

		<p>Co-funded by the Erasmus+ Programme of the European Union</p> 
<p>eCF Council Project: e-CF Multistakeholder partnership driving ICT professional up-skilling and pick up of employability</p> <p>WP4 DLV4.2 - eCompetence Learning Units Second set</p>		
<p>Project Number: 562364-EPP-1-2015-1-IT-EPPKA2-SSA</p>	<p>Dissemination Level: Public</p>	

Document history

Author	Date	Version	Description
FPM	18/12/2017	V 1	First draft and index of the document
FPM	11/1/2018	V2	Adjustment on Introduction and overall structure
FPM	12/1/2018	V3	Adding text in Structure
FPM	24/1/2018	V4	Review on the Main steps and tasks
FPM	5/2/2018	V5.3	Additions and adjustment in chapter DESIGN
FPM	12/2/2018	V5.6	Additions in ECVET paragraph
FPM	21/2/2018	V5.7	Adding last version of competences of the first set in Annex and of A.3 and C.4 of the second set
FPM	20/03/2018	V5.8	Adding last version of last 7 competences of the second set: A.5, A.9, B.5, B.6, C.2, D.1, E.6
FPM	2/4/2018	V5.9	Updates on Focus Groups
FPM	23/4/2018	V6.0	Updates on ECVET paragraph
FPM	30/4/2018	V6.1	Insertions of remaining Annexes and Conclusions
FPM	4/5/2018	V6.2	Adjustment on the Conclusion and updates on the reference list
FPM	15/5/2018	FIN	Rereading and final formatting
FPM	26/5/2018	FIN2	Index paging bug fixed

Support and disclaimers

This project has been funded with support from the European Commission.

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Abbreviations

e- CF	e-Competence Framework
e- CQP	e-Competence Qualification Profile
ECVET	European Credit system for Vocational Education and Training
IS	Information System
LU	Learning Unit
LO	Learning Outcome
LC	Learning Content
WP	Work Package

Executive summary

This document shows the final results obtained within the Work Package 4 (WP4) “Learning Unit Set”.

It reports the second Learning Units (LUs) Set regarding the additional nine e-Competences Qualification Profiles developed in WP3 “Vocational Qualification and Certification Standard”, as identified in accordance with the market needs and the ICT Professionalism Transnational Frame outlined in WP2.

The competences designed into Learning Units and reported in the document are the following:

- [A3] Business plan development
- [A5] Architecture design
- [A9] Innovating
- [B5] Documentation production
- [B6] Systems Engineering
- [C2] Change support
- [C4] Problem management
- [D1] Information Security Strategy development
- [E6] Quality management

This report recalls the approach and the methodology used to analyse the e-Competence Qualification Profiles, to plan the Learning Units and to develop the Learning Outcomes and the Learning Content as already described in DLV4.1. Furthermore, this document sums up the choices and the decisions concerning the evidences. Such evidences have a double value in the present work; on one hand, they act as a reference of practical achievement, such as products and output to be pursued in order to attain an intended Learning Outcome (prospective view); on the other hand, they help identifying representative proofs to demonstrate the achieved Learning Outcome during an assessment or validation process (retroactive view).

Moreover, this report includes the discussion carried out during the project activities on the ECVET system, namely its implications concerning the credit assignment to the e-CQP Learning Units.

The 15 competences and the related Learning Units herein reported are the final outcome of the WP4 design. A final peer-review helped exploiting all the feedback and the methodological improvement emerged during the first and second LUs set development. Further adjustments took into account the feedback by external experts provided during dedicated workshops and follow-ups.

This result must be read as a modular structure and a set of validated information able to frame a comprehensive and significant learning path based on Learning Outcomes related to given e-CF competences. Notwithstanding, only its actual use while designing or attending learning experiences and during validation activities will help with keeping it alive and up-to-date.

Introduction

As already described in DLV4.1, the WP4 “Learning Unit Set” aims at developing a set of e-CF3.0-based Learning Units (LUs). These are framed to implement each of the e-Competence Qualification Profiles, as identified and designed in WP3 “Vocational Qualification and Certification Standard”, that is to translate them into a modular system of information and contents that shows how to achieve a competence through a learning path, whatever its nature (formal or non-formal) and whenever it happens (in the past or in the future). The information that the Learning Units intend to provide concerns the following:

- The Learning Outcomes (LOs), according to the targeted proficiency levels (coherently with eCF dimension 2 and 3);
- The Learning Content (coherently with eCF dimension 3 and 4);
- The evidences, that are a set of proofs needful to assess in a reliable, transparent, and valid way whether the intended Learning Outcomes are actually achieved;
- The potential assignment of credits to a LU that could facilitate the transfer of the learning achievement across Europe.

It is important to note that the present work intends to develop Learning Units able to address both the needs of a learner, willing to enhance ICT skills, and of a VET centre, whose purpose is to design a specific vocational programme. Moreover, the Learning Units aim at establishing a reference framework for both training/learning purposes and for recognition and further certification of prior learning, such as job and life experiences, based on the information provided by the evidences proposed. As such, the set of Learning Units is the basis for framing the pilot joint qualification programme and the related training and certification path, as planned in WP5 “Joint Vocational Qualification Design and Pilot Implementation”.

Methodological approach

The Learning Unit Set: a challenging work of integration

From a methodological point of view, the present WP works in tight collaboration with WP2 “ICT Professionalism Transnational Frame”, WP3 “Vocational Qualification and Certification Standard”, and WP5 “Joint Vocational Qualification Design and Implementation”. A continuous exchange of information is necessary to keep an internal coherence between the theory and the practice, namely among the proposed standard, its effective employment into real vocational education and training contexts and the real market needs. Figure 1 below shows the WP4 process and its interconnection with other WPs.

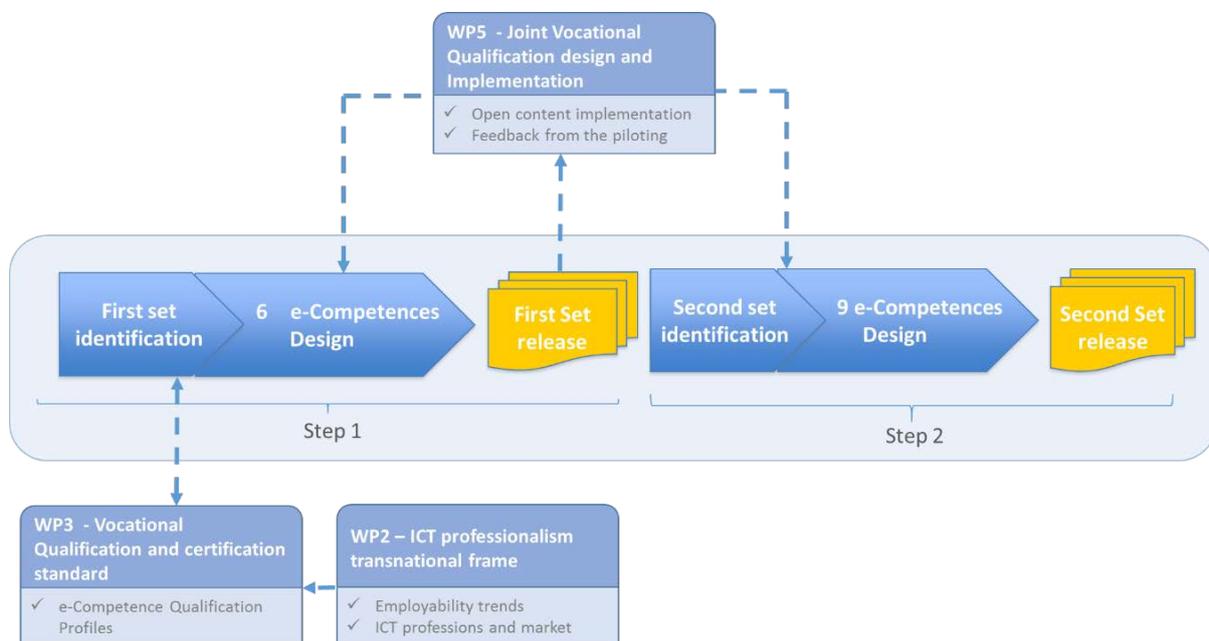


Figure 1 - WP4 and its relation with the other Work Packages

WP2 and WP3 provide the needed input in terms of e-Competences Qualification Profiles (e-CQP) and the overall sectorial context they refer to. In other words, they deal with the e-Competences that ICT market and employability trends mostly require, and with the proposed vocational qualification and certification standard of reference. WP5 experiments WP4 outcomes, namely it implements the needed contents and creates the pilots to test and validate the provided LU sets and the method used to design them.

The mutual interaction among WPs determines three important feedback cycles. The first cycle enables the e-Competence Qualification Profile (e-CQP) fine-tuning based on the revision provided during the Learning Unit design. The second cycle underlines the review of the Learning Unit content following the feedback emerged during the pilot. The third cycle highlights the input coming from the testing in terms of process that may affect the LU design.

The latter refers, for example, to how to identify and formalise the evidences and how to exploit the Learning Outcome approach so that they can be actually used in a learning validation process, meaningful and profitable for both users and operators.

To make explicit the mutual interaction among the project WPs ensures the integration of the LU Set development within the overall purposes of the project.

There is another integration challenge that is inherent to WP4 and refers to the physiological differences among competences. Some are specific and technical, others are managerial. Some include a wide range of proficiency levels, from practicalities (e1, e2) up to strategic implications (e4, e5); others are specifically characterised by a narrow and homogeneous range of proficiency. All these differences require a deep and keen work of continuous cross internal review to guarantee homogeneity in the design choices. The e-competences developed into Learning Units during the first and second set aim at representing such differences.

The following table shows the distribution of the 15 competences over the 5 Areas (Plan, Build, Run, Enable, Manage) and the 5 proficiency levels included in the eCF standard.

Dimension 1	Dimension 2	Dimension 3				
5 e-Comp. Areas (A-E)	40 e-Competences identified	e-Competence proficiency levels e1 to e5, related to EQF levels 3-8				
COUNCIL Learning Unit Set 1+2		e-CF levels identified per competence				
		e1	e2	e3	e4	e5
A. PLAN						
	A.1. IS and Business Strategy Alignment					
	A.2. Service Level Management					
	A.3. Business Plan Development					
	A.4. Product /Service Planning					
	A.5. Architecture Design					
	A.6. Application Design					
	A.7. Technology Trend Monitoring					
	A.8. Sustainable Development					
	A.9. Innovating					
B. BUILD						
	B.1. Application Development					
	B.2. Component Integration					
	B.3. Testing					
	B.4. Solution Deployment					
	B.5. Documentation Production					
	B.6. Systems Engineering					
C. RUN						
	C.1. User Support					
	C.2. Change Support					
	C.3. Service Delivery					
	C.4. Problem Management					
D. ENABLE						
	D.1. Information Security Strategy Development					
	D.2. ICT Quality Strategy Development					
	D.3. Education and Training Provision					
	D.4. Purchasing					
	D.5. Sales Proposal Development					
	D.6. Channel Management					
	D.7. Sales Management					
	D.8. Contract Management					
	D.9. Personnel Development					
	D.10. Information and Knowledge Management					
	D.11. Needs Identification					
	D.12. Digital Marketing					
E. MANAGE						
	E.1. Forecast Development					
	E.2. Project and Portfolio Management					
	E.3. Risk Management					
	E.4. Relationship Management					
	E.5. Process Improvement					
	E.6. ICT Quality Management					
	E.7. Business Change Management					
	E.8. Information Security Management					
	E.9. IS Governance					

Figure 2 - The Competence Set developed into Learning Units

Most of these competences refer to the main ICT process, from the planning to the running phase. They cover a wide range of sounding competences needed by different profiles and they offer a variety of cases to be analysed during the Learning Units development.

A smaller set implements the remaining 4 competences that are related to the transversal ICT process phases Enable and Manage. They were chosen by taking into account two main issues, namely their relevance in roles dedicated to either ICT Quality or Information Security and the increasing responsibility at either managerial (E6; E8) or strategic level (D1; D2).

The process, the main steps and the tasks

The Learning Units development has been articulated in two main steps, respectively devoted to the Set 1, with the first 6 competences, and the Set 2 with the remaining 9 competences.

The deliverable DLV4.1 has already explained the work and the activities concerning the Set 1. The second step has been planned to complete the work on the remaining 9 competences by exploiting the feedback from piloting and fine-tuning the Learning Units design methodology.

Similarly to Step 1, the second step moved through the following five tasks:

1. To select the e-competences for the set 2
2. To verify and refine the Learning Unit structure
3. To design and implement the Learning Units
4. Internal peer reviewing
5. Validation of the methodological approach

1. Selection of the second competence set

The choice of the remaining nine competences followed different criteria. On one hand, it aimed at completing methodologically the choices previously made for Set 1. This led to the introduction of at least two competences (C2, C4) from e-CF Area C (Run) to complete the exploration of competences referred to the main ICT process. Moreover, given the importance attributed to ICT Quality and Information Security, the work aimed at fully addressing both the strategic and the management level. For this, the competences D1 and E6 were added to complement the ones previously designed, i.e. D2 and E8.

On the other hand, the additional competences were selected to cover as complete as possible one e-CF area at least. So far, three more competences within the e-CF Area A (Plan) have been added, thus including six out of the nine competences of this area. More specifically, Business Plan (A3), Architecture Design (A5), and Innovating (A9) were considered as highly significant for an ICT market quickly changing and evolving. Similarly, two more competences were chosen in the e-CF Area B (Build), achieving its half coverage.

A final criterion concerned the coherence with the feedback from external experts and actors. Direct contacts with relevant stakeholders during the follow-up sessions and the surveys provided important feedback and points of view. In view of other European project results, such as e-Skills Match [17], it was also possible to get valid information on the interest of some

competences such as A3 Business Plan Development, B5 Documentation Production and C4 Problem Management.

Overall, hereunder is the list of the competences finally included in WP4.

As already reported in deliverable DLV4.1, the first set includes the following competences:

- [A1] IS and Business Strategy Alignment
- [A6] Application Design
- [A7] Technology Trend Monitoring
- [B3] Testing
- [D2] ICT Quality Strategy Development
- [E8] Information Security Management

The second set of competences exploited in the present deliverable DLV4.2 includes the following ones:

- [A3] Business plan development
- [A5] Architecture design
- [A9] Innovating
- [B5] Documentation production
- [B6] System Engineering
- [C2] Change support
- [C4] Problem management
- [D1] Information Security Strategy development
- [E6] Quality management

5 e-CF Areas (A-E)	15 e-competences	Designer	Reviewer
COUNCIL Learning Unit Set 1+2			
A. PLAN			
	A.1. IS and Business Strategy Alignment	FPM	bITa
	A.3. Business Plan Development	CEFRIEL	ESICEE
	A.5. Architecture Design	ADFOR	UAH
	A.6. Application Design	ADFOR	UAH
	A.7. Technology Trend Monitoring	bITa	FPM
	A.9. Innovating	bITa	ESICEE
B. BUILD			
	B.3. Testing	UAH	CEFRIEL
	B.5. Documentation Production	UAH	ADFOR
	B.6. Systems Engineering	CEFRIEL	ADFOR
C. RUN			
	C.2. Change Support	ESICEE	UAH
	C.4. Problem Management	ADFOR	FPM
D. ENABLE			
	D.1. Information Security Strategy Development	ESICEE	bITa
	D.2. ICT Quality Strategy Development	ESICEE	ADFOR
E. MANAGE			
	E.6. ICT Quality Management	UAH	CEFRIEL
	E.8. Information Security Management	CEFRIEL	ESICEE

Figure 3 - The first and second set of ICT competences and partners in charge of.

Each competence of the set was assigned to partners, by taking into account especially their internal know-how and their core experience. Figure 3 shows the designer and the reviewer for each competence developed in WP4.

Concerning the second set, the partners agreed in dividing the activities in two parts. Firstly A3, A9, B5, C2, and C4 competences were developed. Afterwards, the partners focused on the remaining A5, B6, D1, and E6 competences.

Figure 4 below shows the Competence Set 1 and Set 2 in different colours, respectively in **dark** and **light** yellow. In **green**, the remaining eCF competences that have not been developed in the present work.

Dimension 1	Dimension 2	Dimension 3				
5 e-Comp. Areas (A-E)	40 e-Competences identified	e-Competence proficiency levels e1 to e5, related to EQF levels 3-8				
COUNCIL Learning Unit Set 1+2		e-CF levels identified per competence				
		e1	e2	e3	e4	e5
A. PLAN						
	A.1. IS and Business Strategy Alignment					
	A.2. Service Level Management					
	A.3. Business Plan Development					
	A.4. Product /Service Planning					
	A.5. Architecture Design					
	A.6. Application Design					
	A.7. Technology Trend Monitoring					
	A.8. Sustainable Development					
	A.9. Innovating					
B. BUILD						
	B.1. Application Development					
	B.2. Component Integration					
	B.3. Testing					
	B.4. Solution Deployment					
	B.5. Documentation Production					
	B.6. Systems Engineering					
C. RUN						
	C.1. User Support					
	C.2. Change Support					
	C.3. Service Delivery					
	C.4. Problem Management					
D. ENABLE						
	D.1. Information Security Strategy Development					
	D.2. ICT Quality Strategy Development					
	D.3. Education and Training Provision					
	D.4. Purchasing					
	D.5. Sales Proposal Development					
	D.6. Channel Management					
	D.7. Sales Management					
	D.8. Contract Management					
	D.9. Personnel Development					
	D.10. Information and Knowledge Management					
	D.11. Needs Identification					
	D.12. Digital Marketing					
E. MANAGE						
	E.1. Forecast Development					
	E.2. Project and Portfolio Management					
	E.3. Risk Management					
	E.4. Relationship Management					
	E.5. Process Improvement					
	E.6. ICT Quality Management					
	E.7. Business Change Management					
	E.8. Information Security Management					
	E.9. IS Governance					

Figure 4 - Competence Set 1 and Set 2

2. LUs structure definition

Figure 5 below shows the general structure of a Learning Unit. This was already described in DLV4.1 – Chapter 4. However, following the feedback cycle provided after Step 1, few adjustments were identified.

A first one concerned the terminology used. Each Learning Unit designs a set of Learning Outcomes. These were previously named Learning Objectives, especially to avoid any ambiguity with the Learning Outcomes as cited in the related e-Competence Qualification Profile. Yet, in the final version of the LU structure, it was decided to restore the term *Learning Outcome* and solve the overlapping with the e-CQP frame. The choice mainly aimed at keeping a clear and full alignment with the intended purposes as explained in the European Handbook for Designing and Writing Learning Outcomes [9].

LU Title	<input type="text"/>		
Description	<input type="text"/>		
	E-CQP	Proficiency levels (*)	ECVET
	<input type="text"/>	<input type="text"/>	<input type="text"/>
	Knowledge	Skills	
	<input type="text"/>	<input type="text"/>	
Learning Outcomes	<input type="text"/>		
Learning contents	<input type="text"/>		
Evidences (*)	<input type="text"/>		
Resources	<input type="text"/>		

Figure 5 - The Learning Unit structure

A further adjustment concerned the field “Evidences”. This was logically linked to the proficiency level, as shown in Figure 5 with an asterisk. The modular approach of the LUs implies that a Learning Unit uniquely identifies Learning Outcomes and Learning Content.

Notwithstanding, the Learning Unit might be used at different proficiency levels, as shown in the LU plan. As such, evidences become a key issue that may highlight such a different use of the LU. Therefore, this field was logically linked to the Proficiency Level field.

3. LUs design

As finally framed during the first set development, the main characteristics of a Learning Unit are homogeneity, self-standing and modularity. In other words, the following conditions and premises must be considered:

- a) The Learning Unit represents a self-explicating and stand-alone learning package
- b) The Learning Unit originates by a specific e-Competence Qualification Profile and refers to a set of its Understanding and Skills so to define a homogeneous subject within the competence;
- c) A Learning Unit can be referred to other competences as well. Whenever cross-relations emerge, differences and similarities should be evaluated to verify potential adjustment;
- d) A Learning Unit can refer to one or more competence proficiency levels;
- e) Each competence proficiency level draws up a specific set of Learning Units that enables to identify its complexity and an overall learning experience to achieve it.

