HR) departments; — policy makers; — other organizations and stakeholders in public and private sectors across Europe.
Aims and purposes	"a common European language for ICT workplace-related competences, skills and proficiency levels as required and applied by professionals of the sector."	"a broad common denominator, or overarching reference point, for the variety of informatics degree programmes... All graduates of degree programmes assessed against the Euro-Inf Standards are expected to achieve the programme learning outcomes stated therein."

Basis structure	Business processes deal with ICT systems: plan, build, run, enable, manage.	<ul style="list-style-type: none"> — Generic criteria for Programme Assessment and Accreditation — Programme outcomes for accreditation: <ul style="list-style-type: none"> — underlying conceptual basis for Informatics; — analysis; — design and implementation, — economic, legal, social, ethical and environmental context; — Informatics practice; — other professional competences.
Understanding of ...		
competence (professional context) and outcomes (educational context)	<p>“Competence is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results”.</p> <p>“This is a holistic concept directly related to workplace activities and incorporating complex human behaviours...”</p>	<p>“Programme Outcomes can be described as quality standards for knowledge, skills and competences that graduates of an accredited course should have achieved as the educational base for practising their profession or for post-graduate studies. They will vary in extent and intensity in accordance with the differing objectives of First and Second Cycle degree (FCD and SCD) programmes”.</p> <p>“The intended learning outcomes for the programme are easily accessible to the relevant stakeholders...”</p> <p>“The needs of relevant stakeholders (such as students, potential employers, graduates, informatics societies, etc.) have been explicitly identified and are taken into account. Graduates have clear labour market prospects”.</p>

levels	<p>"Five e-Competence proficiency levels [...] focus specifically on "demonstrated abilities" in practical work experiences."</p> <p>"... levels can be defined through three dimensions:</p> <ol style="list-style-type: none">1. Autonomy [...]2. Context complexity [...]3. Behaviour here representing an observable outcome...".	<p>Two Programme levels:</p> <ul style="list-style-type: none">— First Cycle graduates should be able to formalize and specify real-world problems whose solution involves the use of informatics,— Second Cycle graduates are, in addition, expected to have demonstrated their ability to specify and complete informatics tasks that are complex, incompletely defined or unfamiliar. <p>Terminology used for outcomes: awareness, complex.</p>
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Annex D

(informative)

Overview of CEN/TR 16234-4 - Case Studies illustrating e-CF usage in practice

EN 16234-1 (e-CF) and related concepts provide a shared European language for ICT professional development for all stakeholders and from multiple ICT sector perspectives. The list of EN 16234-1 (e-CF) case studies provided by Table D.1 (available in CEN/TR 16234-4:2021), offers a broad insight into a variety of perspectives and practical applications.

Table D.1 — Overview of e-CF case studies provided by CEN/TR 16234-4 “e-Competence Framework (e-CF) - A common European Framework for ICT professionals in all sectors – Part 4: Case Studies”

Case Study	Case study title and source	e-CF usage	Key perspectives
A 5.1	Skill-UP: Please, mind the gap - e-CF and ICT Professional Role Profile Mapping to accelerate company transformation. <i>Nexi Payments S.p.A./Mercury Payments S.p.A.; Italy</i>	e-CF and ICT Professional Role Profiling to standardize roles across markets, to map competences and experiences, to enhance Nexi IT organization with specialized job profiles and to boost people development.	<ul style="list-style-type: none"> ▪ Identification of future competence needs; ▪ Cross company and cross border common language; ▪ Competence gap identification; ▪ Decision support on develop or buy new competences.
B 5.2	Educating the European ICT Professionals of the Future - an e-CF compliant curriculum. <i>HU University of Applied Sciences (HU), Utrecht, The Netherlands</i>	In order to create a future proof curriculum for the part-time (continuing education) Master of Informatics at the HU the e-CF was incorporated. Competences related to ICT Professional role profiles are taught across several modules in order to prepare IT professionals for their next challenge in their organisation.	<ul style="list-style-type: none"> ▪ Identification of current and future roles based on the EU ICT Professional Role Profiles; ▪ Education based on the related competences; ▪ Unique competitive advantage as e-CF competences are increasingly demanded.

