
ICS:

CCMC will prepare and attach the official title page.
Content

Content ........................................................................................................................................................................2
European foreword ..........................................................................................................................................................4
Introduction..................................................................................................................................................................5
1 Scope ........................................................................................................................................................................7
2 Normative references ..................................................................................................................................................7
3 Terms and definitions ..................................................................................................................................................7
4 Executive overview ...................................................................................................................................................7
  4.1 e-CF scope and target groups ..................................................................................................................................7
  4.2 e-CF a fundamental pillar of ICT Professionalism for Europe .............................................................................8
  4.3 e-CF structure, content and application opportunities .............................................................................................8
     4.3.1 e-CF overview: structure, content .....................................................................................................................8
     4.3.2 e-CF at a glance – The conceptual view ........................................................................................................12
     4.3.3 e-CF application strategies at a glance ........................................................................................................14
  4.4 The e-CF as a standard: normative versus informative elements ............................................................................15
  4.5 Entry start points for using the e-CF ....................................................................................................................16
     4.5.1 Competences ..................................................................................................................................................16
     4.5.2 Transversal Aspects .........................................................................................................................................16
     4.5.3 European ICT Professional Role Profiles ....................................................................................................18
     4.5.4 Deliverables ...................................................................................................................................................19
  4.6 Purpose and target groups of this user guide ..........................................................................................................19
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
     5.1.1 People are more important than things: The e-CF giving shape to the value and investment in human capital........20
     5.1.2 Basic factors for successful implementation ..................................................................................................21
     5.1.3 Roles and job profile building ..........................................................................................................................22
     5.1.4 Support ICT strategy development with personnel and competence planning ........................................22
     5.1.5 Competence gap analysis and identifying training needs ..............................................................................22
     5.1.6 Personnel/ talent development and learning ....................................................................................................23
     5.1.7 Recruitment support ........................................................................................................................................23
     5.1.8 Enhancement of communication internal and externally ..................................................................................24
     5.1.9 e-CF universal model embracing specific ICT frameworks and standards ........................................24
  5.2 Applying the e-CF in a qualification context ..........................................................................................................24
     5.2.1 Comparing the e-CF to the EQF .....................................................................................................................25
     5.2.2 Relevance of e-CF to Vocational Education and Training (VET), Higher Education (HE) and private training providers ..........................................................................................................................26
     5.2.3 Developing curricula based on the e-CF ...........................................................................................................27
5.3 e-CF application by individuals, ICT students and professionals ................................................................. 28
  5.3.1 CV and self-promotion .................................................................................................................................. 28
  5.3.2 Assessment and recognition of competences ............................................................................................... 29
5.4 e-CF applied in ICT labour market research ..................................................................................................... 29
  5.4.1 A common reference for market observation – under development .......................................................... 29
5.5 e-CF in policy and digital skills strategy development ..................................................................................... 30
  5.5.1 Setting digital skills priorities ....................................................................................................................... 30
  5.5.2 Public procurement processes – under development ...................................................................................... 30
  5.5.3 e-CF adoption as an indicator of digital maturity – under development ....................................................... 30
  5.5.4 Implementing e-CF in European instruments: Europass, Desi, Ovate .......................................................... 30
5.6 Making combined use of frameworks ............................................................................................................... 31
  5.6.1 Some basics for introduction .......................................................................................................................... 31
  5.6.2 e-CF interfaces provided by EN16234-1:2019 Annex B: EQF, ESCO, DigComp, SFIA, P21, ICT Professional Role Profiles, ISO standards ........................................................................................................... 32
  5.6.3 e-CF connecting with multiple ICT market standards: DIGIFRAME .......................................................... 32
  5.6.4 How to create further framework interfaces: Example e-CF and Euro-Inf .................................................. 32
Annex A e-Competence levels 1 to 5 from EN16234-1:2019 .................................................................................. 34
Annex B (informative) Examples of deliverables related to e-CF competences ..................................................... 35
Annex C (informative) .................................................................................................................................................. 41
Bibliography ........................................................................................................................................................................ 44
European foreword

This document (prCEN/TR 16234-2:2020) has been prepared by Technical Committee CEN/TC 428 “ICT Professionalism and digital competences”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

This document will supersede CEN/TR 16234-2:2016.

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

- Review of all previously existing chapters and content in the light of the EN16234-1 revision and benefitting from multiple e-CF user experiences gathered and application feedback received.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

This standard 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 standardised but provided to support orientation and understanding. When applying the standard, this approach must be recognised 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:

- Part 1: is the Framework of the e-CF published as a European Norm (EN).
- Part 4: provides a series of Case Studies illustrating e-CF practical use from multiple ICT sector perspectives and 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 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.

To support users and guide developers of applications of this standard, the following narrative provides an overview of the underpinning philosophy and principles adopted during the standard’s construction and maintenance. Understanding these guiding principles is equally important for applying the standard across multiple environments concerned with ICT professionalism.

The Guiding Principles:

**This standard 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 companies, educational institutions including higher education and private certification providers, social partners and individuals. Across this broad application context, this standard is designed to support common understanding, not to mandate the use of each and every word used within it.