During the first set development (D4.1), a different solution was tested for the definition of B3 competence. This different approach required identifying the Knowledge, the Skills, and the Learning Outcomes by keeping the coherence with the various proficiency levels referred by the LU. Anyway, the task resulted quite difficult to manage and it was decided to keep a certain level of approximation by focusing only on the modular approach as an opportunity to represent the complexity. Actually, during the second set development, the LU design introduced an internal mechanism to better represent the variable linked with the context complexity addressed by the LU, without increasing too much the complexity of the LU itself. As the proficiency level is strictly linked to the competence in action in a certain context, the evidences proposed may reflect it. Thus, it was accepted to specify them coherently with the proficiency levels addressed, whenever possible.

The steps to design the Learning Units were the same followed to design the first set of LUs, as already described in D4.1, and they are hereinafter recalled.

The first step moves to identify the *Learning Unit Plan*, that is to say, the set of all the Learning Units that are related to a competence. For this, each Learning Unit, included in the competence, reports the title, the subset of Skills and Knowledge (named Understanding and Ability, whenever not specified in the eCF standard) and the related proficiency levels.

The second step of the task moves to identify the following components of each Learning Unit:

- The *Learning Outcomes*: the learning achievements the Unit addresses. They logically aim at focusing on the *competence in action*. Therefore, they highlight the actions that a learner would be able to do for pursuing specific objectives in a real context. They are phrased also by taking into account the European Guideline finally published [9]

- The *Learning Content*: the topics that the Unit deals with and that could be, for example, included in a training course.
- The *Evidence examples*: the proofs that could demonstrate at what extent the learner has achieved the intended Learning Outcomes when acting in field the part of competence underpinned by the Learning Unit. They are specified by the proficiency level.

The Learning Content is then implemented in the following work package (WP5) into Open Resources for the training platform and the pilots. The *resources* belong to the following three main categories: new COUNCIL Open Educational Resources (CAT. 1); existing resources by the partners, that have been shared and adjusted for the COUNCIL pilot training (CAT. 2); and external resources from the literature and the web (CAT. 3).

The LU design is critical and requires a continuous work of feedback and adjustment to keep coherence at three levels, namely with the related e-CQP (WP2), with the other Learning Units developed within the same competence and with the Learning Units designed in the other competences. The main criticalities concern the following issues:

- The Knowledge and the Skills as well as the Understanding and the Abilities should be complete, sufficiently detailed, and significant to outline the LU domain against the whole competence and the other LUs identified.
- The Learning Outcomes set should cover all the important competence aspects underpinned by the LU.
- The Learning Outcomes within a Learning Unit should show a comparable grain (i.e. level of specialisation).
- The LU Plan should be well balanced; so far the Learning Units should show a comparable grain.
- The different competences should develop items (LUs, LOs) of mutual comparable grain.

The LU design of the second competence set kept these challenges up, even though the solutions finally adopted still showed a margin of improvement. Such improvement has to be mostly understood in terms of level of details that one is able to set in the LU items. This becomes easier when the LU is employed in a real training context that provides details and specific requirements. The feedback cycle, coming from WP5 through the content implementation and the training pilots delivery, provided information useful to refine and fine-tune the concerned Knowledge and Skills as well as the clearness of the Learning Outcome to achieve. Anyway, it also shows how the LU design itself may offer just a reference frame that could be valid for many different situations. When a training action is required, the content and details need to be declined and implemented accordingly with the specific context.

One more issue concerns the potential credits (ECVET) referred to each Learning Unit. The pilot phase (WP5) provides useful information to quantify the duration of learning activities, even though it is mostly linked with the specific experimentation scenario. Moreover, the pilots can either partially cover the competence Learning Units or they can deal with only a specific competence proficiency level, specifically a subset of the overall competence Learning Unit set. Therefore, at this stage, the credits assignment is to be considered an approximate

quantification that may benefit from further testing. Notwithstanding, the present work results provide a useful starting point for valuing the effort in terms of learning time required to achieve the learning outcome specified in the Learning Unit.

4. Monitoring, peer-reviewing and focus groups

As already described in DLV4.1, besides the project procedure for reviewing the official deliverables and outcome, Work Package 4 introduces an internal mechanism for mutual supervision and peer review.

LEARNING UNIT (LU) PLAN	
1	Learning Units are clearly and objectively referred to a set/subset of Skills and Understanding of the related Competence.
2	Their title doesn't coincide with an Understanding's or Skill's one
3	The identified set of LUs completely cover all the Understanding, Skills and all that is needed to learn and act that competence
4	Each LU reply to the requirement of homogeneity, self-explicating resource, modularity
5	Each LU is clearly linked to one or more proficiency levels
6	Each LU is generally described and clearly introduced
LEARNING OBJECTIVES (LO):	
7	The title always contains a verb , as the LO replies to a specific "problem" a learner should be able to face and solve if the learning outcomes of the LU are actually acquired.
8	The set of identified LOs entirely covers the learning outcome of the LU (<i>exhaustivity</i>)
LEARNING CONTENT (LC):	
9	Any content identified for the LO defines a specific topic that is needful for facing the "problem solving" proposed by the LO
10	The content doesn't report any "Exercises" or any other resource that don't directly deal with/define a specific topic concerning the LO.
GENERAL DESCRIPTION OF EACH LU:	
11	It includes the description of the LOs contained in the LU and their main contributions to the LU.
12	The "main contributions" really increase the comprehension on what is the added value of the LO against the overall LU (eg <i>what does it provide to the learner? How does it help the learner increasing his/her performance in acting the related competence ?</i>)
EVIDENCES:	
13	They provide a clear example of proof that a learner can think to produce for further assessment
14	The set of identified evidences are significant and entirely cover the LU's scope.

Figure 6 - Peer review checklist form

To assure a common way of reviewing, the task provides a checklist of key issues as showed in Figure 6 above. At the completion of a Competence LU design, the task requires to formally

fill in the checklist form and to evaluate each item included according to a three-value scale (Yes, No, Partially) that denotes how far each indicator is effectively matched. The form allows to add comments and notes at use of the peer reviewer and details addressed to the reviewed.

The task assigned a reviewer for each competence. The assignment criteria took into account both the partner's expertise in the competence and the mutual advantage while collaborating and exchanging good practices in the design task. Moreover, to achieve a level of sharing as high as possible among the partners, the assignment criteria also suggested that a reviewer changed couple when reviewed. This helped ensuring a wider range of sharing and a level of homogeneity as high as possible across the overall design team. Figure 3 shows the pairs assigned in the peer reviewing tasks.

5. Validation of the methodological approach

In order to monitor and keep coherence with the market and the actual external needs, the WP4 planned to organise a Focus Group in each country, by engaging a restricted team of external experts and stakeholders.

Together with the outcomes emerging from the joint-pilots, the task implemented a feedback cycle and provided information to fine-tune the Learning Unit design and to validate the methodology adopted coherently with the overall process already shown in Figure 1.

The e-CF founding principles underline the fact that “Competence is a durable concept and, although technology, jobs, marketing terminology and promotional concepts within the ICT environment change rapidly, the e-CF remains durable requiring maintenance approximately every three years to maintain relevance” [5]. So far, this validates one of the fundamentals of the Learning Unit design due to the fact that it is strictly related to the e-CF standard. Nevertheless, the methodological approach to derive the Learning Units from the e-CQP needs to be endorsed following the contribution of the externals that are able to evaluate the outcomes in terms of Knowledge, Skills, Learning Outcomes, Contents, and expected Evidences. Therefore, the main objectives pursued with the Focus Groups were the following:

- Verifying the clearness and significance of the Learning Units designed coherently with the Competence to be trained
- Getting information, comments, and feedback on the set of competences taken into account by the LU design and on their completeness and content update.

The focus groups were carried out after the first competence set release. Their outcomes enabled small adjustment so to validate the first set and to approach the second set design on a stronger methodological basis. In some cases, a further peer review completed the finalisation work on the first competence set.

The national focus groups were held in Italy, Spain, Bulgaria, and the Netherlands. Time and activities were planned according to the local needs and requirements. Figure 7 below shows an overview of the national focus groups. These were organised in different moments (October 2017 – March 2018) and they were addressed to externals such as experts, professionals, training institutions, companies and social parts.

Country	Partners	Nr. Participants	Type of participants	Place and Date
Italy	FPM, ADFOR, CEFRIEL	14	Professionals, Companies, worker organisations, consulting organisations	Milan, October 9, 2017
Spain	UAH jointly with Federación de Servicios, CCOO (Trade Union) and DG Formación, Consejería de Economía, Empleo y Hacienda	5	IT VET providers, authorities qualification units, senior professionals specialized in HR profiles in IT sector	Online hosted by DG Formación, Consejería de Economía, Empleo y Hacienda
Bulgaria	ESICEE, NAVET, BASSCOM	7	IT VET providers, training developers and designers, trainers	Sofia, March 15, 2018
The Netherland	blTa	4	Professor and content specialist, course developer, certification/courseware analyst and vocational teacher	Bloemendal, November 30 and Decemeber, 2017

Figure 7 - National Focus Groups

Each country had a margin of flexibility in planning the focus group activities, coherently with the real target of participants achieved.

The Italian team proposed a format to be shared among the WP4 team.

The format planned activities to be carried out either individually or in small groups according the local requirements. The activities are articulated into the following three main parts leading the participants logically through the WP4 methodological process:

- Part A - Choice of the competence and related LU plan design
- Part B - Single LU design in coherence with the competence analysed
- Part C - Identification of clear and significant evidences.

The results underlined a general agreement on the consistency and comprehension of the Learning Units and the Learning Outcomes formulation. In many cases, the work highlighted small adjustment that were included for improving the single competence design. Overall, a good part of participants declared not to be familiar with the eCF standard. Some difficulties concerned how to compare the qualification levels with their usual educational levels and how Learning Units may actually mix different proficiency levels. In general, the shift from a knowledge to a Learning Outcome approach is not to be taken for granted and it highly benefits from a deeper exploration and discussion together with the participants. Similar considerations regard the evidences. The participants agreed that the most relevant ones to prove the actual competence achievement shall come from the work experience. It best provides proofs of the Learning Outcomes accomplished. Annex IV – Focus Groups includes the format proposed.

Design of the e-Competence Learning Units

The Learning Unit design intends to provide full information to approach either a formal training or a competence recognition process in a comparable way. The following paragraphs include some modifications to the preliminary version of the approach as already reported in DLV4.1. The pictures and examples reported are mostly excerpts from the second competences set.

LU plan

As described in DLV4.1, the LU plan sets the list of Learning Units related with the specific e-Competence. Therefore, it plays two major roles. On one hand, it has to define how many units can be reasonably associated to a specific Competence to represent exhaustively all the Learning Outcomes and the domains addressed (horizontal dimension). On the other hand, it has to identify the Learning Units' nature to cover all the levels and the complexity of learning (vertical dimension).

The plan specifies the LU titles and the competence proficiency levels they refer to. This first step seems to identify few items, but it is the result of a complex analysis of the e-CQP elements. It had to manage a high quantity of data and, above all, to evaluate many cross references within the specific e-CPQ itself and across the other competences as well.

As expert of the competence in charge, each partner approached the task, firstly, by exploiting its own experience and specialist knowledge. Notwithstanding, the step shared some common suggestions and initial criteria to carry out the task in a homogeneous, solid and grounded way.

Overall, the LU plans show a case system that can be analysed and argued according to the competence nature.

- a) *Inclusive set*: the competence identifies a set of Learning Units in a progressive way. The highest proficiency level is associated to the whole Learning Unit set designed and it includes the previous proficiency levels' ones, as shown in Figure 8 below. A major part of the competences falls within this case. They mostly belong to either the e-CF area A (Plan) or they are related to the management or the strategy development, present as well in areas C (Run), D (Enable), and E (Manage). This seems to prove that a common approach for the LU design is possible. The overall outcome benefits from a good mutual coordination and reviewing that assures homogeneity.
- b) *Uniform set*: the Learning Unit set is equal despite differences in the proficiency level, as shown in Figure 9. This occurred for a few competences, exclusively characterised by the two highest e-CF levels (e-4, e-5). This fact highlights the difficulty to identify significant differences in the Knowledge and Skills domains and, above all, in the Learning Outcome definition when dealing with lead professionals and officers who practice innovation and strategic development.
- c) *Disentangled / freestanding set*: each competence proficiency level is characterised by a subset of the overall Learning Unit set and it doesn't require to include the previous ones. Therefore, there is no progression in the subsets from the lower up to the higher e-CF levels. This suits the cases where the raise of proficiency level clearly implies

changes in the Knowledge and Skills domains as well as in the pursued objectives while practicing the competence. An example is B3.Testing, shown in Figure 10 below.

C.4._Problem Management						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Problem Management process and activities					
LU 2	Problem Management IT tool types					
LU 3	Problem Solving methods and techniques					
LU 4	Problem Management process evaluation and optimisation					

 not present in the eCF 3.0 standard

Figure 8 - LU plan: example of an “inclusive set” approach

A.9 Innovating						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Why Innovation					
LU 2	Positioning innovation in the organisation					
LU 3	Leading innovation					
LU 4	Systematic approach to innovation					
LU 5	New emerging technologies and business impacts					

 not present in the eCF 3.0 standard

Figure 9 - LU Plan: example of a "uniform set" approach

B.3 Testing						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU1	Fundamentals of Testing					
LU2	Testing Throughout the Software Life Cycle					
LU3	Testing Design Techniques					
LU4	Tool Support for Testing					
LU5	Test Management					

 not present in the eCF 3.0 standard

Figure 10 - LU Plan: example of a "disentangled set" approach

In the *inclusive set* case, there are Learning Units that deal with transversal contents and topics, potentially valid for any proficiency level; moreover, there are Learning Units very specialised for the highest proficiency levels (e4, e5).

In the *uniform set* case, the designed e-CF levels seem apparently identical. Differences are likely to concern the kind of evidences that a learner may produce to prove the actual experience and the results achieved. Anyway, it can be also possible that the design requires further efforts to pinpoint the significant differences in terms of Learning Outcome.

One more comment concerns the modular approach potentialities as supposed in the premises mentioned in the previous chapter on methodology. At the end of the second set, the LU plans showed few examples where a Learning Unit was referred to more than one competence. It is the case of the LU6 and LU10, designed in the A1 - IS and Business Strategy Alignment. Such Learning Units were respectively included in the A9 - Innovating and A7 - Technology Trend Monitoring as well. This outcome is due to the fact that the two Learning Units deals with general aspects on strategy, business and ICT market that are fundamental for leading professionals and officers. In fact, A1 - LU6 is titled “New emerging technologies and business impact” and A1 – LU10 title is “Analysis of future developments of business, customer needs, and technology application”.

LU structure

Learning Outcomes (LOs)

The Learning Outcomes refer to what a learner should be able to face once s/he has finally achieved a part of competence related to a Learning Unit. This requires him/her “*to apply knowledge, skills, and attitudes for achieving observable results*”¹. As such, it can be also said LOs identify tasks and the work-related objectives that the learner might be asked to accomplish when acting a specific competence in an actual context. From the learner’s perspective, a Learning Outcome identifies the intended outcome a learner should expect to address when approaching a specific Learning Unit.

At an operational level, a Learning Outcome is “a statement of what an individual learner knows, is able to do, and understands following completion of a learning process, which is defined in terms of knowledge, skills, and competence” [7]. In the present work, a Learning Unit identifies the learning process. An alternative formulation can also say that a Learning Outcome is defined as “a set of knowledge, skills, and/or competences an individual has acquired and/or is able to demonstrate after completion of a learning process, either formal, non-formal, or informal” (Cedefop, 2014). The two definitions stress respectively the intended and the actually achieved Learning Outcomes. Similarly, the task to develop appropriate Learning Outcomes for the Unit responds to the need to address both learners and trainers in two different moments. On one side, it addresses the moment when they come across with a new learning experience or course to be designed, and the expectations need to be clearly formulated. On the other, it addresses the moment when they need to self/evaluate prior

¹ It refers to the eCF standard’s definition of competence: “ Competence is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results”.

learning or evenly assess it for a formal recognition. So far, a reference framework of learning achievement is necessary as well.

Moreover, both the learning and teaching process should be aligned with the proposed statements. In fact, on one hand, LOs should assist teachers in identifying and combining teaching methods as well as promoting reliable and valid assessment based on clear and shared criteria. On the other hand, the LOs' statements should help learners to identify and reflect on their personal expectations, to shape personal learning paths, to link them with the competences and abilities actually used in a real context.

Once the LU Plan is designed in compliance with the e-Competence Qualification Profile, each Learning Unit refers to a minimum set of specific e-CQP Knowledge, Understandings, Skills and Abilities. Afterwards, such a set can be increased accordingly with the following detailing steps.

As the Learning Unit identifies a specific learning process, the additional step aims to specify in details the Learning Outcomes for each LU. This is a critical point as the development of clear, comprehensible and significant LO statements is expected to have a deep impact in both the training (design and delivery) and the learning evaluation. Moreover, identifying and formulating appropriate LOs requires here to clarify as far as possible the “horizontal dimension”², that's, the object and the scope of the intended learning; therefore, it results fundamental and functional in order to identify the Learning Content of the Unit.

The development of the Learning Outcome statements took into account the Bloom taxonomy, the suggested action verbs [8], and the recent guidelines by Cedefop for defining and writing Learning Outcomes for VET [9]. As a rule of thumb, the Learning Outcome syntax requires to combine the subject (the learner) with an action verb, an object, and a context as shown in Figure 11 below.

The basic structure of learning outcomes statements...			
... should address the learner.	... should use an action verb to signal the level of learning expected.	... should indicate the object and scope (the depth and breadth) of the expected learning.	... should clarify the occupational and/or social context in which the qualification is relevant.
Examples			
The student...	...is expected to presentin writing the results of the risk analysis	...allowing others to follow the process replicate the results.
The learner...	...is expected to distinguish between...	...the environmental effects...	...of cooling gases used in refrigeration systems.

Source: Cedefop.

Figure 11 - The basic structure of learning outcomes statements

² Cedefop, “Introducing the horizontal dimension of learning outcomes statements is about clarifying the object and the scope of the intended learning, notably by specifying the learning domains being addressed.”[16]

In the present work, the vertical dimension of the Learning Outcomes is implicitly included in the proficiency levels addressed by the Learning Unit. The Learning Outcome statements don't report specific indications on the level and complexity of learning. The first set development experimented a more sophisticated approach on B3 - Testing to modulate Learning Units accordingly with the proficiency level addressed. In any Learning Unit included in the competence, a colour code distinguished Knowledge, Skills and Learning Outcomes coherently with the potential related e-CF level, as shown in Figure 12 below. However, the method revealed to be quite complex for partners to manage it in a homogeneous way. Moreover, it might impact on the modular approach of the Learning Unit. In fact, Learning Outcomes would be strictly linked to the e-CF levels of the specific competence and that would hardly allow to refer them to other potential competences. For these reasons, it was finally decided to adopt the simplified LO definition framework that ensures a greater flexibility.

COMPETENCE:	B.3_Testing
LEARNING UNIT:	LU 1 - Fundamentals of Testing
General description:	This LU aims at providing a general idea of what is testing and a explanation of the main testing principles and processes. The psychological factors influencing testing are also described.
Learning Objectives The learner will be able to...	
B3_LU1_LO1:	Describe key concepts and terms of testing
B3_LU1_LO2:	Explain the importance of testing and the connection to software quality
B3_LU1_LO3:	Explain objectives of testing along life cycle distinguishing between testing and debugging
B3_LU1_LO4:	Explain testing principles
B3_LU1_LO5:	Describe fundamental testing process
B3_LU1_LO6:	Describe the psychological factors which influence testing including differences in mindsets of developers and testers
Color KeyMap	
	Ks, Ss and LOs related to Level 1
	Ks, Ss and LOs related to Level 2
	Ks, Ss and LOs related to Level 3
	Ks, Ss and LOs Related to Level 4

Figure 12 – A changeable set of Learning Outcomes within the Learning Unit

The Learning Outcomes of the competences of the second set are reported in the next chapter.

Learning Content

Once the Learning Outcomes are defined, the related Content can be identified as the specific topics a LU must include and deals with. Such topics provide a learner with the needed conceptual and methodological basis for achieving the related Learning Outcomes. Hence, they concern concepts, principles, theories, and methods. So far, content is strictly coherent with the Knowledge and Skills related to a Learning Unit and its related Competence.

The Learning Contents of the competences of the second set are reported in the next chapter.

Educational Resources

In the DLV4.1, WP4 identified three possible categories to implement resources useful for the learning and training activities within the COUNCIL project.