Case Study	Case study title and source	e-CF usage	Key perspectives
C 5.3	Teaching students human resources practices in the ICT profession within Informatics services management course - example of hiring process. <i>University of Zagreb, Faculty of Organization and Informatics</i>	One of the important topics within IT service management is human resources management, related to the ICT profession. In order to introduce students to the process of preparation of job advertisements and job applications, we used ICT profiles and related e-CF competences.	<ul style="list-style-type: none"> ▪ Identification of job profiles/roles in an ICT company based on the EU ICT Professional Role Profiles; ▪ Preparation of job advertisements for a specific profile based on related e-competences; ▪ Preparation of a job application for a specified job ad (ICT profile); ▪ Evaluation of candidates according to their application.
D 5.4	Implementation of Software Engineering Competence Remote Evaluation for Master Program Graduates - e-CF based Learning Outcome usage for Improving the Quality and Relevance of Higher Education (HE). <i>Transport and Telecommunication Institute (TTI), Riga, Latvia</i>	Boosting innovation and digital skills in European universities in order to deliver high quality education and digital skills. Software Engineering Master Program's learning outcome structuring on the base of e-CF competences.	<ul style="list-style-type: none"> ▪ e-CF competence online evaluation for HE establishments as Open Educational Resource; ▪ Increased opportunities for professional development for ICT Master students; ▪ Greater understanding of interconnections between formal, non-formal education; ▪ Student oriented Software Engineering Master Program design.
E 5.5	ICT profile review process in the context of the German dual Vocational Training System - use of the e-CF. <i>Federal Institute for Vocational Education and Training in cooperation with Airbus Operations GmbH Bremen</i>	Use of the e-CF in the last process phase of the regulatory procedure of German vocational training ICT profiles and mapping of all the skills and competences to the e-CF to ensure a common European understanding.	<ul style="list-style-type: none"> ▪ Translate vocational training ICT profiles into e-CF competences; ▪ Document reached proficiency levels of German ICT vocational training profiles.

Case Study	Case study title and source	e-CF usage	Key perspectives
F 5.6	<p>Making a role profile of an early adopter of Blockchain using the e-CF standard.</p> <p><i>The Dutch Blockchain Coalition (DBC)</i></p>	<p>Along with other technical innovations, blockchain shares the trait that accepted descriptions of related skills, competences and knowledge are scarce or non-existent. Transfer and sharing of know-how on this decentralized database technology often takes place in masterclasses, short-term education and seminars. Early adopters, developers as well as users, render their experiences and findings, while discussing application in practice. In this environment, the e-CF is used the skills, knowledge and competences sort by Dutch Blockchain early adopters.</p>	<ul style="list-style-type: none"> ▪ Providing the base for the identification and development of new and evolving technology competence articulation.
G 5.7	<p>UWV from Data Services towards Data Science using e-CF competences, EU Professional Profiles and the Edison Body of Knowledge.</p> <p><i>UWV and Capgemini, The Netherlands</i></p>	<p>e-CF applied to new job roles including e-competences.</p> <p>Demonstration of e-CF applied in conjunction with another standard; in this case the Edison data science body of knowledge.</p>	<ul style="list-style-type: none"> ▪ Implementation of new data services; ▪ Promote personal development; ▪ Broad support of organisational change; ▪ Workforce Transformation.
H 5.8	<p>National approach to systematic multi-stakeholder engagement for ICT education; using e-CF as a common language.</p> <p><i>Development of the Estonian National skills strategy by the Estonian Association of Information and Technology in co-operation with the National Qualifications Authority, Estonia</i></p>	<p>Estonia decided upon an ICT competence approach to create national economic competitive advantage. This required co-operation and common understanding between industry, education providers and national qualifications authority. The e-CF provided a common structure and platform for co-operation.</p>	<ul style="list-style-type: none"> ▪ e-CF and ICT profiles were deployed; ▪ Competence was at the heart of the skills approach; ▪ Curriculum development was supported by the application of learning outcomes.