**This standard 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, this standard 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 Managers’ 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 this standard, they may be integrated as knowledge and skills examples in Dimension 4.

**This standard does not attempt to cover every possible competence deployed by an ICT professional nor are the included competences necessarily unique to ICT.** This standard 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, this standard 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 this standard 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.

**This standard 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 recognise 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.

This standard has a sector specific relationship to the EQF; competence levels within this standard 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 this standard 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 this standard is imperative; following maintenance updates, it is essential that users are provided with a simple upgrade path. Users of this standard invest considerable time and resources to align processes or procedures to it. Organizations deploying these downstream activities are reliant upon this standard and need to be confident of the continued sustainability of their processes. Updates to this standard must respect this requirement and ensure continuity by enabling continued use of the existing standard until convenient to upgrade to the latest version.

This standard 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 Standardisation. This standard is a key component of the European Digital Agenda for ICT Professionalism; it is designed for use by any organisation or individual engaged in ICT Human Resource planning and competence development.
1 Scope

This Technical Report supports understanding, adoption and use of EN 16234-1 e-Competence Framework (e-CF) 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 technical report supports Information and Communication Technology (ICT) stakeholders dealing with ICT Professional competences from multiple perspectives, in particular:

— ICT service, demand and supply companies;
— ICT professionals, managers and human resource (HR) departments;
— vocational education institutions and training bodies including higher education;
— social partners (trade unions and employer associations);
— professional associations, accreditation, validation and assessment bodies;
— market analysts and policy makers; and
— other organizations 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 e-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all sectors
- TR16234-3 Methodology of the e-Competence Framework (e-CF)
- TR 16234-4 Case Studies illustrating e-CF practical use from multiple ICT sector perspectives

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:

- ISO Online browsing platform: available at http://www.iso.org/obp

4 Executive overview

4.1 e-CF scope and target groups

The EN16234-1 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 and proficiency levels that can be understood across Europe.

The e-Competence standard was created for application by:
— ICT service, user and supply companies,
— ICT professionals, managers and human resource (HR) departments,
— vocational education institutions and training bodies including higher education,
— social partners (trade unions and employer associations), professional associations, accreditation, validation and assessment bodies,
— market analysts and policy makers,
and other organizations and stakeholders in public and private sectors.

4.2 e-CF a fundamental pillar of ICT Professionalism for Europe

Figure 1 — e-CF an essential pillar of ICT Professionalism for Europe

Text under development – e-CF connected with the forthcoming European Foundational Body of Knowledge for the ICT Profession, ICT Professional Ethics Framework, European ICT Professional Role Profiles. All these interconnected basic concepts and frameworks supported by practical guidance on how to implement and apply them in organisation, qualification and policy environment.

4.3 e-CF structure, content and application opportunities

4.3.1 e-CF overview: structure, content

The e-CF standard 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 that follows. The
standard 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 e-CF four dimensions and transversal aspects

<table>
<thead>
<tr>
<th>Dimension 1: 5 e-Competence areas</th>
<th>MAY APPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derived from the IT 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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension 2 41 e-Competences</th>
<th>SHALL APPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>41 e-Competences provide the European standard references for IT Professional competence as required and performed in an IT work context. Each dimension 2 description contains a competence title and a generic competence description, defined from an organisational perspective.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension 3 5 e-CF proficiency levels</th>
<th>SHALL APPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension 4 knowledge and skills examples</th>
<th>MAY APPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transversal aspect components</th>
<th>MAY APPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>provide basic generic ICT related descriptors for successful application of e-CF competences in the workplace.</td>
<td></td>
</tr>
</tbody>
</table>

The four-dimensional structure plus transversal aspects of the e-CF offer comprehensive insight into the competence requirements of organisations and executed by IT 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 e-CF.

The figure below illustrates the content of a typical competence, A.2 Service 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 1 provides an example of e-Competence description in all four dimensions.

Figure 2 — EN16234-1:2019 “e-CF” e-Competence example A.2. Service Level Management
The 41 competences defined by this standard are constructed in the same way, consisting of 4 dimensions as previously described. The following table represents the entire table of competences, 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>
<thead>
<tr>
<th>Dimension 1</th>
<th>A. PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimension 2</strong></td>
<td>e-Competence: Title + generic description</td>
</tr>
<tr>
<td><strong>Dimension 3</strong></td>
<td>Level 1</td>
</tr>
<tr>
<td>e-Competence proficiency levels e-1 to e-5</td>
<td>–</td>
</tr>
<tr>
<td><strong>Dimension 4</strong></td>
<td>K1</td>
</tr>
<tr>
<td>Knowledge examples</td>
<td>SLA documentation</td>
</tr>
<tr>
<td>Skills examples</td>
<td>S1</td>
</tr>
<tr>
<td>Is able to</td>
<td>analyse service provision records</td>
</tr>
</tbody>
</table>
### Figure 3 — EN16234-1:2019 e-Competence Framework (e-CF) overview