The resource Cat.1 identifies the resources that the project implements directly. On one hand, it refers to any resource derived from the LU set design, such as the competence LU explanations and the self-evaluation that proposes a Learning Outcome-based questionnaire for the learner to self-assess. On the other hand, they can be presentations, suggested learning activities and other explanations concerning the topics and developed by using a common format designed for the eCF COUNCIL. This content are implemented during the WP5 activities in full compliance with the open educational resources policies and requirement.

The resource Cat. 2 considers any educational resources by partners that can be reasonably retrieved, used and shared in an open standard way within the eCF COUNCIL project training activities. They may require a partial restyling or customisation to match the project requirements, such as employment in local training, language translation, compliance with the potential Intellectual Property Rights. The idea is to exploit as much as possible all the well-done and already implemented materials on the topics. It avoids any kind of redundancy with already existing stuff and it allows exploiting them instead of wasting time and resources to implement them again from scratch.

The resource Cat. 3 gathers all the external references from literature and the web, such as links to articles, OERs, and MOOCs. The external resources may likely cover the needed topics only partially or within wider learning paths. Anyway, some of them might be quite interesting to refer to and local training institutions and individuals themselves can use it flexibly. Regarding this kind of resources, a particular attention is to be paid to issues such as their durability over time, maintenance, translations, and IPR implications. So far, it is needful to carry out carefully the search of external resources and to follow explicit criteria when including them for the project purposes. Some useful criteria are the followings:

- Agreement on websites considered acceptable in terms of validity and quality provision.
- Stability of the links.
- Adhesion to the web policies for open resources.
- Chance to proceed with potential third party for agreement in case of existing IPR.
- Clear statement of responsibility regarding the use of third-party materials.

Overall, the main risks in exploiting external resources concern:

- Case studies can be hardly customised for local and/or specific training purposes. Moreover, localisation could make them invalid, by changing the context premises (e.g. national/legal/ financial considerations)
- Videos, images and sound materials are not easily editable content. Translations, any kind of adaptation and their importation might be not possible
- Materials coming from different sources are hard to aggregate under a common format
- Problems or exercises, which are too much linked to a specific technology, could rapidly change or be outdated in short time. For example, working with a version of language or platform in exercises would lead to several problems in short time: obsolescence,

when a new version is released (which is very common in IT); lack of attractiveness or rejection for those who are not interested, don't use or even are against such technology or vendor. This is the reason why it would be better to think at more general resources; yet, this would lead to a further risk of not providing details that are anyway needful for learning.

The training pilots delivered during WP5 activities show some examples of such resources. For the present work, the educational resource categories are simply included as part of the design.

Assessment and evidences

The assessment should evaluate and formalise how far the Learning Outcomes have been actually achieved. In order to assess in a transparent and objective way, the definition of explicit, clear and sharable criteria is fundamental. So far, the evidences acquire a key importance for proving all that a learner has actually been able to do and to produce against the Learning Outcomes included in the competence.

Recalling the fundamental of the LU structure, a Learning Outcome is a “statement of what a learner knows, understands, and is able to do on completion of a learning process, defined in terms of knowledge, skills, and competence” [6]. Moreover, a Learning Unit aims at guiding a person through a learning path that helps him develop and acquire a competence or a part of it in terms of “a demonstrable ability to apply knowledge, skills, and attitudes in a defined context (education, work, personal, or professional development) for achieving observable results.” [4] In this way, the results and the chance to observe and demonstrate them acquire a crucial importance.

So far, the assessment criteria might be identified by taking into account the *results* a learner can produce along the learning process, being it a formal training or a non-formal working context. Such *results* can even be tangible or intangible, but it is important that they can prove the above-mentioned ability.

Moving on in the reasoning, identifying the assessment criteria may coincide with finding out the minimal requirement that make the *results* acceptable against the Learning Outcomes. This can be also expressed in terms of:

- *Effectiveness*, that is to say the minimum level of an outcome quality (e.g. coherence with the application context, matching with the context requirement)
- *Efficiency*, such as levels of time, cost and resources used for achieving an outcome
- *Necessary and sufficient elements*, such as the use of specific tools/ resources that are essential for acting a competence and producing a *result*.

At present, there is no official reference guideline across Europe that provides a common template and format to create and define assessment criteria in such a way. Good practices are instead available, mainly referred to the evidence-based approach underpinned by the validation of non-formal and informal learning in Europe [12] [13]. So far, it has been decided to adopt a pragmatic approach and to focus on defining the evidences that can prove the results implicitly identified by the Learning Outcomes.

The first hypothesis set to analyse each Learning Outcome and to identify the evidences and the documents that can serve as an example.

As already mentioned above, the evidences are considered as representative for the assessment purposes and they mainly focus on evaluating the ability to demonstrate how far a learner can actually “[...] *apply knowledge, skills, and attitude for achieving observable results*” [4]. Hence, the evidences are likely to come from the real contexts directly experienced by a learner. Moreover, they can include results of exams and tests demonstrating the comprehension and the acquisition of the topics included in a Unit. As such, they may also be the outcome of simulations, exercises, and case study analysis that can show the achieved level of mastery on specific knowledge and skills.

The evidences based on the results from formative and summative assessment during formal training are quite easy to imagine and describe. On the contrary, the former type of evidences has less methodological references. Therefore, the present work mainly focused on drawing an exemplificative list of evidences from the work experience such as documents, graphics, reports and designs. Such proofs must show all that a person is actually able to produce when acting the competence in a real application context, whatever it happens either during formal learning paths (e.g. internship, project work in field) or in non-formal learning experiences such as work.

Overall, the evidences play a dual role and they support the learner in two ways. Firstly, they help focusing the attention on the past experience, by raising awareness on personal professional achievement and self-evaluating the prior learning in non-formal contexts. Secondly, they provide guidance and they indicate how the intended Learning Outcomes play in practice in a real context.

During the first set development, each Learning Unit specified 3 types of evidences:

1) Test & Quiz:

- Focused on facts, principles, theories, and practices related to a field of work or study;
- Mostly Knowledge and partially Skill oriented;
- Easy to get after a formal course; also useful to assess the knowledge acquired in prior learning.

2) Exercises, Case Studies, Simulation:

- Focused on the ability to apply knowledge and use know-how to complete tasks and solve problems in virtual contexts
- Skill-oriented
- Easy to obtain after a formal course; also useful to assess the Skills acquired in prior learning.

3) Documentation / products / results from work experience:

- Focused on demonstrating the ability to apply knowledge and use know-how to complete tasks and solve problems in real contexts, directly experienced
- Competence-oriented

- Difficult to plan a common format as depending on the single experience and on the individual ability to identify, formalise and produce them.

During the second set development, the work decided to focus mainly on the third type of evidences as the most critical one. In fact, on one hand, they enable to detect a learner’s actual experience; on the other, they can provide important elements to prove the proficiency level actually involved. Therefore, the second set designed Learning Units that articulate the evidence list by proficiency level addressed.

As previously explained, the third type of evidences can pinpoint the *observable results*, whether tangible or intangible, as achieved during the work experience. The work searched a way to report them as clearly as possible. Finally, it chose a formulation that can guide the learner in better understanding what the evidence should explain. The formulation is made up of a verb, an object and further contextual elements. It recalls the Learning Outcome statement but its meaning is different. Figure 13 below shows examples of such evidence formulation.

COMPETENCE:		A.1_IS and Business Strategy Alignment		
LEARNING UNIT:		LU 8 - ICT Sourcing models		
Learning Outcome The learner will be able to...		Learning Content	Evidence examples (Level 5)	
A1_LU8_1	Recognise and frame sourcing models	Introduction to IT Supply chain	Describe a real case of ICT supplier catalogue categorized	
		IT Supply management Unit and IT Department: organizational models		
A1_LU8_2	Decide appropriate sourcing models	Insourcing vs outsourcing		
		Sourcing models (internal, knowledge, capacity, execution, service)		
		Supplier categorization		
		Criteria for correct decision on the most appropriate model against a given context (Kraljic matrix, project relevance, supplier risk, technological knowledge)		
		Case studies of sourcing models and supplier categorization		
A1_LU8_3	Manage supplier relationship	Service Level Agreement (SLA)		Describe and example of SLA ad OLA with a description of the related management processes
		Operational Level Agreement (OLA)		
		Service Levels management process		
		Supplier interaction model (performance vs strategic potential)		
A1_LU8_4	Manage cloud computing sourcing	Cloud computing: service models (IaaS, PaaS, SaaS)	Share cloud computing service selection documentation	
		Cloud computing: sourcing models (Private, Public, Community, Hybrid - and integration issues)		
		Cloud computing sourcing and service models selection criteria (customization, control, flexibility, capex vs opex, speed)		
		Cloud computing supply chain: actors and roles		
		Case studies of cloud computing sourcing		

Figure 13 – Examples of evidence formulation

While working on identifying evidences during the second set, a further classification mentioned four type of evidences that can be produced, by taking into account where they can be searched and found.

A first type of evidences might be directly related to the *observable results* achieved by the competence fulfilment. It might be any kind of physical/intellectual product or part of it. They should be formalised digitally through multimedia. When describing intangible results, evidences might be a collection of proofs with a personal re-elaboration allowing a third party

to understand their value. These evidences might be called **Evidences on Results/Product/Output**.

A second type of evidences might be related to the **Reputation** that an individual has in a professional context. These evidences can be feedback from colleagues, letters of reference by the chief, or official survey results referred to the results obtained. They prove how third parties value the quality of a work and the results obtained.

A third type of evidences may be linked to the **Tools** required when acting the competence. They should demonstrate the use of tools, web applications, and other resources, or the application of specifications or procedures that are essential for the competence and for achieving the expected result. This type might include external technical certifications.

Finally, a fourth type of evidences may be identified in **expository documents**, purposely created by the candidate, such as story-telling or self-made reports. They aim at explaining and arguing how s/he can act a competence and its most relevant aspects from a personal point of view. The **Personal Follow Up Evidences** may demonstrate the *level of awareness* achieved by a candidate.

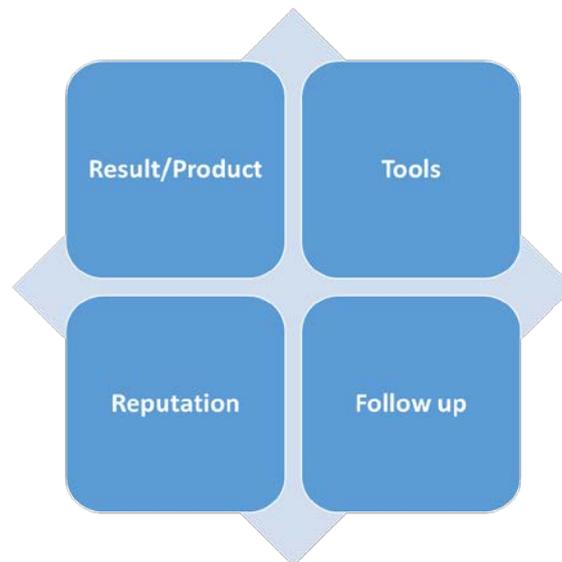


Figure 14 - A classification for evidences

At the work package end, it can be said that the principles and the classifications until now described generally inspired the development of the evidence lists in every competence LU design. Each LU started from an analysis of the learning outcomes and worked to identify proper evidences to be reported in the list. Anyway, the final outcome was also affected by the different partners' experience and their need to cope with specific issues of the competences they were assigned. Consequently, this led to a discretionary margin of subjectivity that makes the final outcome not completely homogeneous. Notwithstanding, it also reflects the nature of evidences as they take shape and become meaningful only when they actually refer to and come from a concrete and specific context. So far, it is not possible to develop a prescriptive list of evidences that cover all the potential contexts. Such list can't be prescriptive, but it can

only suggest where to look for. As such, the designer's subjectivity creates a gap of flexibility as a matter of facts that only a learner can bridge with its actual experience.

ECVET

The European Credit system for Vocational Education and Training (ECVET) provides a powerful tool of the strategic framework for European cooperation in Education and Training (ET 2020) for increasing cross-border cooperation in education and training. It should lead to portable qualifications and transferable learning outcomes, thereby making learning mobility and lifelong learning a reality for young and adult learners [15].

As the project intends to deal with it, the work package wanted to design the learning unit structure highlighting the potential ECVET implication. A full ECVET system should implement different parts. A framework based on Units of Learning Outcomes is necessary to design credits that can be then transferred and accumulated. Additional information such as points provide a quantitative way to weight and measure the achievements in relation to a final qualification. Assessment, validation and recognition procedures are necessary to define the context within which partners can cooperate. Agreements (i.e. Memorandum of Understanding, Learner Agreement) formally set the ECVET partnership and the relation with the end-user. A governance model identifies competent institutions, responsible for designing and awarding qualifications or recognising units or other functions linked to ECVET (i.e. points allocation, rules and practices for assessment, validation and recognition of Learning Outcomes). So far, WP4 specifically takes charge of the methodological frame and focuses on the Units of Learning Outcomes and the ECVET point assignment. On the other hand, the allocation of points are normally part of the design of qualifications and units.

In the present work, the Learning Units identify a coherent set of knowledge, skills and Learning Outcomes underpinning part of the full e-Competence Qualification. Learning Outcomes can be assessed and validated, independently of the learning process or the learning context in which they are achieved. As such, the Learning Units can enable progressive achievement of competence qualifications through transfer and accumulation of Learning Outcomes. Therefore, the Learning Unit represents the unit for ECVET point assignment in relation to the e-Competence Qualification Profile.

ECVET points are a numerical representation of the overall weight of the Learning Outcomes and of the relative weight of units in relation to the e-competence qualification. The points themselves have no value unless they are related to the Learning Unit description and information about the level of qualifications. In fact, ECVET points can complement and support the understanding of the competence qualification. In other words, the number of ECVET points allocated to a qualification or to a unit can provide qualitative and complementary information. Overall, for example, they can indicate whether the scope of the qualification is narrow or broad. Moreover, as unit allocation, they can provide a learner with information about how close s/he got to the competence qualification or what remains to be achieved.

As mentioned in ECVET Recommendation [14], some issues shall be taken into account when assigning ECVET points:

1. Points are usually allocated first to the qualification as whole and then to its units according to their relative weight within the qualification.
2. For a given qualification, one formal learning context is taken as a reference. In case no formal learning pathways reference exists, then ECVET points can be allocated through estimation by comparison with another qualification which has a formal reference context. EQF levels or similarities of the Learning Outcomes in a closely related professional field might help valuing the comparability of such reference context.
3. The points so allocated to units and qualification are the same regardless of how a learner achieves the related outcomes through formal, non-formal or informal learning.
4. The ECVET points should be established according to three main criteria or to a combination of:
 - a. The relative importance of the Learning Outcomes which constitute the Unit for labour market participation, for progression to other qualification levels, or for social integration.
 - b. The complexity, scope, and volume of Learning Outcomes in the Unit.
 - c. The effort necessary for a learner to acquire the knowledge, skills, and competence required for the Unit.
5. As a general rule, 60 points are allocated to the Learning Outcomes expected to be achieved in a year of full time formal VET.

Such recommendation only provides a general guide and, actually, there is not a unique reference frame for a qualification to implement its credit system. Moreover, there are previous projects and experiences that report the difficulties to find out a proper, reliable and shared methodology for allocating ECVET points. Notwithstanding, even if the ECVET system is far from a full adoption and implementation across Europe, the monitoring shows that the system is widely encouraged, and many steps have been taken - and quite a lot has been accomplished - in the Member States, with their different starting points and different educational practices and cultures.

Regarding COUNCIL e-Competence qualification, there is no existing formal learning context that can provide a reference. Despite of that, the WP5 pilots offer an important learning setting on whose base to formulate and compare hypothesis in a reasonable way. The task to assign ECVET points to the Learning Units must take into account mutual relations with the e-Competence Qualification Profile, its proficiency levels and all the other competences for achieving a balanced weight. For this reason, the task followed more than two phases as suggested in the Recommendation – that is to say, point allocation to qualification first and then to related units- but it also included a bottom-up approach, exploiting the data and the information emerging from the pilots, planned in WP5.

The actual time allocated and directly experienced during the training and learning activities provides an informative basis of discussion useful to find out a method to allocate ECVET points to the Learning Units. Moreover, the feedback by learners as well as the training performance can give a realistic evaluation on the complexity and the effort to achieve the Learning Outcomes.

The competence is intrinsically multidisciplinary as it underpins several knowledge and skills. Similarly, a one year full time VET is generally multidisciplinary and underpins several competences as well. As such, the initial idea was to suppose reasonable figures concerning the accomplishment of a specific proficiency level of the competence in a one-year full-time learning, including theory and practice. Therefore, for a specific proficiency level the figures considered are as follows:

- maximum threshold: 60 points
- average range: 20-30 points

The assumption is that a learner can achieve the e-competence qualification, coherently with a specific proficiency level. Therefore, the maximum threshold also refers to the e-competence qualification.

Regarding the single Learning Units, the points must be allocated by taking into account that a same unit can be included in more than a proficiency level. The initial hypothesis set each Learning Unit as potential carrier from 1 up to 5 ECVET points, according to the overall complexity, volume, and scope of the Learning Outcomes included.

Anyway, given the previous assumption of valuing the qualification within 60 points, the allocation of points to the single Learning Units must take into consideration also the LU set approach. In the *inclusive* LU plans, as shown in Figure 8, the highest proficiency level is associated to the whole Learning Unit set designed for the competence, and it includes the previous proficiency levels' ones. Therefore, the sum of all the Learning Units designed must relate to the threshold of 60 points. This consideration also concerns the case of competences designed according to a *uniform set approach*. Finally, in the case of a *disentangled* LU set, the hypothesis can only say that the qualification carries as many points as the sum of the Learning Units included, and that this figure has a value up to about 60 points.

Based on WP5 pilots, the team aimed at verifying these assumptions and suppositions. Some important issues concern the following outcome:

- the direct experience with learners helped with valuing the Learning Unit points mostly related to the knowledge release and only partially to the skills
- the hours spent in face-to-face and online learning helped to provide an overall estimation of the time a learner should spend to consolidate mostly the knowledge through some skills training
- a further estimation should be added in order to catch the time and the effort a learner should employ to actually develop the part of competence underpinned by the Learning Unit across the work and in-field experience.

During an internal workshop with partners, each competence was analysed Learning Unit by Learning Unit. The hours spent in the pilot training have been increased by a multiplying factor, representing the contribute in terms of importance, external impact and complexity (low= 1,1; medium=1,3; high= 1,5).

The result, properly translated into equivalent points (25 hours for 1 credit), is the initial hypothesis for assigning points to each Learning Unit. The following table reports the aggregated figures (rounded to the nearest integer) for each competence (Hypothesis A).

An additional multiplying factor might estimate the effort needed to actually acquire a plain competence through in-field experience and work. Such a factor should take into account the fact that the more managerial (the higher proficiency level) the competence is, the more it needs learning by experience and systemic vision, instead of knowledge or basic skills training. To complete the reasoning, it was assumed that the multiplying factor is equal to an integer from 1 up to 5 ($K_{e1}=1$; $K_{e2}=2$; ...; $K_{e5}=5$). The final estimation takes into account the highest proficiency level for the competence, as upper limit. The result is reported in Figure 15 under the last column, hypothesis B.

COUNCIL Learning Unit Set 1+2	Credit point assignment		
	Ip.A	K	Ip.B
A. PLAN			
A.1. IS and Business Strategy Alignment	11	5	55
A.3. Business Plan Development	8	5	40
A.5. Architecture Design	6	5	30
A.6. Application Design	12	3	36
A.7. Technology Trend Monitoring	4	5	20
A.9. Innovating	4	5	20
B. BUILD			
B.3. Testing	6	4	24
B.5. Documentation Production	4	3	12
B.6. Systems Engineering	5	4	20
C. RUN			
C.2. Change Support	3	3	9
C.4. Problem Management	5	4	20
D. ENABLE			
D.1. Information Security Strategy Development	12	5	60
D.2. ICT Quality Strategy Development	5	5	25
E. MANAGE			
E.6. ICT Quality Management	6	4	24
E.8. Information Security Management	20	3	60

Figure 15 – Estimating ECVET points for the competences

This has been an exercise to identify criteria for discussing the problem of credit sizing. In this context, the initial assumption forecasted an average of 20-30 points up to a maximum of 60. The final calculation seems to meet this expectation.