Case Study	Case study title and source	e-CF usage	Key perspectives
I 5.9	<p>Using the e-CF to develop a certification framework and spin-off curricula and VET programmes.</p> <p><i>Promanad, Rotterdam, The Netherlands</i></p>	<p>In order to develop internationally recognizable curricula a certification framework was developed based on the e-CF in order to assess knowledge, comprehension and application of concepts that form the foundation for the development of the e-CF competences.</p>	<ul style="list-style-type: none"> ▪ By using the e-CF for defining a certification framework, it has a clear rationale behind it that can be easily explained to all stakeholders; ▪ By using the e-CF to develop exams, these are not only nationally but also internationally recognized; ▪ By using the e-CF and the European ICT Professionals Role Profiles to build ICT curricula, programs are not only much more appealing to students, but also to employers and to accreditation committees.
J 5.10	<p>Aligning IT Professional Resources to the new Company Strategy.</p> <p><i>VIVAT, The Netherlands</i></p>	<p>In 2016, VIVAT refreshed its strategy to prepare for the future by focusing on four strategic themes: Customer Centricity, Digitalisation, Data and Innovation.</p> <p>Addressing ICT Human Resources was a key factor in this change process. The e-CF supported this imperative from tactics to strategy.</p>	<ul style="list-style-type: none"> ▪ Definition of ICT Job Descriptions; ▪ Connecting Job Description to Training Requirements; ▪ e-CF was adopted as reference framework supporting the HR management process at the strategic, tactical and operational levels for the integration with different frameworks (Cobit5, SAFe).

Case Study	Case study title and source	e-CF usage	Key perspectives
K 5.11	<p>e-CF in support of cultural change in a large ICT user organisation</p> <p><i>Red Eléctrica de España, Spain</i></p>	<p>In 2018, Red Eléctrica de España began a huge IT reorganization process to foster and accelerate the digital transformation of the company. To guarantee the success of the reorganisation process, the DTI prioritised the development of internal talent as a key strategical pillar to drive the transformational process. European ICT Professional Role Profiles and the e-CF were the reference models to implement the strategical Training and Development Plan for the DTI.</p>	<ul style="list-style-type: none"> ▪ Close collaboration between ICT and HR department; ▪ Unify profiles that performed similar functions; ▪ Balance the internal distribution of roles and responsibilities; ▪ Implement a IT talent management process; ▪ Objectively verify and justify all training activities needed to develop the DTI internal talent.

Bibliography

- [1] DIGIFRAME. European Commission (EASME) (Ed.): Digital Organisational Frameworks and IT Professionalism – Final Report. Brussel, February 2019
- [2] The Council of the European Union, Council recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning, 2017/c 189/03, Official Journal of the European Union, 15 June 2017
- [3] About ECVET: <https://www.cedefop.europa.eu/en/events-and-projects/projects/european-credit-system-vocational-education-and-training-ecvet>
- [4] About EQAVET: <https://www.eqavet.eu/>
- [5] About C.E.D.E.F.O.P. <https://www.cedefop.europa.eu/>
- [6] About EHEA: <http://www.ehea.info/>
- [7] About EQANIE: <http://www.eqanie.eu/>
- [8] About ACM curricula guidelines <https://www.acm.org/education/curricula-recommendations>
- [9] About SWEBOK (Software Engineering Body of Knowledge):
<https://www.computer.org/education/bodies-of-knowledge/software-engineering>
- [10] About Joint Research Centre. (European Commission, *DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe*, 2013, ISBN 978-92-79-31465-0):
<https://publications.jrc.ec.europa.eu/repository/bitstream/JRC83167/lb-na-26035-enn.pdf>
- [11] *The Information Technology Capability Maturity Framework (IT-CMF) - The Body of Knowledge Guide.*
Murley, M., Kenneally, J., Carcary, M., Doherty, E., Conway, G., Crowley, C., O'Brien, C., Thornley, C., Murnane, S. and Veling, L. Van Haren, The Netherlands, 2015