<table>
<thead>
<tr>
<th>Dimension 1</th>
<th>Dimension 2</th>
<th>Dimension 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 e-CF areas</td>
<td>41 e-Competences identified</td>
<td>5 e-Competence proficiency levels</td>
</tr>
<tr>
<td><strong>A. PLAN</strong></td>
<td>A.1. Information Systems and Business Strategy Alignment</td>
<td>e-1 e-2 e-3 e-4 e-5</td>
</tr>
<tr>
<td></td>
<td>A.2. Service Level Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.3. Business Plan Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.4. Product/Service Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.5. Architecture Design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.6. Application Design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.7. Technology Trend Monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.8. Sustainability Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.9. Innovating</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.10. User Experience</td>
<td></td>
</tr>
<tr>
<td><strong>B. BUILD</strong></td>
<td>B.1. Application Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.2. Component Integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.3. Testing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.4. Solution Deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.5. Documentation Production</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.6. ICT Systems Engineering</td>
<td></td>
</tr>
<tr>
<td><strong>C. RUN</strong></td>
<td>C.1. User Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.2. Change Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.3. Service Delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.4. Problem Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.5. Systems Management</td>
<td></td>
</tr>
<tr>
<td><strong>D. ENABLE</strong></td>
<td>D.1. Information Security Strategy Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.2. ICT Quality Strategy Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.3. Education and Training Provision</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.4. Purchasing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.5. Sales Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.6. Digital Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.7. Data Science and Analytics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.8. Contract Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.9. Personnel Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.10. Information and Knowledge Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.11. Needs Identification</td>
<td></td>
</tr>
<tr>
<td><strong>E. MANAGE</strong></td>
<td>E.1. Forecast Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.2. Project and Portfolio Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.3. Risk Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.4. Relationship Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.5. Process Improvement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.6. ICT Quality Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.8. Information Security Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.9. Information Systems Governance</td>
<td></td>
</tr>
</tbody>
</table>
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 4 — Transversal Aspects applying across the entire framework**

![Figure 4](image)

**4.3.2 e-CF at a glance – The conceptual view**

The e-CF may be broadly considered from two perspectives, the application view, examples of which are provided in section 4.2.3, and the conceptual viewpoint that focuses upon the dimensional construct of the framework and the underpinning definitions of each component. This structural perspective 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 5 — e-CF at a glance - The conceptual view (note: higher resolution quality of graphics under elaboration)
4.3.3 e-CF application strategies at a glance

There are many ways of using the e-CF for ICT Professional competence development and planning in an ICT organisational or qualification/certification context. The following figure 5. provides an illustration of how different process perspectives may be supported by the application of the e-CF whilst figure 6 shows a possible application to qualification environments.

**Figure 6 — e-CF application strategies across processes in the ICT organisation**

![Diagram showing e-CF application strategies across processes in the ICT organisation]

**Figure 7 — e-CF application strategies across ICT qualification processes**

![Diagram showing e-CF application strategies across ICT qualification processes]
4.4 The e-CF as a standard: normative versus informative elements

The European e-Competence Framework is published as a European Norm. The e-CF is a flexible tool and it is therefore important to differentiate between elements providing the standard and elective 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 e-Competence standard.

- **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 level 3 descriptors are derived from stakeholder agreed examples of the competence performance applied at each level, whilst the definition of the dimension 3 standard 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 not provided as a standard. 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 IT Professional competence performance. They offer standard generic references which may be exploited by framework users within a specific context.

Figure 8 — e-Competence example – standard content versus example elements

4.5 Entry start points for using the e-CF

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 e-CF can be addressed from different starting points. Some possible potential entry points are described in the following sub sections.

4.5.1 Competences

As the core of the framework competence descriptions, articulated within dimension 2, provide clear definitions. The comprehensive nature of these descriptions make 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.

4.5.2 Transversal Aspects

Transversal Aspects are provided by EN16234-1:2019 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
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 organisation, they bridge organisational processes with individual employee competences. This dual perspective is a consistent feature of the e-CF which from the outset was designed to address and link the competence of individuals and organisations.

A possible approach to deploying the e-CF could be to start from transversal aspects. Although these aspects play a role in every organisation and for every employee, they need to be adapted to context. Responding to the following questions my help in applying the e-CF, using transversal aspects as an entry point:

- What processes connect the organisation 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 organisation 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 IT 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 organisation on one hand and the actions and competencies 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 e-CF, in particular competence descriptions in dimension 2 which in turn provide linkage to European ICT Professional Role Profiles. 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 need to be explored to determine organisational and individual competence requirements.

Considering transversal aspects contributes to enhancing professionalisation of the organisation and the expertise of IT 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 IT professionals beyond technology.