Overall, WP4 provides a framework for a potential COUNCIL credit transfer system. The LU set team worked towards a mutual acknowledgment of the approaches to design units and allocate ECVET points. The next steps should be to validate a procedure for finalising the ECVET point allocation to each e-competence at a given proficiency level. Afterwards, it might formalise the ECVET partnership through a Memorandum of Understanding that allows to set up the overall cooperation process and actually makes the credit transfer in place.

e-Competence Learning Units – Second Set

This section of the document reports the Learning Units designed for the second set of e-Competences.

The notes below concern the explanation and the coding of some items, as already reported in DLV4.1:

- *Knowledge*: it reports the minimum set derived from the analysis of the related e-Competence Qualification Profile. The list herein mentioned is expected to increase and enlarge coherently with a specific context and the content implementation. The code is *Kx* (*Knowledge1, Knowledge 2...*) when the item is coherent with the list reported in the eCF3.0 standard. The item code is *Ux* (*Understanding 1, Understanding 2...*) when it has been directly introduced and formalised by the present project.
- *Skills*: as for Understanding, the document reports only the minimum set of items. The code is *Sx* (*Skill 1, Skill 2...*) when the item is coherent with the list reported in the eCF3.0 standard. The item code is *Ax* (*Ability 1, Ability 2...*) when it has been directly introduced and formalised by the present project.

A3 - Business plan development

A.3 Business Plan Development						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Modelling a business plan					
LU 2	Implementing a business plan					
LU 3	Strategic thinking					

 not present in the eCF 3.0 standard

COMPETENCE:	A.3 Business Plan Development
LEARNING UNIT:	LU 1 – Modelling a business plan
General description:	The learning unit aims to describe the main concepts about corporate and digital strategy, to explain the main tools and techniques to model a business initiative, to explain the basic financial concepts in order to plan the related revenues and costs and to illustrate the basic techniques to elicit the relevant information.

<p>Knowledge</p>	<p>K1 business plan elements and milestones K2 the present and future market size and needs K3 competition and SWOT analysis techniques (for product features and also the external environment) K4 value creation channels K5 profitability elements K6 the issues and implications of sourcing models K7 financial planning and dynamics K9 risk and opportunity assessment techniques U1 relevant types of business models U2 relevant models, tools and techniques of economic and financial analysis U3 economic, technological, industry and organization environment</p>
<p>Skills</p>	<p>S1 Address and identify essential elements of product or solution value propositions S2 Define the appropriate value creation channels S3 Build a detailed SWOT analysis S4 Generate short and long term performance reports (e.g. financial, profitability, usage and value creation) S5 Identify main milestones of the plan A1 Develop the business case or business plan documentation A2 Develop the business model corresponding to the entire organization or to a specific initiative (e.g. business model canvas) A3 Develop the product vision or product roadmap (e.g. vision board, product roadmap, product canvas) A4 Develop the business realization plan A5 Elicit needs and requirements A6 Analyse and model requirements and solution scope (e.g. using UML, SYSML, BPML)</p>

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)	Evidence examples (Level 5)
A3_LU1_1 Outline Corporate and Digital Strategy main concepts and approaches	The enterprise organization, offer and market demand	Explain the organizational context of a specific organization	Describe the organizational context of a specific organization	Identify the problems and opportunities of the organizational context of a specific organization
	The "Growth strategy" approach	Explain the vertical and horizontal integration	Describe the vertical and horizontal integration	Apply the vertical and horizontal integration the a specific organization
	The "Positioning strategy" approach	Recognize the characteristics of the BCG matrix	Complete a BCG matrix	Define the corresponding strategies of a BCG matrix
	The "Capability organization" approach	Identify the main corporate capabilities of a specific organization	Describe the main corporate capabilities of a specific organization	Design the main corporate capabilities of a specific organization
	The "Portfolio strategy" approach	Recognize the relevant project selection techniques	Describe the relevant project selection techniques	Apply the relevant project selection techniques

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)	Evidence examples (Level 5)
A3_LU1_2 Outline Business modelling definitions and recognize related tools and techniques	Innovation and business modelling	Explain the business model of a given organization	Describe the business model of a given organization	Develop the business model of a given organization
	The vision board and the product canvas	Explain the vision board and product canvas for a given product idea	Produce the vision board and product canvas for a given product idea	Evaluate and refine the vision board and product canvas for a given product idea
	The business model canvas	Explain the business model canvas for a given product idea	Produce the business model canvas for a given product idea	Evaluate and refine the business model canvas for a given product idea
	The capability and value stream analysis	Explain the different value generated by organizational processes	Analyse the different value generated by organizational processes	Analyse the different value generated by organizational processes and suggest the improvement actions

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)	Evidence examples (Level 5)
	The business model evaluation matrix (e.g. IP vs. partnerships; capabilities vs. partnerships, etc.)	Explain how to read a business model evaluation matrix	Analyse a business model evaluation matrix	Design a business model evaluation matrix
A3_LU1_3 Apply Financial Analysis key concepts and related tools and techniques	The balance sheet and the reporting models	Recognize the key elements of a balance sheet	Identify the KPIs of a balance sheet	Calculate the KPIs of a balance sheet
	Revenues, costs, margins, cash flows analysis	Recognize the revenues, margins and costs of a balance sheet	Analyse the revenues, margins and costs of a balance sheet	Analyse the revenues, margins and costs of a balance sheet and suggest improvement actions
	Financial Analysis indicators (e.g. NPV, IRR, payback period, EVA etc.)	Explain the main techniques of investment evaluation	Analyse the results of the main techniques of investment evaluation	Apply the main techniques of investment evaluation
A3_LU1_4 Use the main Elicitation tools and techniques	Elicitation techniques: interview, collaboration meetings, survey and questionnaires, document analysis, observation etc.	Organize the agenda of a brainstorming session	Facilitate a brainstorming session	Conduct a brainstorming session

COMPETENCE:	A. 3 Business Plan Development
LEARNING UNIT:	LU 2 – Implementing a Business plan
General description:	The participant will improve the knowledge and skills necessary to lead a group of people in the realization of a business strategy, a business model and a business plan.
Knowledge	<p>K1 business plan elements and milestones</p> <p>K2 the present and future market size and needs</p> <p>K3 competition and SWOT analysis techniques (for product features and also the external environment)</p> <p>K4 value creation channels</p> <p>K5 profitability elements</p> <p>K6 the issues and implications of sourcing models</p> <p>K7 financial planning and dynamics</p> <p>K8 new emerging technologies</p> <p>K9 risk and opportunity assessment techniques</p> <p>U1 relevant types of business models</p> <p>U2 relevant models, tools and techniques of economic and financial analysis</p> <p>U3 economic, technological, industry and organization environment</p> <p>U4 project management approaches</p>

Skills	<p>S1 Address and identify essential elements of product or solution value propositions</p> <p>S2 Define the appropriate value creation channels</p> <p>S3 Build a detailed SWOT analysis</p> <p>S4 Generate short and long term performance reports (e.g. financial, profitability, usage and value creation)</p> <p>S5 Identify main milestones of the plan</p> <p>A1 Develop the business case or business plan documentation</p> <p>A2 Develop the business model corresponding to the entire organization or to a specific initiative (e.g. business model canvas)</p> <p>A3 Develop the product vision or product roadmap (e.g. vision board, product roadmap, product canvas)</p> <p>A4 Develop the business realization plan</p> <p>A5 Elicit needs and requirements</p> <p>A6 Analyse and model requirements and solution scope (e.g. using UML, SYSML, BPML)</p> <p>A7 Analyse the market and contribute to define the marketing plan</p> <p>A8 Contribute to the project plan of the initiative and to the corresponding release plan</p> <p>A9 Contribute to the transition and operation plan</p> <p>A10 Validate requirements and solution</p> <p>A11 Manage the team committed to the development of the business plan and of the related work products</p> <p>A12 Contribute to the management of the requirements baseline and the solution configuration</p> <p>A13 Contribute to the management of the documentation and knowledge</p>		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A3_LU2_1 Apply knowledge, tools and techniques to guide a team in the realization and management of business planning deliverables	The planning and monitoring of project activities	Produce a WBS or a Gantt chart	Identify the critical path
	The management of the requirements baseline	Explain how to use a requirements management tool	Identify requirements dependencies
	The verification and validation of the solution	Explain the User Acceptance Tests for a given solution	Produce the User Acceptance Tests for a given solution
	The governance of the transition to operations	Explain a transition plan	Produce a transition plan

		The knowledge management	Explain how to use a knowledge management tool	Define the architecture of a knowledge management tool
A3_LU2_2	Interpret and predict innovation and technological trends needed to address corporate and market strategies	The innovation and technological trends and the market demand	Outline the current and future relevant ICT technologies	Describe the current and future relevant ICT technologies

COMPETENCE:	A.3 Business Plan Development
LEARNING UNIT:	LU 3 – Strategic Thinking
General description:	The participants will also improve the knowledge and skills necessary to apply strategic thinking and organisational leadership to exploit the capability of Information Technology to improve the business.
Knowledge	<ul style="list-style-type: none"> K1 business plan elements and milestones K2 the present and future market size and needs K3 competition and SWOT analysis techniques (for product features and also the external environment) K4 value creation channels K5 profitability elements K6 the issues and implications of sourcing models K7 financial planning and dynamics K8 new emerging technologies K9 risk and opportunity assessment techniques U1 relevant types of business models U2 relevant models, tools and techniques of economic and financial analysis U3 economic, technological, industry and organization environment U4 project management approaches U5 system thinking techniques U6 leadership techniques U7 complexity management approaches

<p>Skills</p>	<p>S1 Address and identify essential elements of product or solution value propositions S2 Define the appropriate value creation channels S3 Build a detailed SWOT analysis S4 Generate short and long term performance reports (e.g. financial, profitability, usage and value creation) S5 Identify main milestones of the plan A1 Develop the business case or business plan documentation A2 Develop the business model corresponding to the entire organization or to a specific initiative (e.g. business model canvas) A3 Develop the product vision or product roadmap (e.g. vision board, product roadmap, product canvas) A4 Develop the business realization plan A5 Elicit needs and requirements A6 Analyse and model requirements and solution scope (e.g. using UML, SYSML, BPML) A7 Analyse the market and contribute to define the marketing plan A8 Contribute to the project plan of the initiative and to the corresponding release plan A9 Contribute to the transition and operation plan A10 Validate requirements and solution A11 Manage the team committed to the development of the business plan and of the related work products A12 Contribute to the management of the requirements baseline and the solution configuration A13 Contribute to the management of the documentation and knowledge A14 Ensure the alignment of the business plan to the overall corporate and digital strategy A15 Provide a systemic view of a business initiatives A16 Lead to a common vision of a desired future</p>		
	<p>Learning Objectives The learner will be able to...</p>	<p>Learning Content</p>	<p>Evidence examples (Level 5)</p>
<p>A3_LU3_1</p>	<p>Apply system thinking and strategic leadership inside the</p> <p>Corporate knowledge and system thinking</p>	<p>Analyse the vision and mission of a given company and of its main organization product families</p>	

organizational context	Strategic leadership and Servant Leadership	Apply strategic and servant leadership techniques
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A5 - Architecture design

A.5._Architecture Design						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	ICT Architecture principles and quality dimensions					
LU 2	ICT Architecture implementation					
LU 3	IT Architecture evaluation and evolution					
LU 4	Enterprise Architecture models and ICT Architecture					
LU 5	Business strategy and ICT Architecture alignment					

not present in the eCF 3.0 standard

COMPETENCE:	A.5._Architecture Design
LEARNING UNIT:	LU 1 - ICT Architecture principles and quality dimensions
General description:	This LU provides a general overview of the perspectives of an ICT Architecture and of the requirements for designing and implementing a consistent ICT environment. The concept of architecture in ICT doesn't actually differ for architecture in constructing buildings or any other structures. It is the process of development of methodical specifications, models and guidelines within a coherent framework.

Knowledge	K2 Systems architecture requirements: performance, maintainability, extendibility, scalability, availability, security and accessibility
Skills	S2 Use knowledge in various technology areas to build and deliver the enterprise architecture

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)	Evidence examples (Level 5)
A5_LU1_1 Properly define the concept of architecture applied to ICT in the organisation	The meaning of architecture	Based on documented experience, discuss the ICT logical architecture perspectives of a real organisation based on business needs and requirements	Based on own documented experience, describe the logical architecture of an organisation according to business requirements, and discuss the guidelines for the physical architecture in a fast changing technology environment	Based on documented experience, present and discuss the impacts of business needs and technology innovation on the ICT architecture in a real organisation
	Architecture requirements			
	Architecture layers			
	Building blocks and consistency			
	Reasons for an ICT Architecture			
A5_LU1_2 Recognize the layers of ICT architecture in the organisation and interpret their consistency	ICT architecture layers in the organisation			
	Business architecture definition and components			
	Logical architecture definition			
	Physical architecture definition			
	Consistency of an ICT architecture			
A5_LU1_3 Identify the perspectives of an ICT architecture	Application perspective			
	Data perspective			
	Infrastructure perspective			
	ICT services perspective			
	ICT organisation perspective			
A5_LU1_4	Requirement types			

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)	Evidence examples (Level 5)
Correlate the logical architecture to the requirements	High level requirements for the logical architecture			
	Quality attributes in an architecture perspective			
	Guidelines for logical architecture			
	Logical architecture documentation and communication			
Correlate the physical architecture to the logical architecture A5_LU1_5	Logical architecture mapping			
	Sourcing options impact			
	Impacts on applications			
	Impacts on infrastructure			
	Impacts on ICT organisation			
	Guidelines for physical architecture			

COMPETENCE:	A.5._Architecture Design
LEARNING UNIT:	LU 2 – ICT Architecture implementation
General description:	This LU provides guidelines to manage the ICT Architecture in the enterprise. Implementing the ICT Architecture requires to document, publish and control the standards defined according to the Architecture for the enterprise. It includes the development at different levels of models and patterns to support new implementations, and the evaluation of complex situations, in order to ensure consistency.
Knowledge	K4 The company' s enterprise architecture and internal standards
Skills	S5 Develop design patterns and models to assist system analysts in designing consistent applications



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Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)	Evidence examples (Level 5)
A5_LU2_1 Implement and maintain applications architecture	Business processes coverage	Based on own documented experience, present and discuss the implementation of ICT architecture in projects, applications and infrastructure	Based on documented experience, discuss the implementation approach to the ICT architecture according to changing business needs and technology evolution and how it impacts on standards	Based on documented experience, discuss how to manage the ICT architecture in complex situations, ensuring consistency with dynamic business requirements
	Application sourcing: make or buy, SaaS			
	Functional and non-functional requirement			
	Integration needs and options			
	Custom development standards and tools			
	Application quality attributes			
A5_LU2_2 Implement and maintain infrastructure architecture	Infrastructure components			
	Functional and non-functional requirement			
	Processing equipment, tiers and devices			
	System software and applications			
	Networking			
	Components compatibility and integration			
	Infrastructure quality attributes			
A5_LU2_3 Implement and maintain information and data architecture	Information and data needs			
	Operational and non operational data			
	Data distribution and replication			
	Information integration			
	Analytics and Business Intelligence			
	Information quality attributes			

A5_LU2_4	Implement and maintain ICT processes and organisation	ICT services and processes			
		Organisation, roles, responsibilities			
		Human resources and competences			
A5_LU2_5	Ensure consistency of implemented architecture	Architecture frames interdependencies			
		Change impacts			
		Components lifecycle impacts			
		Alternative solutions evaluation			

COMPETENCE:	A.5._Architecture Design
LEARNING UNIT:	LU 3 – IT Architecture evaluation and evolution
General description:	In this LU the drivers for evaluating the current Architecture and the possible new standards to adopt are discussed. An ICT Architecture is not fixed over time. Business rules and requirements, technology and best practices evolve continuously, so the Architecture must be regularly reviewed based on factors such as needs, opportunities, risks and costs.
Knowledge	K3 Costs, benefits and risks of a system architecture
	K5 New emerging technologies (e.g., distributed systems, virtualisation models, datasets, mobile systems)
Skills	S1 Provide expertise to help solve complex technical problems and ensure best architecture solutions are implemented
	A1 Develop company's architecture policies and standards

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A5_LU4_1 Evaluate the current ICT architecture	Organisation and IT maturity models Evaluation models Functional coverage Information management Security Best practices and standards adoption ICT organisation and capabilities ICT Governance Costs identification and quantification Industry benchmark	Based on documented experience, present and discuss ICT Architecture changes based on technology evolution and enterprise needs, supported by a costs / benefits analysis and an implementation plan	Based on proven experience, present and discuss a complex change in ICT Architecture, supported by economics, risk evaluation and management, and an enterprise-wide change plan
A5_LU4_2 Evaluate technological opportunities	Technology lifecycles The stages of technology adoption Evaluate infrastructure components Evaluate software tools Evaluate applications Components integrability Risks and opportunities trade-off		
A5_LU4_3 Analyse the impact of changes in the ICT architecture and economics	Impact of changes on overall ICT architecture Changes in logical and/or Physical architecture Impact of changes on organisation and human resources Solutions lifecycle Benefits of changes evaluation Cost evaluation: CAPEX, OPEX, TCO		

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A5_LU4_4 Define new architecture components and plan the adoption	Change management costs		
	The architecture new components definition and documentation		
	Adoption plan of new components		
	Transition management		
	Organisation changes for consistency		
	Architecture new components test		
	Architecture changes validation		

COMPETENCE:	A.5._Architecture Design
LEARNING UNIT:	LU 4 – Enterprise Architecture models and ICT Architecture
General description:	This LU introduces the mostly used methods and frameworks for analysing and describing the Enterprise Architecture, and the impacts on ICT Architecture. Enterprise architecture (EA) is a “practice for conducting enterprise analysis, design, planning, and implementation, using a comprehensive approach at all times, for the successful development and execution of strategy”. Enterprise architecture applies architecture principles and practices to guide organizations through the business, information, process, and technology changes necessary to execute their strategies. These practices utilize the various aspects of an enterprise to identify, motivate, and achieve these changes.
Knowledge	K1 Architecture frameworks, methodologies and systems design tools
Skills	S4 Assist in communication of the enterprise architecture and standards, principles and objectives to the application teams

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A5_LU3_1 Describe Enterprise Architecture goals	Definitions of Enterprise Architecture Scopes of Enterprise Architecture Architectural description of an enterprise Enterprise integration of business processes Benefits of Enterprise Architecture Organisational and processes and standards Enterprise innovation The Enterprise Architecture model and framework Artefacts and deliverables Enterprise Architecture and IT	Based on proven experience, discuss the ICT architecture of an organisation from an Enterprise Architecture Framework perspective	Based on documented experience, discuss how the Enterprise Architecture Frameworks can address and support the definition of the ICT architecture
A5_LU3_2 Evaluate benefits of Enterprise Architecture on IT	IT planning and management Requirements engineering Project management Systems design and development IT value creation IT complexity reduction IT risk management IT responsiveness to changes		
A5_LU3_3 Apply the Zachman framework for modelling the enterprise	The Zachman schema The "What, How, When, Who, Where, and Why" interrogatives The six perspectives The interrogatives/perspectives intersection vision		

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	The architecture models and documentation Technology Domain		
A5_LU3_4 Apply TOGAF® Enterprise Architecture standard for modelling the enterprise	The Open Group Architecture Framework Enterprise Architecture Domains The architecture new components definition and documentation Adoption plan of new components Transition management Organisation changes for consistency Architecture new components test Architecture changes validation		
A5_LU3_5 Evaluate Enterprise Architecture frameworks	Other Enterprise Architecture frameworks Frameworks comparison Modelling languages and tools: BPMN, UML Enterprise Architecture use and criticism		

COMPETENCE:	A. 5. _Architecture Design	
LEARNING UNIT:	LU 5 – Business strategy and ICT alignment	
General description:	This LU describes the drivers to consider for consistently rethinking the business strategy through innovation. Fast evolving technology implies challenges and opportunities for the enterprise. The digital transformation can even change the way the organisation is doing its business.	
Knowledge	U1 Opportunities and Impacts of digital transformation	
Skills	S3 Understand the business objectives / drivers that impact the architecture component (data, application, security, development etc.)	
	A2 Contribute to business development and innovation through ICT architecture	
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 5)
A5_LU4_1 Analyse the business model and strategy of the organisation	Business model description	Based on proven experience, present and discuss a business and ICT digital transformation and alignment project
	Strategic thinking and vision	
	Organisation's positioning in the market	
	The SWAT analysis	
	Threats and opportunities	
	The role of ICT	
Business and ICT alignment		
A5_LU4_2 Monitor technology trends and evaluate impacts	Technology lifecycle and maturity	
	New technology opportunities in different industries	
	Impacts of emerging technologies on business models	
	Impacts of emerging technologies on the organisation	
	Impacts on ICT role and processes	
The digital transformation		

A5_LU4_3	Develop a consistent vision of ICT and business model evolution	Drivers for changing: business and ICT	
		Stakeholder's role	
		Needs for changing	
		Economics evaluation	
		Business model and ICT consistency	
		Business and ICT continuous alignment	
A5_LU4_4	Develop a coherent change management plan	Enterprise and ICT goals definition	
		Critical business and ICT capabilities identification	
		Change process identification and communication	
		Change management critical success factors	
		Resistance to change identification and overcoming	
		Risks monitoring and management	
		Cost and benefits continuous monitoring	

A9 – Innovating

A.9._Innovating						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Why Innovation					
LU 2	Positioning innovation in the organisation					
LU 3	Leading innovation					
LU 4	Systematic approach to innovation					
LU 5	New emerging technologies and business impacts					

 not present in the eCF 3.0 standard

COMPETENCE:	A.9_Innovating
LEARNING UNIT:	LU 1 - Why innovation
General description:	Businesses must innovate to stay competitive or to survive. Organisations in general need to innovate to align with external- predominately tech driven - changes that influences individuals, organisation and society in general. This LU provides fundamental to apply this innovation.
Knowledge	K1 existing and emerging technologies and market applications K2 business, society and/ or research habits, trends and market needs K3 innovation processes techniques & information resources
Skills	S1 identify business advantages and improvements of adopting emerging technologies

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A9_LU1_1	Explain the need for innovating	Understanding innovation in relation to growth	Create a roadmap for innovating (2 years scope) based on current technological and business changes you see	Create a roadmap for innovating (2 years scope) based on current technological and business changes you see and indicating the business case
		Sharpening of your competitive edge		
		Business planning		
		Looking for existential disrupters		
A9_LU1_2	Describe the strategic value of innovating	Understanding of usability, business life cycles, operations and maintenance		
		Transforming insights into innovative business ideas		
		Using the right methods to improve organisation innovation power		
		How ideas transform into technology based products and services		
A9_LU1_3	Identify the spirit of time	Recognizing of hypes		
		Recognizing of grassroots developments		
		Global/market trends and recognising their relative importance		
		Finding the catalysts of innovation		
		Trusting your intuition		
		Trusting external sources		
A9_LU1_4	Scope the innovation area	Product innovation		
		Process innovation		
		Transaction innovation		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	Organisational innovation		
	Business model innovation		
COMPETENCE:	A. 9_Innovating		
LEARNING UNIT:	LU 2 - positioning innovation in the organisation		
General description:	Businesses must innovate to gain competitive advantage. This requires an innovation culture and process.		
Knowledge	K1 existing and emerging technologies and market applications		
	K2 business, society and/ or research habits, trends and market needs		
	K3 innovation processes techniques & information resources		
Skills	S1 identify business advantages and improvements of adopting emerging technologies		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A9_LU2_1 Describe why innovation is essential	Fail factors for companies	Group discussion on innovation culture and role play of managing hinder power within the organisation	Group discussion on innovation culture and role play of managing hinder power within the organisation
	Innovation methods identification		
	Scoping: (platform) economies force many companies to choose		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	Culture: only innovative company are able to get and retain talent		
A9_LU2_2 Identify the needed competences / job profiles	Creating an open culture		
	Embracing specialists		
	Embracing generalists		
	Balancing generations		
A9_LU2_3 Describe the characteristics of an organisation capable for innovation	Open vs close innovation		
	Scenario thinking		
	Creativity in processes		
	Hinder powers		
	List of do & don't's		

COMPETENCE:	A.9_Innovating
LEARNING UNIT:	LU 3 – Leading innovation
General description:	<p>Making strategic agendas more robust amid uncertainty requires leadership to thrive forward</p> <p>Understand the most common and problematic challenges businesses face today.</p> <p>Gain insights to various degrees of leadership that encourage innovation.</p> <p>Recognize uncertainties and turn them into alternative futures and opportunities.</p> <p>Gain a greater visibility into the ways a competitive landscape can evolve.</p> <p>Craft high-level portfolios of strategic options that have a better chance of yielding success.</p>
Knowledge	K1 existing and emerging technologies and market applications
	K2 business, society and/ or research habits, trends and market needs
	K3 innovation processes techniques & information resources
Skills	S1 identify business advantages and improvements of adopting emerging technologies
	S2 create a proof of concept
	S3 think out of the box
	S4 identify appropriate resources

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A9_LU3_1 Deploy innovation in the organization	How to create a business culture of experiment and innovation Creating a list with guiding principle for the organisation Building the case for change Exhibiting strong support to ease the fear of failure Extracting value from organizational diversity Technology strategy	Build an innovation agenda (2 year scope) based on a distinct approach	Build an innovation agenda (2 year scope) based on a distinct approach and sketch the potential strategic impact
A9_LU3_2 Recognize the value of technology management	Technology forecasting Technology roadmap Technology project portfolio and technology portfolio Inter and intra organisation decision making		
A9_LU3_3 Explain how decision making works	The actors The strategic game playing by these actors Their strategies to get others actors aligned The tension between individual and collective rationality The role of trust		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	The role of smart command and control Coping with uncertainties and ambiguous information		
A9_LU3_4 Create an innovation Mind set	Setting the innovation agenda Talent strategy Continuous search for new sources Monitoring the external world Open innovation & collaboration methods Dare to fail fast		
A9_LU3_5 Demonstrate how to reach out to potential partners and investors	Presenting ideas successfully / selling innovation Building business cases / business canvassing Identify areas of ROI Calculate long term impacts		

COMPETENCE:	A. 9_Innovating
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LEARNING UNIT:	LU 4 – Systematic approach to innovation
General description:	Luck does not suffice when it comes to innovation. A systems approach to innovation is much more productive. This LU...
Knowledge	K1 existing and emerging technologies and market applications
	K2 business, society and/ or research habits, trends and market needs
	K3 innovation processes techniques & information resources
Skills	S2 create a proof of concept
	S4 identify appropriate resources

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A9_LU4_1 Select innovation programs and models	Guiding principles for innovation	Create a presentation based on a trend and a certain model	Create a presentation based on a trend and a certain model and sketch the strategic impact
	The Lean Startup		
	Design Thinking		
	FORTH		
	Incremental innovation (single loop) vs radical innovation (double loop)		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A9_LU4_2 Apply tools for innovation	Prototyping		
	Strategic foresight		
	Customer journey mapping		
	Personas		
	Business model canvas		
	Service scenario mapping		
	Stakeholder mapping		
	Value network prototyping		
	SWOT		
A9_LU4_3 Describe the customer	Understanding who the customer is		
	Customer needs research / understanding customer needs		
	Voice-of-customer (VOC) methods		
	Consumer market research		
	Global behavioural studies		
	Consumer trends		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	Consumer lifestyles Demographics Consumer profiles		
A9_LU4_4 Observe the market	Market research Market and technology trends Understanding which (technology) trends to follow Market analysis Competitive analysis Market entry study Market drivers Market growth rate Market forecasting White space analysis		
A9_LU4_5 Transform ideas in technology based	Methods to identify the right idea Validate the idea		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
<p>products and services</p>	Use cases		
	Think big, start small		
	Prototyping		
	Go to market plan		

COMPETENCE:	A.7_Technology Trend Monitoring
LEARNING UNIT:	LU 5 – New emerging technologies and business impacts (LU 6 of A.1)
General description:	This LU aims at giving tools to evaluate the impact of new technologies on the business. In particular, the LU provides tools and methods to keep oneself updated by overviews and insights about new/emerging technologies and business innovation sources, it identifies and classifies impacts of new technologies at various levels and it evaluates the impact of new technologies using best practices and tools with the engagement of business stakeholders
Knowledge	K1 Emerging technologies and the relevant market applications
	K2 Market needs
	K3 Relevant sources of information (e.g. magazines, conferences and events, newsletters, opinion leaders, on-line forum, etc.)
Skills	S1 Monitor sources of information and continuously follow the most promising
	S3 Identify business advantages and improvements of adopting emerging technologies

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU6_1 Monitor new technologies trends	Methods to identify and monitor the main sources of market and technology research Technology lifecycle and maturity (e.g. Hype curve Gartner, TRL scale, ...) Exemplificative lists of references and related main contribution of: - Significant networks/hub/research centre - Sectorial events and webinar or online courses - Technical communities Case studies of technology lifecycles	Provide an analytical document reporting the innovation of a new technology based on the information collected from different sources and explaining the business impact of the new technology	Provide an analytical document reporting the innovation of a new technology based on the information collected from different sources and explaining the business impact of the new technology
A1_LU6_2 Classify business impacts of technologies	Impacts on business models Impacts on business factors (benefits, costs, markets, ...) Impacts on processes and organization Impacts on Information Systems architecture Impacts on human resources Impacts on customers Case studies of impacts classification of specific ICT solutions		
A1_LU6_3 Evaluate impacts of new	Identify strategic dimensions for the evaluation of new technologies role in a defined business		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
<p>technologies on business</p>	Evaluation models of new technologies (e.g. BCG matrix, SWOT model, ...)		
	Classify benefits of new technologies		
	Identify added value and competitive advantages related to new technologies		
	Use best practices, methodologies and tools (e.g. BIA, Questionnaires, ...) to evaluate the impacts identified for each classification		
	Models and methods to create a business case		
	Case studies of impacts evaluation of specific ICT solutions		

B5 - Documentation production

B.5_Documentation production						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU1	Context analysis, planning and management	■	■	■	■	■
LU2	Content creation	■	■	■	■	■
LU3	Content tools	■	■	■	■	■
LU4	Quality assurance and document management	■	■	■	■	■

■ not present in the eCF 3.0 standard

COMPETENCE:	B5_Documentation production
LEARNING UNIT:	LU 1 - Documentation planning and context analysis
General description:	This LU is focused on the general analysis of needs in the context of documentation for each deliverable, process and product of IT projects or services considering existing standards (IEEE, ISO, etc.) for services and software documentation. The unit will review the connection of documentation to the IT services and development processes.
Knowledge	K3 Different technical documents required for designing, developing and deploying products, applications and services U2 documentation standards for IT
Skills	S1 Observe and deploy effective use of corporate standards for publications S4 Keep publications aligned to the solution during the entire lifecycle

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
B5_LU5_L01 Analyse IT documentation needs given the context	1.1 General IT documentation needs analysis	N. A.	Case studies and exercises to analyse IT documentation needs	Case studies and exercises to plan required documentation

<p>B5_LU5_L02</p> <p>Apply IT standards to determine structure of documentation for a project or service</p>	<p>1.2 Applicable standards guiding IT documentation</p>	<p>Exam on applicable standards determining documentation for IT services or projects</p>	<p>Case studies and exercises to apply standards to IT services and projects documentation</p>	<p>Case studies and exercises to conceive documentation schemes for IT projects and services</p>
<p>B5_LU5_L03</p> <p>Identify and describe the connection between processes from IT services and projects and the documentation</p>	<p>1.3 Connection to processes and project development</p>	<p>Exam on identification and explanation of the link between documents</p>	<p>Case studies and exercises to connect specific documents to the appropriate processes within IT services and projects</p>	<p>Case studies and exercises to conceive integration of documentation within processes of IT services and projects</p>

<p>COMPETENCE:</p>	<p>B5_Documentation production</p>
<p>LEARNING UNIT:</p>	<p>LU 2 – Content creation</p>
<p>General description:</p>	<p>This LU is focused on the creation, edition and maintenance of content for developing the IT documentation considering the methods for working with the information sources and selecting the appropriate content, how to structure the information within the documentation and how to write it while creating and integrating contents.</p>
<p>Knowledge</p>	<p>U2 documentation standards for IT U3 technical writing methods</p>

Skills	<p>S1 Observe and deploy effective use of corporate standards for publications</p> <p>S2 Prepare templates for shared publications</p> <p>S3 Organize and control content management workflow</p>
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Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)
B5_LU2_L01	Analyse information sources and select information for the creation of IT documentation	2.1 Information sources and selection of information	Exam on methods for analysis of information sources	Case studies and exercises to select information after analysing information sources
B5_LU2_L02	Design the structure of information needed for IT documentation according to standards and needs analysis	2.2 Structure of information	Exam on design of structure of information in IT documentation	Case studies to plan and design the structure of information in IT documentation
B5_LU2_L03	Apply content methods to create the guidelines for content creation for the required IT documents	2.3 Content creation	Exam on principles of content creation	Case studies and exercises to determine content creation guidelines according to standards and needs analysis

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)
B5_LU2_L04 Apply writing techniques to the creation of content for IT documents	2.4 Writing practices for creating content	Exam on practices for content creation	Case studies and exercises to create content for specific documents according to standards and needs analysis
B5_LU2_L05 Apply methods for an adequate integration of content from different sources	2.5 Integration of content	Exam on methods for content integration	Case studies on integration of content from several sources to complete the required IT documentation

COMPETENCE:	B5_Documentation production
LEARNING UNIT:	LU 3 – Content tools
General description:	<p>This LU is focused on the practical use of tools for content creation for the documentation production for IT services and projects. The unit covers from the basic office productivity tools and applications like word processors, presentation software and basic image and diagramming tools to other systems for basic media production and edition. The unit also deals with the use of CMS (Content Management Systems) as well as creation and edition of online and interactive content with markup languages and edition tools.</p>

Knowledge	K1 Tools for production, editing and distribution of professional documents K2 Tools for multimedia presentation creation
Skills	S3 Organize and control content management workflow

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)
B5_LU2_L01 Design and create IT documentation using word processing and edition tools	3.1 Word processing and document edition	Exercises on basic use of word processing and edition tools	Case studies and exercises to design IT documentation with word processing and edition tools
B5_LU2_L02 Design and create IT documentation using media and presentation tools	3.2 Media and presentation creation and edition	Exercises on basic use of media and presentation tools	Case studies and exercises to design IT documentation with media and presentation tools
B5_LU2_L03 Practice content management using CMS tools	3.3 Content management systems	Exam on practices for content management	Case studies and exercises to apply content management to IT documentation through CMS tools

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)
B5_LU2_L04 Design and create interactive and online content for IT documentation according to needs analysis	3.4 Interactive and online content	Exam on design and creation practices for interactive and online content	Case studies and exercises to design and create interactive and online content

COMPETENCE:	B5_Documentation production
LEARNING UNIT:	LU 4 – Context analysis, planning and management
General description:	This LU is focused on the methods for the quality assurance of the documentation ensuring the effective verification and validation of documentation, its accessibility and the proper localisation and translation when applicable. As a basic requirement for consistency of the quality assurance process, the unit also addresses configuration and document management as well as content management
Knowledge	K4 Organize and control content management workflow U1 Content management systems and document management systems U4 Documentation review methods U5 Documentation configuration management
Skills	S4 Keep publications aligned to the solution during the entire lifecycle A1 Verify and validate documentation A2 Analyse accessibility

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
B5_LU2_L01 Identify and describe the foundational concepts on quality assurance for IT documentation	4.1 Quality assurance of documentation	Exam on foundational concepts on quality assurance for IT documentation	Case studies and exercises to plan quality assurance for IT documentation
B5_LU2_L02 Apply best practices for localization/translation of IT documentation when required by needs analysis	4.2 Localization/translation	Case studies to apply best practices for localization/translation of IT documents	Case studies and exercises to plan correct localization/translation of IT documentation
B5_LU2_L03 Apply methods for document management and configuration control with tools	4.3 Document management and configuration control	Case studies and exercises to manage IT documents and control IT documentation configuration	Case studies and exercises to plan IT document management and configuration control
B5_LU2_L04 Apply best practices for content management	4.4 Content management	Case studies and exercises to apply content management to specific IT documentation	Case studies and exercises to plan content management for the IT documentation

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
B5_LU2_L05 Analyse accessibility of IT documentation and fix accessibility issues	4.5 Accessibility	Exercises to analyse accessibility of an IT document and fix non compliance issues	Case studies and exercises to plan and develop accessibility analysis to IT documentation

B6 – Systems Engineering

B.6 System Engineering						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Requirement and system modelling			■	■	
LU 2	System engineering processes			■	■	
LU 3	System lifecycle				■	

■ not present in the eCF 3.0 standard

COMPETENCE:	B.6 System Engineering
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LEARNING UNIT:	LU 1 – Requirement and system modelling
General description:	The learning unit aims to describe the main concepts about system engineering, to explain the main tools and techniques to analyse and model requirements, to describe how to decompose the system into subsystems and components, the describe how to integrate, verify and validate components, subsystems and systems, to describe how to manage the requirements and design baselines.
Knowledge	K1 appropriate software programs/modules, DBMS and programming languages K2 hardware components, tools and hardware architectures K3 functional & technical designing K4 state of the art technologies K5 programming languages K6 power consumption models of software and/or hardware U1 requirements analysis U2 requirements management U3 system architecture design U4 detailed system design
Skills	S1 explain and communicate the design/development to the customer S2 perform and evaluate test results against product specifications A1 analyse and model business, stakeholder, system and transition requirements A2 manage requirements and design baselines along the entire system life cycle

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
B6_LU1_1 Outline Requirements Engineering Concepts and Definitions	Requirements engineering concepts and definitions	Describe the characteristics of requirements quality	Assess the characteristics of requirements quality
	Requirements attributes, states and categories	Classify functional and non functional requirements	Relate functional and non functional requirements
	The requirements engineering processes	Describe the main engineering processes	Define a framework of the engineering processes
B6_LU1_2 Outline System Engineering Concepts and Definitions	System engineering concepts and definitions	Describe the system engineering main concepts	Memorize the system engineering main definitions
	The business, system and specialistic views of the system	Analyse the Vee Model of a given project	Produce the Vee Model of a given project
	The system lifecycle	Analyse the system lifecycle of a given project	Produce the system lifecycle of a given project

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
	The system engineering team	Analyse the system engineering team	Set up the system engineering team

COMPETENCE:	B.6 System Engineering
LEARNING UNIT:	LU 2 – System engineering processes
General description:	The learning unit aims to describe the main concepts about system engineering, to explain the main tools and techniques to analyze and model requirements, to describe how to decompose the system into subsystems and components, the describe how to integrate, verify and validate components, subsystems and systems, to describe how to manage the requirements and design baselines.