By implementing a comprehensive overhaul of transversal aspects, the effectiveness and professionalism of IT 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’ (precise and add reference) This is a complex, multidisciplinary topic and the framework offers guidance on the many facets that ethics impact ICT professional activities.
4.5.3 European ICT Professional Role Profiles

e-CF competences are embedded within the European ICT Professional Profiles which represent 30 typical roles conducted by IT professionals, covering all IT 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

Table 2 — EU ICT Professional Role Profile example (11) Information Security Manager Role

<table>
<thead>
<tr>
<th>Profile title</th>
<th>INFORMATION SECURITY MANAGER ROLE</th>
<th>(11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary statement</td>
<td>Leads and manages the organisation information security policy.</td>
<td></td>
</tr>
<tr>
<td>Mission</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Deliverables</td>
<td>Accountable</td>
<td>Responsible</td>
</tr>
<tr>
<td></td>
<td>• Information Security Policy</td>
<td>• Knowledge or Information Base</td>
</tr>
<tr>
<td></td>
<td>• Information Security Strategy</td>
<td>• New Solution and Critical Business Integration Proposal</td>
</tr>
<tr>
<td>Main task/s</td>
<td>• Define the information security strategy and standards</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contribute to the development of the organisation’s security policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Manages security audits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Evaluate risks, threats and consequences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Establish and manage prevention, detection, correction and remediation plans</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Inform and raise awareness among general management and across all IT users and professionals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Conduct information security operations</td>
<td></td>
</tr>
<tr>
<td>e-Competences (from e-CF)</td>
<td>A.7. Technology Trend Monitoring</td>
<td>Level 4</td>
</tr>
<tr>
<td></td>
<td>D.1. Information Security Strategy Development</td>
<td>Level 5</td>
</tr>
<tr>
<td></td>
<td>E.3. Risk Management</td>
<td>Level 4</td>
</tr>
</tbody>
</table>
### 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 standard European ICT Professional Role Profiles may, in turn, enable e-CF users to link to their own environment.

#### 4.5.4 Deliverables

The language used in the 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 European ICT Professional Role Profile 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 C, 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 identify the activities of IT 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 Technical Report provides guidance on how to apply EN 16234-1 from multiple ICT stakeholder perspectives. It addresses the fact that a European reference set of ICT competence definitions is unlikely to match all organisation's or individual's needs in the same way. EN 16234-1 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

Figure 9 — 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, organizations 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.

To come to a common understanding in such situations, the e-CF can assist by bringing together the necessary and desired organisational capabilities with the necessary competencies 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.
Paul Strassmann brought to our attention, the importance of human capital in his book *Information Productivity; Assessing the Information Management Costs of U.S. Industrial Corporations.* He came to the conclusion that the return on investment for employee skills development is far higher than for an organisation's investment in hardware and software.

5.1.2 Basic factors for successful implementation

5.1.1.1. A good case: Positive arguments to persuade internal departments: What makes the e-CF a good investment and a success

- The European e-Competence Framework (e-CF) is a standard developed by the European Committee for Standardisation (CEN) the public standards agency fostering the economy of the European Union in global trading. In consequence, the e-CF is a sustainable structure, independent of commercial interests.
- The e-CF provides a common language for use by multiple stakeholders including industry, education, central and regional governments and information technology professionals. It provides a universal tool to support understanding and communication digital competences.
- The breadth of coverage and scope of the e-CF includes not only technical but also business and process perspectives providing comprehensive coverage relevant to the application of Information Technology by organisations and individuals from a broad spectrum. To enable common understanding across this universal network the granularity of language provide is appropriate to a wide audience; it avoids technical jargon and uses common English language throughout. The e-CF has been translated into several European languages and each national standardisation institute 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 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.

5.1.1.2. How to make the e-CF successful in your organisation

Buy in from many parts of an organisation, 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 section 5.1.1.1 above.

Although tactical use of the e-CF is possible, it is more likely that the e-CF will form an important component of an organisation's 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 emphasised 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 explain it across all departments. Recognising that that different departments will have different perspectives and presenting the e-CF to them as a unifying framework will add to quality of internal communication.

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 organisation.

5.1.3 Roles and job profile building

The European ICT Professional Role Profiles published by CWA 16458:2018 offer an alternative perspective and complimentary access point for the implementation of the e-CF. The e-CF is the formal CEN standard "EN 16234-1:2019 - e-Competence Framework (e-CF) and European Role Profiles provide a tool based upon the e-CF (see 4.4.3 for further details and an example).

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

See European ICT Professional role profiles version 2 CWA Part 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 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. Adopting e-CF (and ICT profiles) language
2. Create an organisation-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 organisation
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 e-CF is to identify gaps between existing and required skills, knowledge and competence either from the organisation 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 organisation. This information will be derived from the organisation's 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 4.4.2) which are related to every competence. They are of value in identifying additional learning requirements that contribute to the professional identity of IT practitioners.

Furthermore, the European ICT Foundational Body of Knowledge for the ICT Profession (EU ICT BoK) which is planned to complement the e-CF standard by publication in 2021, embodies essential knowledge areas and units that support the common and specialised knowledge requirements of IT professionals.

### 5.1.6 Personnel/talent development and learning

Although the 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 IT 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 IT 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 IT 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 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 organisation 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 user guide, the e-CF provides a common language for communicating competence and its components, knowledge, skills and attitude.

This adds value within an organisation to support clear understanding of roles, capabilities, responsibilities and continuous development. It enhances interdepartmental discussions and improves common understanding 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 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 organisation 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 e-CF universal model embracing specific ICT frameworks and standards

The e-CF provides a universal model covering all 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-proces specific frameworks are available and commonly used in industry and qualification practice. The below figure 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 European ICT Professional Role Profiles families.