<p>Knowledge</p>	<p>K1 appropriate software programs/modules, DBMS and programming languages K2 hardware components, tools and hardware architectures K3 functional & technical designing K4 state of the art technologies K5 programming languages K6 power consumption models of software and/or hardware U1 requirements analysis U2 requirements management U3 system architecture design U4 detailed system design U5 system integration U6 system verification U7 system validation U8 system operation management and support</p>
<p>Skills</p>	<p>S1 explain and communicate the design/development to the customer S2 perform and evaluate test results against product specifications S3 apply appropriate software and/or hardware architectures S4 design and develop hardware architecture, user interfaces, business software components and embedded software components A1 analyse and model business, stakeholder, system and transition requirements A2 manage requirements and design baselines along the entire system life cycle A3 design a system architecture A4 design subsystem and components A5 develop a verification and validation plan</p>

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
B6_LU2_1 Outline system engineering processes	The INCOSE framework for System Engineering activities	Describe the INCOSE framework	Set up the INCOSE framework for a given project
	The PMI Framework for PM activities	Describe the PMI framework	Set up the PMI framework for a given project
B6_LU2_2 Apply system engineering processes	A global system engineering process framework.	Employ the main tools and techniques of system engineering	Set up a tailored framework of processes for a given project
	The system engineering activity planning processes		
	The requirements analysis and design definition processes		
	The requirements and design lifecycle management processes		
	The elicitation processes;		
	The solution verification and validation		
	The integration, operation, support, maintenance and retirement processes		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
B6_LU2_3 Tailor system engineering processes to an ICT solution	Languages, technologies, and architectures for SW and HW systems	Describe the main languages, technologies, and architectures for SW and HW systems	Apply the main languages, technologies, and architectures for SW and HW systems
	The systems engineering processes for ICT systems	Identify the specific systems engineering processes for SW and HW systems	Apply the specific systems engineering processes for SW and HW systems

COMPETENCE:	B.6 System Engineering
LEARNING UNIT:	LU 3 – System lifecycle
General description:	The learning unit aims to give the management and behavioural competencies to perform system engineering activities
Knowledge	K7 information security basics K8 prototyping U9 configuration management U10 system lifecycle management

Skills	<p>S5 manage and guarantee high levels of cohesion and quality in complex software developments</p> <p>S6 use data models</p> <p>S7 apply appropriate development and/or process models, to develop effectively and efficiently</p> <p>A6 develop an integration plan</p> <p>A7 manage system configuration</p> <p>A8 apply a system thinking approach</p>
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Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
B6_LU3_1 Combine different project management approaches	The management approaches: predictive approaches vs. adaptive approaches	Apply the SCRUM methodology
	Integration Management	Define an integrated program plan
	Scope Management	Define a specification requirements document
	Time & Cost Management	Calculate activity dependencies
	Risk Management	Apply contingency costs
	Monitor & Control Project Work	Apply the Earned Value Management Technique
	The configuration management tools	Use a specific requirement management system
B6_LU3_2 Develop a system thinking environment	The behavioural characteristics of system engineers	Apply negotiation technique to set up the requirements baseline
	The system thinking competency	Apply a systemic view of a given situation
B6_LU3_3 Apply UML and SYSML modelling language	The use of UML for SW Systems	Use UML modelling language for SW development and architectures

		The use of SYSML for generic systems	Use SYSML modelling language for generic systems development and architectures
B6_LU3_4	Apply Simulation and systems prototyping	Simulation and prototyping techniques for systems	Apply simulation and prototyping techniques for systems
B6_LU3_5	Outline Security issues of systems engineering	Security issues of system engineering	Describe main security issues related to systems engineering activities and to the final solution

C2 - Change support

C.2 Change support						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Establishment of baselines					
LU 2	Track and control changes					
LU 3	Integrity of the baselines					
LU 4	Change management tools and techniques					
LU 5	Audits of changes					
LU 6	Process related standards and practices in information security management					

 not present in the eCF 3.0 standard

COMPETENCE:	C.2 Change support
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LEARNING UNIT:		LU 1 – Establishment of baselines			
General description:	LU 1 provides the methodology and practices in identification of configuration items. LU1 tracks the processes needed to establish a stable basis for the continuing evolution of an work product. The baselines and configuration items are the key elements for creation of a change support management system.				
Knowledge	K1 functional specifications of the information system				
	U6 Process based management				
Skills	S1 share functional and technical specifications with ICT teams in charge of the maintenance and evolution of ICT solutions				
	A5 Manage processes				
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
C2_LU1_1	Identify configuration items	Select configuration items and work products	Describe the criteria for selection/ identification of configuration items at work product level. Provide examples for work products. Describe characteristics of a configuration item	List the key criteria for selection/ identification of configuration items at work product level. Provide examples for work products.	List the key criteria for selection/ identification of configuration items at work product level. Provide examples for work products.
		Assign unique identifiers to configuration items			
		Specify the important characteristics of each configuration item			
		Specify when each configuration item is placed under configuration management			
		Identify the owner responsible for each configuration item			
		Specify relationships among configuration items			

<p>C2_LU1_2</p> <p>Establish a change support management system</p>	Establish a mechanism to manage multiple levels of control	<p>Describe the main features of a change support management system – levels of control, authorized access, share and transfer items, store, update and recover items and records, create reports.</p>	<p>Demonstrate ability to work with a change support management system.</p>	<p>Demonstrate ability to work with a change support management system.</p>
	Provide access control to ensure authorized access to the configuration management system			
	Store and retrieve configuration items in a configuration management system			
	Share and transfer configuration items between control levels in the configuration management system			
	Store and recover archived versions of configuration items			
	Store, update, and retrieve configuration management records			
	Create configuration management reports from the configuration management system			
	Preserve the contents of the configuration management system			
	Revise the configuration management structure as necessary			
<p>C2_LU1_3</p> <p>Create and Release Baselines</p>	Obtain authorization for creating or releasing baselines of configuration items	<p>Describe the process of creation of and releasing baselines</p>	<p>Describe baselines for example of a work product</p>	<p>Manage the baselines for example of a work product</p>
	Create or release baselines only from configuration items in the configuration management system			
	Document the set of configuration items that are contained in a baseline			
	Make the current set of baselines readily available			

COMPETENCE:	C.2 Change support
LEARNING UNIT:	LU 2 – Track and control changes
General description:	LU2 concerns the impact that the change will have on the work product, related work products, the budget, and the schedule.
Knowledge	K2 the existing ICT application technical architecture
	K4 change management tools and techniques
Skills	S4 anticipate all actions required to mitigate the impact of changes (training, documentation, new processes...)
	S3 analyse the impact of functional/technical changes on users

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
C2_LU2_1 Analyze and determine the impact that the change will have on the related products and items	Initiate and record change requests in the change request database	Analyze a change request in a given context (work product)	Prioritize change requests in a given context (work product)	Prioritize change requests in a given context (work product)
	Analyze the impact of changes and fixes proposed in change requests			
	Categorize and prioritize change requests			
	Review change requests to be addressed in the next baseline with relevant stakeholders and get their agreement			
	Track the status of change requests to closure			
C2_LU2_2 Control changes to configuration items	Control changes to configuration items throughout the life of the product or service	Prepare a review to demonstrate that a change have not caused unintended effects on the baselines	Prepare a review to demonstrate that a change have not caused unintended effects on the baselines	Manage the review process
	Obtain appropriate authorization before changed configuration items are entered into the configuration management system			
	Check in and check out configuration items in the configuration management system for incorporation of changes in a manner that maintains the correctness and integrity of configuration items			
	Perform reviews to ensure that changes have not caused unintended effects on the baselines			

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
	Record changes to configuration items and reasons for changes as appropriate			

COMPETENCE:	C.2 Change support
LEARNING UNIT:	LU 3 – Integrity of the baselines
General description:	LU3 follows the process on establishing and maintaining the integrity of baselines.
Knowledge	K3 how business processes are integrated and their dependency upon ICT applications
	U6 Process based management
	K5 the best practices and standards in information security management
	K2 the existing ICT application technical architecture
Skills	A5 Manage processes
	S4 anticipate all actions required to mitigate the impact of changes (training, documentation, new processes...)

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
C2_LU3_1 Record configuration management actions	Record configuration management actions in sufficient detail so the content and status of each configuration item is known and previous versions can be recovered	Describe a configuration management action(s) and identify the version of configuration items that constitute a particular baselines	Describe a configuration management action(s) and identify the version of configuration items that constitute a particular baselines	Describe a configuration management action(s) and identify the version of configuration items that constitute a particular baselines
	Ensure that relevant stakeholders have access to and knowledge of the configuration status of configuration items			
	Specify the latest version of baselines			
	Identify the version of configuration items that constitute a particular baseline			
C2_LU3_2 Describe status and history of changes and other actions of configuration items	Describe differences between successive baselines	Describe status of baselines and identify changes	Describe status of baselines and identify changes	Follow the status of baselines and identify changes
	Revise the status and history (i.e., changes, other actions) of each configuration item as necessary			

COMPETENCE:	C.2 Change support
LEARNING UNIT:	LU 4 – Change management tools and techniques
General description:	LU 4 describes the most used change management tools and techniques

Knowledge	K4 change management tools and techniques				
Skills	S4 anticipate all actions required to mitigate the impact of changes (training, documentation, new processes...)				
	A6 Improve business processes				
Learning Objectives The learner will be able to...		Learning Content	Evidence examples Proficiency Level 2	Evidence examples Proficiency Level 3	Evidence examples Proficiency Level 4
C2_LU4_1	Control the changes with project planning technique	Establish Estimates	Describe the specific goals and specific practices of project planning and their relations with change support	Describe the specific goals and specific practices of project planning and their relations with change support	Review the specific goals and specific practices of project planning and their relations with change support
		Develop a Project Plan			
		Obtain Commitment to the Plan			
C2_LU4_2	Prepare a change support management plan	Change identification	Develop a change support management plan	Describe the process in establishment of a change support management plan	Monitor the process in establishment of a change support management plan
		Change management			
		Change control			
		Change audits			
C2_LU4_3	Choose the best tool for each specific project	Description of requirements to change support management system	Describe the requirements of change support management system	Describe a reasoned choice of a change support management system	Describe a reasoned choice of a change support management system
		Identifiers			
		Source code control systems			
		Reporting systems			
		Audit systems			
Integration					

COMPETENCE:	C. 2 Change support
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LEARNING UNIT:	LU 5 – Audits of changes
General description:	LU 5 aims to provide the learner with the description of the applicable methods for audit performing and different types of audit. It reflects the role of audit on the change management.
Knowledge	K3 how business processes are integrated and their dependency upon ICT applications
Skills	S2 manage communications with ICT teams in charge of the maintenance and the evolution of information systems solutions
	S3 analyse the impact of functional/technical changes on users

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
C2_LU5_1 Perform audits to maintain the integrity of configuration baselines	Assess the integrity of baselines	Describe the applicable methods for audit performing
	Confirm that change support management records correctly identify configuration items	
	Review the structure and integrity of items in the change support management system	
	Confirm the completeness, correctness, and consistency of items in the change support management system	
	Confirm compliance with applicable configuration management standards and procedures	
	Track action items from the audit to closure	

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
C2_LU5_2 Perform different types of audits	Functional configuration audits	Describe the differences and methodologies for performing different types of audit
	Physical configuration audits	
	Configuration management audits	

COMPETENCE:	C.2 Change support		
LEARNING UNIT:	LU6 – Process related standards and practices in information security management		
General description:	LU6 considers the best practices in information security management and how the change support management system affects the areas of information security		
Knowledge	K5 the best practices and standards in information security management		
Skills	S3 analyse the impact of functional/technical changes on users		
	S4 anticipate all actions required to mitigate the impact of changes (training, documentation, new processes...)		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	
C2_LU6_1 Support the processes of change management in ISMS	How to manage changes in an ISMS according to ISO 27001	Describe what an Information Security Management System is and the main reference standards to consider in the ISO 27000 family Outline what are the main requirements of an ISMS based on the ISO 27001	
	Align the change management in ISMS with the business operations		
	Best practices		
C2_LU6_2 Describe how change support is practiced in all aspects of the organization's hardware, software, and network resources, including those done by third-party providers	Effects of change support on business processes	Identify affected business and technical areas in change support management system	
	Effects of change support on technical policies		
	Legal aspects of information security		

C4 - Problem management

C. 4. _Problem Management						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Problem Management process and activities		■	■	■	
LU 2	Problem Management IT tool types		■	■	■	
LU 3	Problem Solving methods and techniques			■	■	
LU 4	Problem Management process evaluation and optimisation				■	

not present in the eCF 3.0 standard

COMPETENCE:	C. 4_Problem Management
LEARNING UNIT:	LU 1 – Problem Management process and activities
General description:	Being able to identifying and solve the root cause of an incident is essential in order to avoid the incident to occur again. In addition to adequate technical skills, an appropriate process should be in place to ensure the problem is effectively and efficiently managed. This LU provides the widely accepted terminology, process structure, roles and responsibilities according to IT Problem Management best practices, and addresses the organisation's environment components and procedures.
Knowledge	K1 The organisation' s overall ICT infrastructure and key components
	K2 The organisation' s reporting procedures
	K3 The organisation' s critical situation escalation procedures
Skills	S1 Monitor progress of issues throughout lifecycle and communicate effectively
	A1 Identify and classify incidents and problems
	A4 Efficiently communicate with internal and external parties

A5 Take the most appropriate decision after a failure

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
A6_LU1_1 Properly define incident and problem, and the actions to undertake	Incident and problem: definitions	Based on documented experience, discuss incident types and classification, and the problem management process in a real organisation	Based on documented experience, present and discuss recent problem solution cases in the real world, commenting the own role in the process and actions taken	Based on documented experience, present and discuss the own role as accountable for problem management in the organisation, including communication with stakeholders and actions for preventing problems
	When an incident is also a problem			
	Incident management and problem management: different goals and actions			
	Relations between incident management and problem management			
	Reasons for incidents and problems to occur			
A6_LU1_2 Operate in a structured problem management process	Problem Management process definition according to ITIL and other frameworks			
	Scope of the process			
	Steps and activities: from detection to solution and closure			
	Roles involved, skills and main responsibilities			
	Problem management documentation and communication			
A6_LU1_3 Document and categorize the problem	The Problem Record			
	Problem area identification and assignment			
	Severity level and Priority			
A6_LU1_4 Operate according to the	The organization's infrastructure components			
	The organization's business applications and users			

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
organisation's operational environment	The organization's problem management process, roles and tools			
	Effective communication with the different internal and external stakeholders			
A6_LU1_5 Correctly activate escalation procedures	Possible actions after a failure, workarounds			
	Escalation process logic			
	Escalation rules and levels			
A6_LU1_6 Cooperate in related processes	Relationship with Change Management			
	Relationship with Release Management			
	Relationship with Configuration Management			
	Relationship with Knowledge Management			

COMPETENCE:	C.4_Problem Management
LEARNING UNIT:	LU 2 - Problem Management IT tool types
General description:	A variety of tools and techniques are available for identifying and solving IT problems. This LU provides an overview of the tool types and their common functionalities, suggesting how they can be effectively used in relation with the problem type and symptoms.
Knowledge	K4 The application and availability of diagnostic tools
Skills	S2 Identify potential critical component failures and take action to mitigate effects of failure
	A2 Use incident and problem tracking tools efficiently
	A3 Use diagnostic tool efficiently

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
A6_LU2_1 Approach a problem using Service Desk Tools	Service Desk Tools functionalities	<p>Based on documented experience, discuss how available tools were used for tracking incidents, and identifying and solving a problem</p>	<p>Based on documented experience, discuss how different tools and skills were used for identifying root cause and solving a problem</p>	<p>Based on documented experience, discuss the capabilities of the different tool types and how they can be used to anticipate potential problems</p>
	Incident and Problem Management support			
	Trouble ticket lifecycle			
	Tool's underlying process and organisation's process			
	Symptom and impact, solution or workaround, root cause analysis			
	Known error database			
A6_LU2_2 Analyse a problem using System Diagnostic Tools	Troubleshooting aids			
	Messages, logs, error reports, audit reports			
	System monitors			
	Performance monitors			
	TSM Tools			
	Known problem solutions from the Web			
A6_LU2_3 Approach a problem using Monitoring Tools	Monitoring Tools functionalities			
	Network monitoring and systems monitoring			
	Events to be monitored			
	Threshold values and alerts			
	Response automation			
A6_LU2_4	Application problem types			

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
Approach application problems	Information from Change and Release Management			
	Application tracking			
	Application tracking tools			
A6_LU2_5 Anticipate potential problem	History and trends			
	Recurring problems			
	Root cause identification and removal			

COMPETENCE:	C.4_Problem Management
LEARNING UNIT:	LU 3 - Problem Solving methods and techniques
General description:	Finding the root cause of a problem and solving it is not always a matter of technical skills and tools only. General problem solving methods and techniques can be used in order to follow a rational approach in uncertain complex situations.
Knowledge	U1 General problem solving methods and techniques
Skills	A6 Apply general problem solving methods to identify root cause of a problem

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
A6_LU3_1 Follow a structured problem solving approach	The problem solving process Identifying and analysing the problem The 5W2H approach Possible solutions generation Solution steps Solution types and models Common errors in problem solving process	Based on documented experience, discuss how general problem solving methods and techniques have been used in tracking and finding the root cause of real IT problems in the real world	Based on documented experience, discuss how the use of general problem solving methods can improve the performance of a technical team in IT problem solution
A6_LU3_2 Use problem solving tools when appropriate	Diagrams and graphs Correlation diagrams Fault tree analysis Brainstorming and affinity diagrams Ishikawa fishbone diagrams Other tools		
A6_LU3_3 Face a problem with a positive attitude	The mental attitude in problem solving Psychology in problem solving The Sherlock Holmes approach Decision making Solution confirmation		
A6_LU3_4 Apply problem solving in IT problem management	Problem definition Input analysis Diagnostic hypothesis Verification and testing Plan for contingency Root cause determination		

COMPETENCE:	C.4_Problem Management
LEARNING UNIT:	LU 4 - Problem Management process evaluation and optimisation
General description:	Problem management process is critical when a service disruption occurs, it has therefore to be designed, monitored, and optimized. This LU provides guidelines on structuring the process and allocating resources based on risk management principles, monitoring the process performance indicators, and evaluate trends in order to anticipate possible incidents and problems.
Knowledge	K5 The link between system infrastructure elements and impact of failure on related business processes
	U2 Risk management principles
Skills	S3 Conduct risk management audits and act to minimise exposures
	S4 Allocate appropriate resources to maintenance activities, balancing cost and risk
	S5 Communicate at all levels to ensure appropriate resources are deployed internally or externally to minimise outages
	A7 Define and review the Problem Management process
	A8 Monitor the efficiency of the Problem Management process
	A9 Ensure adequate resources availability

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 4)
A6_LU4_1 Design a problem management process	Roles, responsibilities and tasks Tools selection and adoption Internal resources and external providers Communication workflow Traditional function oriented methods Escalation procedure design Process communication to the organisation	Based on documented experience, present and discuss the criteria for selecting problem management tools, for defining the problem management process, training and enabling the team, evaluating efficiency and preventing incidents and problems
A6_LU4_2 Design the process and allocate resources based on risks	Business needs and SLAs Risk management principles Impact evaluation Infrastructure resources allocation Human resources allocation and training External providers contracts and SLAs	
A6_LU4_3 Analyse process performance	KPIs definition and analysis Improvement and optimisation areas identification Costs and exposures balance	
A6_LU4_4 Analyse problem causes and trends in order to prevent disruptions	History and trends analysis Change types and rates to incidents and problems correlation Pareto distribution Possible actions to prevent further incidents and problems Process review and optimisation	

D1 - Information Security Strategy development

D.1 Information Security Strategy Development						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU1	Security and resilience of service delivery systems					
LU2	Operational risk management and business impact					
LU3	Access to information resources and essential elements of personal and administrative security as a combination of technical, organizational and personal security					
LU4	Technological security: attacks and countermeasures					
LU5	Vulnerability evaluation in real-world					
LU6	Security in new technologies					
LU7	Resilience of services in the event of technical and organizational risks					
LU8	Legal aspects in information security					
LU9	Security standards and best practices					
LU10	Strategic thinking and process of strategy development					

 not present in the eCF 3.0 standard

COMPETENCE:	D.1 Information Security Strategy Development		
LEARNING UNIT:	LU 1 – Security and resilience of service delivery systems		
General description:	The LU 1 make the learner aware about the complexity of today's socio-economic relationships (dependencies), possible security threats and security management approaches. The LU 1 provides the description of general concepts and relationships among them in order to manage and ensure operational resilience, as well as the domains of an organization's cyber resilience capabilities.		
Knowledge	K1 The potential and opportunities of relevant standards and best practices		
	K4 Possible security threats		
Skills	S3 Apply relevant standards, best practices and legal requirements for information security		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D1_LU1_1 Argument the provision of security and continuity of a business	Complexities of today's socio-economic environment	Outline the arguments for need of development and implementation of information security strategy	Outline the arguments for need of development and implementation of information security strategy
	Destructive events		
	Possible security threats and cyber vulnerabilities		
	Defence, Security, Risk management and Resilience		
D1_LU1_2 Define the key components of operational resilience	Services	Figure, definitions and relationships among the components of operational resilience	Figure, definitions and relationships among the components of operational resilience
	Business processes		
	Assets		
D1_LU1_3 Name the main standards and practices in	Strategies for protecting and sustaining assets	Describe the potential and opportunities of	Describe the potential and opportunities of
	The ISO 27000 family of standard and their role for an Information Security Management System (ISMS)		

	information security	RMM and CRR models for assessment of the organizational and operational resilience	relevant standards and best practices	relevant standards and best practices
COMPETENCE:	D.1 Information Security Strategy Development			
LEARNING UNIT:	LU 2 – Operational risk management			
General description:	The goal of risk management (RSKM) is to identify potential problems before they occur so that risk addressing activities can be planned and taken into account throughout the lifecycle of the service or the process on mitigation of adverse effects on the achievement of the business objectives.			
Knowledge	K3 The information strategy of the organisation			
Skills	S1 Develop and critically analyse the company strategy for information security			
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D1_LU2_1	Define a risk management strategy	Sources and categories of risks	Case study	Case study
		Parameters of risks		
		Formulation of a risk strategy		
		Assess the business impact of a security breach of certain kind		
D1_LU2_2	Identify and analyse the risks	Documentation of risks – identification of problems, threats and vulnerabilities	Case study	Case study
		Evaluation, categorization and prioritization of risks		
		General addressing the categories of risks		
D1_LU2_3	Mitigation of risks	Development and implementation of a plan for risk mitigation	Case study	Case study
		Strategic aspects of the service(s)		
		Effects of risks on the assets		

	Effects of risks on the services		
	Risk management		

COMPETENCE:	D.1 Information Security Strategy Development		
LEARNING UNIT:	LU 3 – Access to information resources and essential elements of personal and administrative security as a combination of technical, organizational and personal security		
General description:	In order to support services, assets such information, technology, and facilities must be made available (accessible) for use. This requires that persons (employees and contractors), objects (systems) and entities (business partners) have sufficient (but not excessive) levels of access to these assets.		
Knowledge	K6 The different service models (SaaS, PaaS, IaaS) and operational translations (i.e. cloud computing)		
	K5 The mobility strategy		
Skills	S4 Anticipate required changes to the organisation’s information security strategy and formulate new plans		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D1_LU3_1 Manage and control access to information resources	Information resources (assets)	Develop a plan for access management according organizational roles	Develop a plan for access management according organizational roles
	Management of identities and credentials		
	Physical and remote access		
	Identity and access management		
	Categorization of information assets on the basis of sensitivity and potential impact to the critical service		

D1_LU3_2	Differentiate access by type of organizational assets and organizational roles	Responsible, Accountable, Consulted, Informed (RACI) matrix	Develop a matrix for access management according organizational roles	Develop a matrix for access management according organizational roles
		Access to technology assets		
		Access to facility assets		
COMPETENCE:	D.1 Information Security Strategy Development			
LEARNING UNIT:	LU 4 – Technological security: attacks and countermeasures (LU 2 of E.8)			
General description:	The learning unit aims to give an insight of information security in enterprises, underlining its different components. The learning unit will It starts from the common attackers techniques till to the modern "APT" (Advanced Persistent Threats), which are commonly used today in Cybercrime attacks, and which are used to compromise the integrity of information systems. Together with the attacks techniques, the learning unit will show also the corresponding available countermeasures.			
Knowledge	K3 The critical risks for information security management			
	K5 Security detection techniques			
	K6 Cyber attack techniques and counter measures for avoidance			
	K4 Possible security threats			
Skills	S2 Analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack			
	S5 Apply monitoring and testing techniques			
	S7 Implement the recovery plan in case of crisis (implement the response techniques in case of attack)			
	A4 Collect and process technical requirements for cyber defence and mitigation of risks			
	S5 Propose effective contingency measures			

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
E8_LU2_1 Identify the Information Security Role in modern Enterprises	Information security, underlining the security objectives in Enterprises	Identify the most important element of information security in enterprises
	Characteristics and strength of the attacker (Hacker) and the defender (Security Expert)	
	relation between: risk, vulnerability, threat and countermeasure	
E8_LU2_2 Categorize the attacker in order to identify at which level of security the enterprise needs to comply	The common stages of cyber security attacks	In a case study, categorize the attackers
	The cyber attackers by characteristics and motivation	
	The high level hacking patterns	
E8_LU2_3 Explain a security model in enterprises	The importance of a data-centric point of view in a security context	Describe Defence in depth approach
	The importance of a multi layered security approach	
E8_LU2_4 Describe the fundamental components of security	Data security elements	List all key components of security needed in enterprise environments
	Network security components	
	Server security approach and tools	
	Client security requirements	
	The edge defence	
E8_LU2_5 Recognize the security governance pillars and relations	Key elements for security monitoring, management and assessment	Relate the security governance activities and the main support tools
Description of advanced attacks		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
	What is ransomware and what are the consequences	Give example of advanced attacks and their consequences
E8_LU2_7 List most advanced countermeasures for specific security areas	Mobile device security	Match example of vulnerabilities and possible countermeasure
	Wi-Fi security assessment	
	Workstation and browser security	
	Industrial Control System security models	
E8_LU2_8 Identify limits of technological malware protection tools	Description of main characteristics of malware protection tools	Identify characteristics, strength and weakness of a certain malware protection tool and consequently identify ways for improving it
	Description of strength and weaknesses of malware protection tools	
	Description of innovative technologies and methods for improving malware detection and protection	
	What human sensor network are	

COMPETENCE:	D.1 Information Security Strategy Development
LEARNING UNIT:	LU 5 - Vulnerability in real world (LU 5 of E.8)
General description:	The learning unit deals with the vulnerabilities that affects now systems and organizations. The learner will than know how to relate vulnerability and risks/attacks, considering both technological and human factors, and how to execute a vulnerability assessment and a penetration test. The learning unit aims also to illustrate the changing paradigms of attack from an approach aimed primarily looking for flaws in the technology to one which instead relies on the human factor to undermine the company's perimeter defences. More generally, it addressed the issue of availability of "social" information for attacks supported by techniques of social engineering.
Knowledge	U4 Vulnerability assessment techniques

	K4 The ICT internal audit approach		
	K5 Security detection techniques, including mobile and digital and cloud		
	K6 Cyber attack techniques and counter measures for avoidance		
	K6 The different service models (SaaS, PaaS, IaaS) and operational translations (i.e. cloud computing)		
Skills	A1 Perform vulnerability assessment		
	S2 Analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack		
	S5 Apply monitoring and testing techniques		
	S7 Implement the recovery plan in case of crisis (implement the response techniques in case of attack)		
	S4 Anticipate required changes to the organisation's information security strategy and formulate new plans		
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 2)
E8_LU5_1	Identify the goal and the benefits of a Security Assessment	Bugs, misconfigurations and configuration errors	Be able to put in relation vulnerability and security risks providing examples
		Vulnerability in a cyber security point-of-view	
		The relation between security vulnerability, risks and time to underline the importance of Security Patching process	
E8_LU5_2	Describe the main phases in a Security Assessment	The Security Assessments in a security framework	List the key elements needed to start a Security Assessment activity
		The definition of the main Security Assessment phases, providing detailed requirements and output for each phase	
		Effort needed to reach the desired quality of the Assessment outputs	
		The role of NDA and Liability Waiver	
E8_LU5_3	Distinguish Vulnerability Assessment vs Penetration Tests	Difference between Security Assessment activities: VA, PT and custom assessment	Give example of Vulnerability Assessment output and describe process
		The key elements for evaluate an assessment activity	
		The concept of Advanced Persistent Threat tests	

	Pro and cons of PT and VA	
E8_LU5_4 Execute a vulnerability assessment and a penetration test	Description of a real-word case study	Execute a short vulnerability assessment and a penetration test

E8_LU5_5	Illustrate the concept of Social Driven Vulnerability Assessment	How to organize, evaluate and performs social driven vulnerability assessments	In a case study, give examples on how to execute a social driven vulnerability assessment, offensive hacking certification; participation to courses on cyber sociology; previous execution assessments of the human element of security in enterprises
		Legal and ethical implications and the available instruments	
E8_LU5_6	Explain the modern attack strategies exploiting social engineering	How to contrast the problem of social engineering attacks through assessment methodologies	Offensive hacking certification; participation to courses on cyber sociology; previous execution assessments of the human element of security in enterprises or give examples of how to exploit social engineering in attacks
		Risk acceptance and mitigation	
		Analysis and improvements of the modern techniques of defence and mitigation vs classic ones	
E8_LU5_7	Illustrate Social Engineering 2.0	Concepts of social engineering 2.0 and its relation to the other human sciences	Offensive hacking certification; participation to courses on cyber sociology; studies on social engineering; give examples of social engineering
E8_LU5_8	breakdown of the attack strategies	Connections of the mobile world with cybercrime	Offensive hacking certification; participation to courses on cyber

<p>for the mobile world</p>	<p>Role of the social engineering in modern cybercrime in the mobile world</p>	<p>sociology; previous execution assessments of the human element of security in enterprises. give examples of social engineering and mobile</p>
<p>E8_LU5_9</p> <p>Describe the modern defence strategies and describe some real attacks that are based on social engineering</p>	<p>Most moderns attack strategies of cybercrime and cyberterrorism, with a special attention to targeted attacks and the role of social engineering</p>	<p>Offensive hacking certification; participation to courses on cyber sociology; participation to study groups or standardization bodies on cybercrime (e.g., APWG, ESET, ECSO, Microsoft DCC). Give examples of possible countermeasure to social engineering attacks</p>
	<p>Relations with the enterprise integrity and defences</p>	
	<p>Importance of the human element in modern attacks and defence systems</p>	

<p>COMPETENCE:</p>	<p>D.1 Information Security Strategy Development</p>
<p>LEARNING UNIT:</p>	<p>LU 6 – Security in new technologies (LU 6 of E.8)</p>
<p>General description:</p>	<p>The learning unit aims to explore some security issues arising from the massive spread of the cloud paradigm, smart / mobile, and IoT. These issues not only alongside aspects of technological security, but also “social” issues, as well as phenomena of “consumerization” and the user’s habit of insecure behaviour. Moreover, the technological evolution dynamic light always new phenomena (biometrics more usable, blockchain for payments and transactions, etc.) and consequently new risks and opportunities. The LU aims to provide a taxonomy of possible threats to the</p>

	infrastructure, devices and applications, deepening methodological approaches, tools and organizational solutions for proper management of security in these areas.
Knowledge	K5 Security detection techniques, including mobile and digital and cloud
	K6 Cyber attack techniques and counter measures for avoidance
	K4 The ICT internal audit approach
	K3 The critical risks for information security management
	K5 the mobility strategy
	K6 the different service models (SaaS, PaaS, IaaS) and operational translations (i.e. cloud computing)
Skills	S5 Apply monitoring and testing techniques
	S7 Implement the recovery plan in case of crisis (implement the response techniques in case of attack)
	S2 Analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack
	A4 Collect and process technical requirements for cyber defence and mitigation of risks
	S3 Establish a risk management plan to feed and produce preventative action plans
	S4 Perform security audit
	S5 propose effective contingency measures

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 2)
E8_LU6_1	Summarize of the current landscape	The status of the cybercrime targeting the mobile terminals	Certifications of ethical hacking or offensive

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
<p>of mobile security and related cybercrime activities</p>	The main attack techniques used for the principal mobile platforms	<p>security, experiences in reverse code engineering of mobile apps; participation to study groups or standardization bodies on cybercrime (e.g.. APWG, ESET, ECSO, Microsoft DCC) or give example of possible threats to mobile applications</p>
	Trends and future evolutions	
<p>E8_LU6_2 Define Cloud Computing Model according to NIST</p>	A Cloud Computing model based on NIST guideline	<p>Be able to distinguish a Cloud Computing services against other kind of service models by the identification of the key characteristics</p>
	The key elements, components and model types (SaaS,PaaS, IaaS)	
	Relation and differences between Cloud Computing and the other ICT service Models (outsourcing, hosting, etc.)	
	The infrastructural difference between Enterprise Cloud Providers and Main Stream Cloud Providers (i.e. Google, Amazon, Facebook, etc.)	
<p>E8_LU6_3 Identify Cloud Computing trends and security concern</p>	Review of a public survey about Cloud Computing concern in a Security point-of-view	<p>Give examples of the main concern about Cloud Computing security</p>
<p>E8_LU6_4 Criticize Cloud Computing needs – a reliable opinion</p>	Analysis in a critical perspective of the reasons that leads a migration from ICT services to a Cloud Computing models	<p>Analyse a set of case studies in order to tell when a CC adopt is really necessary</p>
	The most famous Cloud Computing fails as lesson learned	
	An analytical approach for evaluate if externalize a service and with which model	

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
E8_LU6_5 Manage Security Risks in Cloud Computing projects	Analysis and comparison of Cloud Computing SLA's with the requirements of Business Impact analysis	In a case study, perform a full Risk Analysis of Cloud Computing services
	The top threat in Cloud Computing Environments to be considered during a Risk Evaluation	
	A model to address Cloud Computing-oriented risk analysis	
E8_LU6_6 Explain what is Blockchain	What is Blockchain	Give an example of use case with the block chain and identify information security risks
	What is Bitcoin	
	What is a transaction	
	What it Ethereum and other "general purpose" Blockchain	
	What are smart contracts	
	Privacy and security within transaction	
	Scalability	
Possible use case		
E8_LU6_7 Recognize IoT threats	The IoT paradigm opens a whole new world of vulnerabilities and risks, and adds new access ways to ICT infrastructures	Provide an original analysis about OWASP top 10 IoT risk contextualization to a chosen object (smartwatch, SOHO router, etc.)
	The IoT risks are mostly related to non IoT components of the technological/organizational infrastructure	
	Overview of IoT specific risks examples	
	Overview of IoT related (but not affecting IoT devices) risks examples	
	Standards and guidelines (focus on OWASP Top 10 IoT vulnerabilities)	

COMPETENCE:	D.1 Information Security Strategy Development
LEARNING UNIT:	LU 7 – Resilience of services in the event of technical and organizational risks
General description:	The purpose of this LU is to enable CSOs and security experts to outline a plan for ensuring resilience of services in the organizational and operational context
Knowledge	K3 the information strategy of the organisation
Skills	S2 define, present and promote an information security policy for approval by the senior management of the organisation
	S4 anticipate required changes to the organisation’s information security strategy and formulate new plans
	S5 propose effective contingency measures

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D1_LU7_1 Define and account the organizational and business context	Confidentiality - Integrity - Availability	Describe the context and relations between organizational and operational resilience	Describe the context and relations between organizational and operational resilience
	Organizational Context for Resiliency Activities		
	Management of operational resilience		
D1_LU7_2 Develop a simulation environment taking into account the organizational assets	Simulations of risks - methods and rules for defence from unauthorized access to assets	Develop a simulation environment	Develop a simulation environment
	Assets management		
	Assets to services		

D1_LU7_3 Develop and support plans for ensuring the continuity of services	Continuity of services	Outline a plan for continuity of services	Outline a plan for continuity of services
	Dependencies among services		
	Plan for continuity of services		
	Strategies for resilience		

COMPETENCE:	D.1 Information Security Strategy Development
LEARNING UNIT:	LU 8 – Legal aspects in information security (LU 10 of E.8)
General description:	The learning unit aims to give an overview of the legal and regulation aspects of information security. The LU analyse the new data privacy European regulation and its administrative and technological implications in companies, in order to let the learners understand the consequences and the action for their own companies. The data privacy will be analysed also considering regulations in data transfers. The LU depicts also the regulation on informatics crimes (at European level with some details for Italy), digital forensics and how it can be applied in organizations.
Knowledge	U5 Legal aspects and implication in security projects and data privacy
	K7 Computer forensics
	K2 the impact of legal requirements on information security
Skills	A7 Assess the compliance of the plans and policies with the current regulations and with the organization information security strategy
	S3 apply relevant standards, best practices and legal requirements for information security

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
E8_LU10_1 Describe the European new regulation GDPR	Rules on data management according to data type	
	Rules on data transfer	

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
<p>and its relation to the current Italian regulation on data Privacy (Privacy code)</p>	Rights of the involved person	<p>List the main topics of the European and Italian regulations of data privacy</p>
	Security and data violation	
	Code of conduct	
	Certifications	
	Control Authorities	
	Protections and penalties	
<p>E8_LU10_2 Apply the regulations on data privacy</p>	<p>Technical and business consequences of the GDPR Analysis of the consequences of the GDPR on contrast to the cybercrime activities</p>	<p>Apply the GDPR to the company digital data</p>
<p>E8_LU10_3 Outline the Privacy in data transfer between US and EU</p>	Safe Harbour	<p>Distinguish between the two regulations in data transfer</p>
	Privacy shield	
<p>E8_LU10_4 Distinguish between different types of violations and define the responsibility regime</p>	<p>Definitions of the different types of violations (civil, penal, administrative,...)</p>	<p>Distinguish the different types of violation and the corresponding consequences for involved people</p>
	<p>Corresponding regulations for each type of violations</p>	
	<p>Examples of violations and consequences in ICT</p>	
<p>E8_LU10_5 Recognize an informatics crime and outline the current related regulations</p>	<p>Definition of the informatics crime</p>	<p>Recognize informatics crimes between a list of actions, recognize when and how the administrative responsibility applies</p>
	<p>List of the related European and Italian regulations</p>	
	<p>Italian regulation on Administrative responsibility in informatics crimes</p>	
	<p>Focus on informatics crimes</p>	
	<p>Confindustria guidelines on informatics crimes</p>	

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
E8_LU10_6 Apply the current related regulations to prevent informatics crimes in companies	Application of the Administrative responsibility and corresponding regulations	Application of the administrative responsibility regulation to the company organization (descriptions, tools, guidelines and required documentation) The ethic code created for your company
	Practical examples	
	Technical and methodological tools for the application	
	The Organization model	
	The ethic code	
E8_LU10_7 Outline regulations on digital forensics	The evidence concept	Provide examples of evidences that can be used in civil and penal legal actions and relate them to the current regulation
	The evidence of cyber crimes in Italian regulation	
	Evidence in civil legal action	
	Evidence in penal legal action	
	Italian penal law and cyber crimes	
	Digital forensic in a civil and penal legal action	
E8_LU10_8 Outline regulations on digital forensics in a company	digital forensic in company	Provide examples of application of digital forensic in companies
	how to prepare for the digital forensic	
	the company digital forensic phases	
	examples of main guidelines on digital forensic in companies	

COMPETENCE:	D.1 Information Security Strategy Development
LEARNING UNIT:	LU 9 – Security standards and best practices

General description:	Acquiring the best practices, standards and challenges for IS strategy development the learner will be able to choose the best approach for development and support a IS strategy
Knowledge	K1 the potential and opportunities of relevant standards and best practices
Skills	S3 apply relevant standards, best practices and legal requirements for information security

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D1_LU9_1 Create an Information Security Strategy	The ISO 27000 family of standard and their role for an Information Security Management System (ISMS)	Evaluate and juxtapose the standards and models for IS strategy	Evaluate and juxtapose the standards and models for IS strategy
	The implementation of an ISMS based on the ISO 27001 standard: Clauses 4-10 Appendix A: Security Controls		
	RMM and CRR model		
	Information security and data protection related EU strategies, documents and directives		
D1_LU9_2 Describe the information security specifics and challenges in new and disruptive technology and business models	Specifics of IS management in cloud computing	Outline the major challenges in area of IS faced by new technology	Outline the major challenges in area of IS faced by new technology
	Specifics of IS management in blockchain technology (ICO)		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	Specifics of IS management in IoT		

COMPETENCE:	D.1 Information Security Strategy Development
LEARNING UNIT:	LU10 – Strategic thinking and process of strategy development
General description:	LU6 provides the learner with knowledge on the process of strategy formulation and strategy implementation. The LU gives objective insights on all the steps and aspects of strategy development in the context of organizational and operational processes
Knowledge	K3 the information strategy of the organisation
Skills	S1 develop and critically analyse the company strategy for information security

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D1_LU10_1 Assess the benefits of strategic thinking	Strategic thinking	Describe the specifics of strategic thinking	Communicate effectively the specifics of strategic thinking
	Strategic process		
	Introduction to Balanced Scorecard		
D1_LU10_2 Formulate and support the	Strategy formulation	Describe the process of strategy	
	Strategic roadmap		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
implementation of an IC strategy	Metrics and prioritization	formulation and implementation	Develop a strategy for IS and plan for its implementation
	Communication		

E6 - Quality management

E.6_ICT Quality Management						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU1	Quality Assurance Foundations					
LU2	Quality Assurance Practices in Software Development					
LU3	Quality Assurance Practices in ICT Services					
LU4	Practices for Data Quality					
LU5	Control and Audit					

 not present in the eCF 3.0 standard

COMPETENCE:	E6_ICT Quality Management
LEARNING UNIT:	LU 1 -Quality Management Foundations
General description:	This LU aims at working with the foundations of the quality management for ICT organisations, integrating existing quality management and assurance frameworks, models and standards. The LU also analyses how the quality is integrated within the work processes.
Knowledge	K1 Manages and organizes the methods, tools and procedure to be applied within the organisation and where they should be applied U1 Quality assurance methodologies and standards U2 Quality models for ICT processes
Skills	S1 Illustrate how methods, tools and procedures can be applied to implement the organisation' s quality policy S2 Assist owners in the choice and use of measures to evaluate effectiveness and efficiency of the overall process S3 Monitor, understand and act upon quality indicators

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
E6_LU1_L01	Identify and describe the foundational concepts on ICT quality management	Principles and Concepts	Exam on foundational concepts on ICT quality management	Case studies and exercises to plan ICT quality management

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	Evidence examples (Level 4)
E6_LU1_L02 Apply Quality Assurance General and ICT Frameworks and Models	Quality Assurance General and ICT Frameworks and Models	Exam on quality assurance General and ICT Frameworks and Models	Case studies and exercises to plan and implement ICT quality management in an organisation
E6_LU1_L03 Apply the work processes approach for quality management	Work Processes: Define, Build, Implement and Improve	Exam on concepts for the work processes approach to quality management	Case studies and exercises to define, build, implement and improve quality with a work processes approach

COMPETENCE:	E6_ICT Quality Management
LEARNING UNIT:	LU 2 – Quality Assurance Practices in Software Development
General description:	This LU is focused on the practical application of quality assurance in software development projects and organisations, starting by the foundations of software quality and then walking through the existing different techniques and disciplines (e.g. technical reviews, inspections, software metrics, etc.) which contribute to software quality assurance
Knowledge	-

Skills	<p>S2 Assist owners in the choice and use of measures to evaluate effectiveness and efficiency of the overall process</p> <p>S3 Monitor, understand and act upon quality indicators</p> <p>A1 Apply quality assurance methods to software development</p> <p>A5 Plan and implement software quality activities</p>
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Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
E6_LU2_L01	Identify and describe the foundational concepts on software quality	Foundations of QA for software development	Exam on foundational concepts on software quality	Case studies and exercises to plan ICT services quality assurance
E6_LU2_L02	Identify and describe the techniques, standards, tools, etc. for software quality assurance	Software quality assurance techniques, standards and tools	Exam on software quality assurance techniques, standards and tools	Case studies to plan software quality assurance techniques, standards and tools
E6_LU2_L03	Apply verification and validation methods, techniques and tools to software development and maintenance	Software verification and validation	Exam on practices for software verification and validation	Case studies and exercises to apply verification and validation methods, techniques and tool

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
E6_LU2_L04 Apply software measurement and evaluation methods, techniques and tools to software development and maintenance	Software measurement and evaluation	Exam on practices for software measurement and evaluation	Case studies and exercises to apply software measurement and evaluation
E6_LU2_L05 Identify and describe the link of software quality assurance to configuration management	Link to configuration management	Exam on configuration management concepts and link to software quality	Case studies on configuration management concepts and link to software quality

COMPETENCE:	E6_ICT Quality Management
LEARNING UNIT:	LU 3 – Quality Assurance Practices in ICT Services
General description:	This LU is focused on the practical application of quality management in ICT services, starting by the foundations of quality in ICT services and then analysing how to apply the existing standards (e.g. ISO 20000, ITIL, etc.), techniques, tools and concepts (e.g. Indicators, SLA, etc.).