Figure 10 — e-CF as a major umbrella interface to multiple ICT industry standards

5.2 Applying the e-CF in a qualification context

This chapter explores the relationship between qualification structures and the European e-Competence framework. The aim is to demonstrate how to map learning outcomes from formal education programs to e-CF competences and vice versa. The purpose is to construct a bridge between qualifications arising from an education environment to competences deployed in a workplace environment.
When referring to the qualification 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 are usually difficult to imitate or experience in a classroom environment.

Nevertheless, it is possible and feasible to develop curricula for VET 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.

5.2.1 Comparing the e-CF to the EQF

In the European Qualification Framework, 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.

Although, EQF concepts 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 European Qualifications Framework, 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 European Qualifications Framework, 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 European Qualifications Framework, competence is described in terms of responsibility and autonomy."

In contrast, the core of the e-CF is based upon competence and competence and 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.
5.2.2 Relevance of e-CF to Vocational Education and Training (VET), Higher Education (HE) and private training providers

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.

5.2.2.1 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 (https://www.cedefop.europa.eu/en/events-and-projects/projects/european-credit-system-vocational-education-and-training-ecvet) or EQAVET (https://www.eqavet.eu/).

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 (https://www.cedefop.europa.eu/) 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 cVET 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 section 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.

5.2.2.2 Higher Education

The main motivation of HE to map programs to the e-CF is to enhance links to the IT 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:
Within this panorama, EQANIE, the European Quality Assurance Network for Informatics Education (http://www.eqanie.eu/) 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.

In addition, HE is influenced by other sources of skills and recommendations formally described by relevant organisms such as e.g. ACM curricula guidelines (https://www.acm.org/education/curricula-recommendations), SWEBOK (Software Engineering Body of Knowledge: https://www.computer.org/education/bodies-of-knowledge/software-engineering) or national guidelines of specific countries. The mapping of these sources to e-CF competences would 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.

5.2.2.3 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 of course descriptions of private training courses varies 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 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 very 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, IT Professionals participating in such training enlarge their chances in the international job market.

5.2.3 Developing curricula based on the e-CF

The following sub chapter offers an overview and rationale for using the e-CF at the core of curriculum development. This topic is of such significance to the overall concept of European ICT Professionalism, it has been addressed separately as a CEN Technical Specification entitled 'ICT Curriculum Guidelines' reference ?.

In consequence curriculum designers should refer to the Technical Specification 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 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. Recognising this challenge, a new European standard entitled ‘European Foundational Body of Knowledge for the ICT Profession (BoK)’ connected with the e-CF and complemented by the ICT BoK methodology description and implementation guidance is planned to be available in 2021. (###include references ###). This is accompanied by the Technical Specification entitled ‘ICT Curriculum guidelines’ referenced at the start of this sub-chapter.

The 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, exams and the relationship between learning and teaching, students and teachers/professors/tutors (Strategy and methodology),
- practical, supporting information, such as curricula and learning outcome examples, checklists

5.3 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 Section *), job experiences documented by deliverables or testimonial letters of managers and colleagues, or specific diagnostic/assessment of competences through different mechanisms (see Section 5.3.2).

ePortfolio is an electronic resource to record personal milestones as e.g. education and/or position or professional activities. The ePortfolio 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 would provide 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 QA 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 at level 2.

5.3.2 Assessment and recognition of competences

Assessment and recognition of e-competences is easier with 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 e-portfolio, CV and general evidences in conjunction an interview. This would support 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.

**Under development**: Reference to Technical Report about common metrics and assessment indicators for e-Competence:

- indicators which are related to competences (if yet available)
- guidelines for criteria
- maturity model for assessment of competences in the IT organisation

5.4 e-CF applied in ICT labour market research

5.4.1 A common reference for market observation – **under development**

- Example: Intelligence Group in NL, using e-CF together with other frameworks (ESCO a.o.)
- VMS: from organisation demand to candidates finding
- Cedefop:ESCO and e-CF competences usage in addition
- natural language analysis
5.5 e-CF in policy and digital skills strategy development

5.5.1 Setting digital skills priorities

*Under development*

5.5.2 Public procurement processes – *under development*

- *e-CF (and ICT Profiles) give a neutral reference for recruitment*
- *procurement has its own language, for AI a good data culture is needed, e-CF can help to set that culture and provide a common language*

5.5.3 e-CF adoption as an indicator of digital maturity – *under development*

- *IT-CMF makes a link, take figure as example from Digiframe*

5.5.4 Implementing e-CF in European instruments: Europass, Desi, Ovate

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 IT professionals in the workplace.

5.5.4.1 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 IT 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 IT 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 e-competences as defined by the e-CF.

5.5.4.2 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 annex B.3 of EN16234-2019). This would open up an option of apply e-CF language to OVATE skills analysis.

5.5.4.3 DESI

The Digital Economy and Society Index (DESI) is a composite index that summarises 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 standard 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 e-CF structure. Since inception, the e-CF provides systematic relationships with CMMI and ITIL and three national/international IT 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 EN16234-1:2019 Annex B: EQF, ESCO, DigComp, SFIA, P21, ICT Professional Role Profiles, ISO standards

Annex B of EN16234-1:2019 provides a series of up-to-date and mutually agreed relationship reports about the connections and interfaces with a series of structures, many of them e-CF complementary:

- 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
- European ICT Professional Role Profiles including update of the latest ICT Profiles version by the new EN16234-1:2019 competences
- Related ISO standards and standardisation initiatives

Complementary text under development.

5.6.3 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 chapter 5.1.9. of this document.

5.6.4 How to create further framework interfaces: Example e-CF and Euro-Inf

prTR16234-3 Chapter 7.1. provides methodology guidance from a more generic viewpoint on how to create interfaces between the e-CF and other frameworks of interest to the sector. In this following section, another relationship is elaborated as an illustrative example between e-CF and Euro-Inf, supplementary to the informative Annex B of the EN16234-1 standard.

EQANIE (http://www.eqanie.eu/) 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.
Annex B of this document elaborates the specific characteristics of both frameworks in comparison to each other in more detail.

In view of the definitions provided in 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-organisation, 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.
## Table A.1 — e-Competence levels 1 to 5 from EN16234-1:2019

<table>
<thead>
<tr>
<th>Levels</th>
<th>e-CF Level descriptor</th>
<th>Influence</th>
<th>Complexity</th>
<th>Autonomy</th>
<th>Behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-5</td>
<td>Overall accountability and responsibility; recognised inside and outside the organisation for innovative solutions and for shaping the future using outstanding leading edge thinking and knowledge.</td>
<td>Determines strategy</td>
<td>Unpredictable – unstructured</td>
<td>Demonstrates substantial leadership and independence in contexts which are novel requiring the solving of issues that involve many interacting factors.</td>
<td>Conceiving, transforming, innovating, finding creative solutions by application of a wide range of technical and/or management principles.</td>
</tr>
<tr>
<td>e-4</td>
<td>Extensive scope of responsibilities deploying specialised integration capability in complex environments; full responsibility for strategic development of staff working in unfamiliar and unpredictable situations.</td>
<td>Provides executive leadership</td>
<td></td>
<td>Demonstrates leadership and innovation in unfamiliar, complex and unpredictable environments. Addresses issues involving many interacting factors.</td>
<td>Planning, making decisions, supervising, building teams, forming people, reviewing performances, finding creative solutions by application of specific technical or business knowledge / skills.</td>
</tr>
<tr>
<td>e-3</td>
<td>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.</td>
<td>Consults</td>
<td>Structured – unpredictable</td>
<td>Works independently to resolve interactive problems and addresses complex issues. Has a positive effect on team performance.</td>
<td></td>
</tr>
<tr>
<td>e-2</td>
<td>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.</td>
<td>Applies and adapts</td>
<td>Structured – predictable</td>
<td>Works under general guidance in an environment where unpredictable change occurs. Independently resolves interactive issues which arise from project activities.</td>
<td>Designing, managing, surveying, monitoring, evaluating, improving, finding non standard solutions. Scheduling, organising, integrating, finding standard solutions, interacting, communicating, working in team.</td>
</tr>
<tr>
<td>e-1</td>
<td>Able to apply knowledge and skills to solve straightforward problems; responsible for own actions; operating in a stable environment.</td>
<td>Implements instructions</td>
<td></td>
<td>Demonstrates limited independence where contexts are generally stable with few variable factors.</td>
<td>Applying, adapting, developing, deploying, maintaining, repairing, finding basic-simple solutions.</td>
</tr>
</tbody>
</table>
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 C.1 – Examples of deliverables related to e-CF competences

<table>
<thead>
<tr>
<th>COMPETENCE</th>
<th>DELIVERABLE</th>
<th>DELIVERABLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Information Systems and Business Strategy Alignment</td>
<td>Business Requirements</td>
<td>A description of what a business needs so that it can operate successfully.</td>
</tr>
<tr>
<td></td>
<td>ICT Department &amp; Budget</td>
<td>The organisation, processes, human resources, infrastructure and budget needed to implement IS Strategy</td>
</tr>
<tr>
<td>A.2 Service Level Management</td>
<td>Service Level Agreement</td>
<td>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.</td>
</tr>
<tr>
<td>A.3 Business Plan Development</td>
<td>Business Case (Lightweight Business Case)</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Business Plan (Strategic Themes)</td>
<td>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.</td>
</tr>
<tr>
<td>A.4 Product/Service Planning</td>
<td>Budget Plan</td>
<td>A description of the amount of money spent on an organisation’s Information Technology systems and services, including compensation for IT professionals and expenses related to the construction and maintenance of enterprise-wide systems and services.</td>
</tr>
<tr>
<td></td>
<td>Product or Service Description</td>
<td>A set of Documents which describe the Product or Service to be developed/planed/delivered/maintained.</td>
</tr>
<tr>
<td>A.5 Architecture Design</td>
<td>Enterprise Architecture</td>
<td>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.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>A.6 Application Design</td>
<td>Solution Specification</td>
<td>A set of Documents which define in detail the Solution to be developed.</td>
</tr>
<tr>
<td>Team Backlog</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>A.7 Technology Trend Monito-</td>
<td>Solution based on</td>
<td>A solution based on new technologies that takes advantage of its features to innovate or improve business.</td>
</tr>
<tr>
<td>ring</td>
<td>emerging technologies</td>
<td></td>
</tr>
<tr>
<td>New technology integrati-</td>
<td></td>
<td>A document which illustrates possible goals, benefits and strategy for integrating new technologies in products, solutions, services or own business processes.</td>
</tr>
<tr>
<td>on proposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8 Sustainability Manage-</td>
<td>Sustainable Policy</td>
<td>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.</td>
</tr>
<tr>
<td>ment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.9 Innovating</td>
<td>Proof of concept</td>
<td>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.</td>
</tr>
<tr>
<td>Product innovation plan</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>A.10 User Experience</td>
<td>User Experience Design</td>
<td>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.</td>
</tr>
<tr>
<td>B.1 Application Development</td>
<td>Software/Hardware Com-</td>
<td>A Software/Hardware module that encapsulates a set of related functions (or data).</td>
</tr>
<tr>
<td>Component</td>
<td>ponent</td>
<td></td>
</tr>
<tr>
<td>SW Design Description</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Documented Code</td>
<td></td>
<td>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 algo-</td>
</tr>
<tr>
<td>B.2 Component Integration</td>
<td>Integrated Solution</td>
<td>A solution in which all components and sub-systems are integrated and tested.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>B.3 Testing</td>
<td>Test Procedure</td>
<td>A set of tests which addresses homogeneous/similar solution areas.</td>
</tr>
<tr>
<td></td>
<td>Test Plan</td>
<td>A document describing the scope, approach, resources and schedule of intended test activities.</td>
</tr>
<tr>
<td></td>
<td>Validated Solution</td>
<td>A solution at the end of Test and Validation Phase.</td>
</tr>
<tr>
<td>B.4 Solution Deployment</td>
<td>Release</td>
<td>A result of activities including Solution verification and validation, documentation, and supporting activities to make a solution available.</td>
</tr>
<tr>
<td></td>
<td>Release Plan</td>
<td>A plan of activities including Solution verification and validation, documentation, and supporting activities to make a solution available.</td>
</tr>
<tr>
<td>B.5 Documentation Production</td>
<td>Solution Documentation</td>
<td>A set of Documents which illustrate all aspects related to the Solution.</td>
</tr>
<tr>
<td>B.6 ICT Systems Engineering</td>
<td>Digital Infrastructure (Systems, Network, Cloud etc)</td>
<td>The whole of network, compute, and storage functions required for the successful delivery of applications and services in a all-IP connected economy.</td>
</tr>
<tr>
<td>C.1 User Support</td>
<td>First Level Support</td>
<td>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</td>
</tr>
<tr>
<td>C.2 Change Support</td>
<td>RFC (Request for Change)</td>
<td>A formal proposal for a change to be made including details of the proposed change.</td>
</tr>
<tr>
<td></td>
<td>Up-to-date Solution</td>
<td>An updated Solution during the Maintenance Phase.</td>
</tr>
<tr>
<td>C.3 Service Delivery</td>
<td>Service Catalogue Information</td>
<td>A service catalogue information includes ordering and requesting processes/ prices/ deliverables /contract points.</td>
</tr>
<tr>
<td></td>
<td>Solution in Operation</td>
<td>A solution deployed and running in the actual operational environment.</td>
</tr>
<tr>
<td></td>
<td>Capacity Plan</td>
<td>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.</td>
</tr>
<tr>
<td>C.4 Problem Management</td>
<td>Solved Incident</td>
<td>An incident at the stage where a Solution to address the problem has been applied.</td>
</tr>
<tr>
<td></td>
<td>Escalation Process</td>
<td>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.</td>
</tr>
</tbody>
</table>
| C.5 Systems Management   | System/Network Configuration | The settings or the hardware-software arrangement and how each device and software or
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.
**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
<table>
<thead>
<tr>
<th>D.8 Contract Management</th>
<th>Contract</th>
<th>An agreement between two or more parties to perform a service, provide a product or commit to an act and is enforceable by law.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Training Course</td>
<td>An event with the aim of the acquisition of knowledge, skills, and competences.</td>
</tr>
<tr>
<td></td>
<td>HR Development Plan</td>
<td>A systematic process of matching the interests, skills and talents of employees/staff/personnel with organisational goals</td>
</tr>
<tr>
<td>D.10 Information and Knowledge</td>
<td>Knowledge or Information Base</td>
<td>An organized repository of knowledge consisting of concepts, data, objectives, requirements, rules, and specifications.</td>
</tr>
<tr>
<td></td>
<td>Data Model</td>
<td>A description of data and relations in terms of dependency, consistency and integrity.</td>
</tr>
<tr>
<td></td>
<td>Data Management Plan</td>
<td>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.</td>
</tr>
<tr>
<td>D.11 Needs Identification</td>
<td>Solution Requirements</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Non Functional Requirements</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Program Backlog</td>
<td>A prioritized list of Features that have been analyzed and are intended to address user needs and deliver business benefits for a single Agile Release Train (ART).</td>
</tr>
<tr>
<td>E.1 Forecast Development</td>
<td>Production Forecast</td>
<td>A projection of achievable/likely production volumes, based on market needs, historical sales data and current production capacity.</td>
</tr>
<tr>
<td>E.2 Project and Portfolio Management</td>
<td>Project Plan</td>
<td>A formal, approved document used to guide both project execution and project control.</td>
</tr>
<tr>
<td></td>
<td>Project Portfolio</td>
<td>A formal approved document for analyzing and collectively managing a group of current or proposed projects.</td>
</tr>
<tr>
<td>E.3 Risk Management</td>
<td>Risk Management Plan</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Risk Management Policy</td>
<td>A set of principles/rules to guide decisions</td>
</tr>
<tr>
<td>E.4 Relationship Management</td>
<td>Business Relationship</td>
<td>A relationship established to provide business services.</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Communication plan</td>
<td>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.</td>
</tr>
<tr>
<td>E.5 Process Improvement</td>
<td>Business Process Definition</td>
<td>A formal definition and description of related, structured activities that will accomplish a specific organizational goal.</td>
</tr>
<tr>
<td></td>
<td>Process KPI</td>
<td>A Process Key Performance Indicator is a measurable value that demonstrates how effectively a process objective is achieved.</td>
</tr>
<tr>
<td>E.6 ICT Quality Management</td>
<td>ICT Audit Report</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Quality Performance Indicators</td>
<td>A set of indicators measuring how quality policy is implemented on IS projects and ICT solutions in operation.</td>
</tr>
<tr>
<td></td>
<td>Quality Plan</td>
<td>A definition of the activities which will deliver solutions achieving customer's quality expectations on the basis of the quality standards.</td>
</tr>
<tr>
<td>E.7 Business Change Manage- ment</td>
<td>Change Management Plan</td>
<td>A plan which addresses the impact of change to an organization, easing the transition.</td>
</tr>
<tr>
<td></td>
<td>Digital Transformation Roadmap</td>
<td>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.</td>
</tr>
<tr>
<td>E.8 Information Security Management</td>
<td>Data Protection Policy</td>
<td>A set of principles or rules to guide decisions and achieve optimal outcome(s) in Data protection.</td>
</tr>
<tr>
<td></td>
<td>Security Assessment</td>
<td>An explicit study to locate IT security vulnerabilities and risks.</td>
</tr>
<tr>
<td>E.9 Information Systems Governance</td>
<td>ICT Governance Policy</td>
<td>A principle or rule to guide decisions and achieve optimal outcome(s) in ICT Governance policy.</td>
</tr>
</tbody>
</table>
Annex C (informative)

prTR16234-3 Chapter 7.1. ensures methodology guidance from a moe generic viewpoint on how to create interfaces between the e-CF and other frameworks of interest to the sector. In this following section, another relationship is elaborated as an illustrative example between e-CF and Euro-Inf, supplementary to the informative Annex B of the EN16234-1 standard.

This Annex provides complementary information to chapter 5.6.4. 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 specialisation 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 e-CF standard 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 standard incorporates a transversal component which provides basic generic ICT descriptors for successful application of e-CF competences in a workplace context.

The following table “Comparison of principles applied by the framework EQANIE and of the e-CF” 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 B.1 — Comparison of principles applied by e-CF and Euro-Inf/ EQANIE
<table>
<thead>
<tr>
<th>Philosophy and principles</th>
<th>e-CF</th>
<th>Euro-Inf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>ICT Professionals</td>
<td>Quality of Higher Education Informatics Qualifications</td>
</tr>
</tbody>
</table>
| Target groups             | Stakeholders dealing with ICT Professional competences from multiple perspectives, in particular:  
  — ICT service, demand and supply companies;  
  — ICT professionals, managers and human resource (HR) departments;  
  — vocational education institutions and training bodies including higher education;  
  — social partners (trade unions and employer associations);  
  — professional associations, accreditation, validation and assessment bodies;  
  — market analysts and policy makers; and  
  — other organizations and stakeholders in public and private sectors across Europe. | Stakeholders dealing with Informatics Higher Education from multiple perspectives, in particular:  
  — 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 | • Generic criteria for Programme Assessment and Accreditation  
  • Programme outcomes for accreditation:  
    — 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 | "Competence is a demonstrated ability to apply knowledge, skills and attitudes for achieving..." | "Programme Outcomes can be described as quality standards for knowledge, skills and competences..." |
### (educational context)

observable results”.

“This is a holistic concept directly related to workplace activities and incorporating complex human behaviours…”

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 intended learning outcomes for the programme are easily accessible to the relevant stakeholders…”

“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”

### levels

“Five e-Competence proficiency levels […] focus specifically on “demonstrated abilities” in practical work experiences.”

“… levels can be defined through three dimensions:

1. Autonomy […]
2. Context complexity […]
3. Behaviour here representing an observable outcome…”

Two Programme levels:

- First Cycle graduates should be able to formalise 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

Terminology used for outcomes: awareness, complex
Bibliography

[1] EN XXXX, Title of reference

under development.