Knowledge	U3 Regulations and standards in quality management as well as data quality U5 ICT Services quality assessment and improvement
Skills	S2 Assist owners in the choice and use of measures to evaluate effectiveness and efficiency of the overall process S3 Monitor, understand and act upon quality indicators A2 Apply quality assurance methods to ICT services A6 Plan and implement ICT services quality activities

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
E6_LU3_L01	Identify and describe the foundational concepts on ICT services quality	Foundations of QA for ICT services	Exam on foundational concepts on ICT services quality	Case studies and exercises to plan ICT services quality assurance
E6_LU3_L02	Apply the standard modes for ICT services quality assurance	Standard models for ICT services quality assurance: ISO 20000, ITIL, etc.	Exam on standards for ICT services quality assurance	Case studies and exercises to plan and implement practices from standards for ICT services quality
E6_LU3_L03	Apply the techniques, tools and indicators for ICT services quality	Techniques, tools and indicators for ICT services quality	Exam on Techniques, tools and indicators for ICT services quality	Case studies and exercises to apply techniques, tools and indicators for ICT services quality

COMPETENCE:	E6_ICT Quality Management
LEARNING UNIT:	LU 4 – Practices for Data Quality
General description:	This LU aims at providing a general idea the concept and foundations of quality for data and information and then covering the existing methods and tools for quality data assessment and indicators and information.
Knowledge	U6 Data quality assessment and improvement
Skills	S2 Assist owners in the choice and use of measures to evaluate effectiveness and efficiency of the overall process S3 Monitor, understand and act upon quality indicators A3 Apply quality assurance methods to data quality A7 Plan and implement data quality activities

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
E6_LU4_L01 Identify and describe the foundational concepts on quality of data	Foundations of data quality	Exam on foundational concepts of data quality	Case studies and exercises to correctly identify and manage the concepts on data quality
E6_LU4_L02 Evaluate and control data and information quality	Methods and indicators for data and information quality assessment	Exam on practices for data and information quality assessment	Case studies and exercises to correctly evaluate data quality
E6_LU4_L03 Apply methods for data and information quality improvement	Data and information quality improvement	Exam on practices for data quality improvement	Case studies and exercises to apply data quality improvement methods

COMPETENCE:	E6_ICT Quality Management
LEARNING UNIT:	LU 5 – Control and Audit

General description:	This LU is focused on the general function of control and audit of the quality management results and procedures. It addresses both the control of internal processes and the control of the external contributions to the work of the organisation through outsourcing subcontracting and the use of COTS software.
Knowledge	K2 ICT internal quality audit approach U7 ICT quality management standards and policy
Skills	S4 Evaluate and analyse work processes steps to identify strengths and weaknesses S5 Perform quality audits

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
E6_LU5_L01 Evaluate and control quality and conformance to standards in internal processes	Internal control and quality management standards for audits	Exam on internal control and quality management standards	Case studies and exercises to plan and execute quality audits	Case studies and exercises to conceive internal quality audits
E6_LU5_L02 Evaluate and control external contributors to ICT quality	Quality assurance for outsourcing and COTS	Exam on practices for controlling of external contributors to quality according to standards and procedures	Case studies and exercises to plan and execute control to external contributors to quality	Case studies and exercises to conceive internal quality audits

Conclusions

The document describes how the project approached the design of the Learning Units within the e-CF COUNCIL learning and training purposes.

Coherently with the frame designed in the work package 3 “Vocational Qualification and Certification Standard”, the work defined the Learning Unit structure, made up of:

- Information derived from the related e-Competence Qualification Profile, such as the competence title, the prerequisite, the specific proficiency levels addressed (e-CF dimension 4)
- A General description
- The Understanding and the Skills, coherently with the related Competence’s ones
- The Learning Outcome, that explains the learning achievement that an individual can expect either to address or to have gained through a learning experience
- The Learning Content, related to the Learning Outcomes above defined
- The Evidences, related to the Learning Outcomes of the Learning Unit
- The potential ECVET points

The present document reports the results for the second set of the competences as well as the final version for the first set, included in the annexes.

The work chose a set of fifteen competences, by taking into account, firstly, the outcome of the previous project work packages that had analysed the market and the professionalism emerging in the ICT; secondly, the partners’ experience and internal know-how in order to facilitate at best the initial design effort; finally, the feedback from the externals and the stakeholders who participated the focus groups and the surveys launched along the project life-span. The experimentations through the pilots also allowed to validate the methodology and to fine-tune the learning unit design.

Overalls, the present results provide a complete set of Learning Units that translate the competence qualification profile into a modular structure of content and learning outcomes. According to the competence nature and characteristics, the granularity may slightly differ to each other. The different range of proficiency levels and the various areas, which the competences belong to, create a great variability that the design work tempted to cope with. So far, the present result is likely to benefit from any following improvement. Any use case and employment in real training/ learning context will contribute and will allow it to progress. In addition, it surely needs to be kept up-to-dated coherently with the sector and the e-CF standard evolution.

The following Work Package 5 will exploit how this LU based approach can be deployed in real training and competence validation actions. It will show the overall process and the different ways through which the Learning Units can be differently useful such as: for self-assessing; for identifying a learning experience and filling the competence gaps; for starting a personal portfolio; for validating formally the competence.

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Annex I – First set of competences Learning Units (final)

A1 – IS and business strategy alignment

A.1_IS and Business Strategy Alignment						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Evaluation of the organisational digital maturity					
LU 2	Fundamentals of security					
LU 3	Effects of ICT implementations					
LU 4	Enterprise architecture understanding and frameworks					
LU 5	Business requirements and ICT services					
LU 6	New emerging technologies and business impacts					
LU 7	Cost-benefit feasibility analysis of ICT solutions					
LU 8	ICT Sourcing models					
LU 9	Business strategy and business models					
LU 10	Analysis of future developments of business, customer needs and technology application					

 not present in the eCF 3.0 standard

COMPETENCE:	A.1_IS and Business Strategy Alignment		
LEARNING UNIT:	LU 1 – Evaluation of the organizational digital maturity		
General description:	This LU provides an overview of the different major IT maturity models, it describes the different capabilities related to the digital maturity and provide tools and techniques in order to identify and evaluate them and, finally, it describes the different steps to evaluate the digital maturity.		
Knowledge	–		
Skills	A3 Evaluate organisational digital maturity		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU1_1 Identify organisational digital maturity models	IT maturity definition General purpose and industry specific IT maturity models (e.g. CMM, CMMI, SPICE, IT-CMF, ...)	Describe one of the possible maturity models	Describe one of the possible maturity models
A1_LU1_2 Identify and evaluate critical capabilities	Critical capabilities macro-categories (functional coverage, data management, ICT governance, IT usage, innovation) Critical capabilities identification and evaluation	Describe an example of a real case with a description of critical capabilities, their evaluation and impact on IT strategy	Describe an example of a real case with a description of critical capabilities, their evaluation and impact on IT strategy
A1_LU1_3 Assess the organizational digital maturity using the right IT maturity model	IT maturity model selection Benchmark identification	Describe the application of the digital maturity map in a real case related	Describe the application of the digital maturity map in a real case

	Organizational digital maturity assessment and gap analysis	to a specific sector or technology	related to a specific sector or technology
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COMPETENCE:	A.1_IS and Business Strategy Alignment		
LEARNING UNIT:	LU 2 – Fundamentals of security		
General description:	The fundamentals of security are needed for most of the digital competences, especially for those with a high proficiency level. This LU is aimed at providing some theoretic basics such as the Security Lifecycle, main threats and attacks, etc. and some indications on how to manage security issues in an organization		
Knowledge	K8 Security		
Skills	A1 Understand business impact of hacks A2 Communicate security breaches		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU2_1 Frame the information assurance as practiced in computer operating systems, distributed systems, networks and representative applications	Essential IT security concepts (targets, policy, ...)	Describe and contextualize in a real case the information security lifecycle	Describe and contextualize in a real case the information security lifecycle
	Interrelation between components of the computing environment		
	IT security pillars: CIA (Confidentiality, Integrity, Availability), star model		
	Information Security lifecycle		
A1_LU2_2 Identify the prevalent network and distributed system attacks and	IT Security Attacks classification (active, passive, ...)	Describe a real experienced event of cyber attacks and	Describe a real experienced event of cyber attacks and
	Direct-access attacks and countermeasures		

<p>threats, related defences, and forensics to investigate an incident</p>	<p>Network attacks and countermeasures</p> <p>Social engineering: phishing and malware spreading</p> <p>Case studies of systems attacks and related countermeasures</p>	<p>related countermeasures</p>	<p>related countermeasures</p>
<p>A1_LU2_3</p> <p>Recognize the basics of security and cryptography and some key encryption techniques used today</p>	<p>Introduction to cryptography (Plaintext, Ciphertext, Cipher, Key)</p> <p>Symmetric-key Cryptography</p> <p>Asymmetric-Key Cryptography</p> <p>Ciphers types (Data Encryption Standard (DES), Advanced Encryption Standard (AES))</p>	<p>Explain differences, pros and cons, strengths and weaknesses of different cryptography solutions</p>	<p>Explain differences, pros and cons, strengths and weaknesses of different cryptography solutions</p>
<p>A1_LU2_4</p> <p>Frame the regulation and legal implications of data privacy</p>	<p>Timeline and comparison between EU and US laws related to information security</p> <p>Security standards and controls</p> <p>Certification and accreditation</p>	<p>Provide real examples concerning the observance of privacy and information security legislations, underlining pros and cons/ strengths and weaknesses of the presented cases</p>	<p>Provide real examples concerning the observance of privacy and information security legislations, underlining pros and cons/ strengths and weaknesses of the presented cases</p>
<p>A1_LU2_5</p> <p>Approach cybersecurity management</p>	<p>Security Governance</p> <p>Management models, roles and functions</p> <p>Information security role and positions</p> <p>IT security risk assessment and contingency planning</p> <p>Business continuity and Disaster Recovery</p>	<p>Describe a real case of cybersecurity management function definition with roles and competences</p>	<p>Describe a real case of cybersecurity management function definition with roles and competences</p>

A1_LU2_6 Identify and evaluate business impacts of hacks	Frameworks for business impact of hacks identification	Describe a real case of business impacts of an external hacks (e.g. data theft or denial of service)	Describe a real case of business impacts of an external hacks (e.g. data theft or denial of service)
	Direct cyber attack costs		
	Cyber attack hidden costs		
	Value of data loss quantification techniques (customer impact / revenue loss)		
	Containment and remediation planning methods		
A1_LU2_7 Manage cyber attack communication	Cyber attack communication plan examples	Define a cyber attack communication plan giving examples of both internal and external communication of an attack	Define a cyber attack communication plan giving examples of both internal and external communication of an attack
	Methods to communicate to the board		
	Methods to communicate with external sources, press		

COMPETENCE:	A.1_IS and Business Strategy Alignment
LEARNING UNIT:	LU 3 - Effects of ICT implementations
General description:	The ICT implementations cause some organizational changes. This LU introduces the ICT implementation as a potential change to be necessarily recognised and managed within the organization. It provides models and methods to identify and analyse the targets influenced by the ICT implementation and it provides criteria on how evaluate the impact on different actors and how to develop an effective change management plan.
Knowledge	U1 Impacts of ICT implementations on people and processes in the organizations
Skills	S7 Review and analyse effects of implementations

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU3_1 Frame the change management in nowadays organizations	The impact of digital technology on organizations	Describe a real case of organizational change related to digital technology change	Describe a real case of organizational change related to digital technology change
	What is Change Management		
	Organizational change and resistance to change		
	Case studies of organizational change related to digital technology change		
A1_LU3_2 Analyse the change at various levels: individuals, teams, organization	Methods and approaches to individuals' changes, such as behavioural cognitive approach, humanistic psychology approach and the transformative change model	Provide an analysis report of impacts related to a specific ICT implementation (e.g. influenced actors, targets; criteria to define impacts; impact evaluation)	Provide an analysis report of impacts related to a specific ICT implementation (e.g. influenced actors, targets; criteria to define impacts; impact evaluation)
	Methods and approaches to team changes, such as the Tuckman' s model		
	Team building and team leadership approaches in support to organizational change		
	Principles behind understanding the driving forces and resisting forces in any situation of change		
A1_LU3_3 Value the impact of IT programs and projects on the organization and develop a change management plan	Typology of impacts over individuals, teams, organization and related criteria of significance in relation to a specific context	Define a specific action plan to manage the changes required by an ICT implementation	Define a specific action plan to manage the changes required by an ICT implementation
	A change management plan: what it is, criteria of effectiveness, requirements to deploy and implement it effectively	Report the action plan implementation in support of change management	Report the action plan implementation in support of change management
	Case studies of definition and implementation of action plan to manage the changes		

COMPETENCE:	A.1_IS and Business Strategy Alignment		
LEARNING UNIT:	LU 4 – Enterprise architecture understanding and frameworks		
General description:	This LU is aimed at highlighting the key factors of an Enterprise Architecture (EA) and pinpointing criteria for analysing the efficiency and effectiveness of a specific EA framework may bring to an organization. Moreover, the LU provides an overview how to model an EA through specific languages and tools for managing organizational process efficiency and effectiveness considering the EA operative structure		
Knowledge	K7 Architectural frameworks		
Skills	S10 Understand the enterprise architecture		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU4_1 Argue the foundational elements of an Enterprise Architecture (EA)	EA definition	Share a graphic representation of an EA with a description of its main components	Share a graphic representation of an EA with a description of its main components
	The value EA brings to an organization		
	Building Blocks		
	Artifacts		
	Deliverables		
	Enterprise Continuum		
A1_LU4_2 Compare contemporary Enterprise Architecture frameworks	Introduction to main EA frameworks	Describe an EA framework and pros and cons for the application in a real case, compared with other frameworks	Describe an EA framework and pros and cons for the application in a real case, compared with other frameworks
	Zachman Framework for Enterprise Architecture		
	Department of Defense Architecture Framework – DoDAF		
	Federal Enterprise Architecture Framework – FEAF		
	The Open Group Architectural Framework – TOGAF		

A1_LU4_3	Value architecture modelling languages against a specific context	Architecture Languages introduction	Share examples of technical documentation where modelling languages were used	Share examples of technical documentation where modelling languages were used
		IDEF		
		BPMN		
		UML		
		Criteria for comparing different frames		
A1_LU4_4	Set-up an Enterprise Architecture team	Enterprise Architecture Unit - Objectives	Describe a real case of EA function definition with roles, competences and tools	Describe a real case of EA function definition with roles, competences and tools
		Enterprise Architecture Unit - Team Roles		
		Enterprise Architecture Unit - Main EA Processes and impacts on other IT processes		
		Enterprise Architecture Unit - Start-up tools (catalogs, matrices, ...)		

COMPETENCE:	A.1_IS and Business Strategy Alignment			
LEARNING UNIT:	LU 5 - Business requirements and ICT services			
General description:	The definition of the ICT requirements is fundamental to have an alignment with the business aims. This LU is aimed first of all at defining the context and the main factors from which requirements can be elicited and formalized. Then, the LU gives an overview of tools and technics to pinpoint, model and formalize the actual requirements and it introduces managerial methods to prioritize, review and monitor requirements			
Knowledge	K4 The business aims and organizational objectives			
Skills	S2 Determine requirements for processes related to ICT services S11 Understand the legal & regulatory landscape in order to factor into business requirements			
Learning Objectives The learner will be able to...	Learning Content		Evidence examples (Level 4)	Evidence examples (Level 5)

A1_LU5_1	Identify business aims and organizational objectives	Introduction to demand management and requirements definition	Produce a document with requirements hierarchy and taxonomy against the business inputs of a given context	Produce a document with requirements hierarchy and taxonomy against the business inputs of a given context
		Role and contribution of stakeholders to the requirements engineering		
		The requirements definition phase in the project lifecycle (waterfall vs agile)		
		Requirements hierarchy and taxonomy		
		Business inputs and rationale to the "requirements definition" phase		
		Requirements Engineering frameworks		
A1_LU5_2	Act a requirements elicitation	Knowledge types (implicit, explicit)	Describe the application of a one or more elicitation technique in a real case	Describe the application of a one or more elicitation technique in a real case
		Elicitation techniques (i.e. interviews, surveys, goal based analysis, prototypes, workshops, focus groups, user task analysis)		
		Techniques applicability		
		Case studies of elicitation techniques application		
A1_LU5_3	Use models in requirements definition	Modelling objectives	Describe the application of a one or more elicitation technique in a real case	Describe the application of a one or more elicitation technique in a real case
		Modelling languages (i.e. UML, User Story Mapping)		
		Case studies of modelling languages application		
A1_LU5_4	Formalize requirements documentation	User stories	Describe the application of a one or more elicitation technique in a real case	Describe the application of a one or more elicitation technique in a real case
		Use Cases		
		Requirements documents		
		Requirements catalogue		
		Case studies of requirements documentation production		
A1_LU2_5	Analyse and validate requirements	Requirement organization and prioritization	Show reports and documents describing and explaining in-field	Show reports and documents describing and explaining in-field
		Requirements validation process and requirements reviews		
		Changing requirements and requirements traceability		

		discontinuities on a real context	discontinuities on a real context
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COMPETENCE:	A.1_IS and Business Strategy Alignment		
LEARNING UNIT:	LU 6 – New emerging technologies and business impacts		
General description:	This LU aims at giving tools to evaluate the impacts of new technologies on the business. In particular, the LU provides tools and methods to keep oneself updated on overviews and insights about new/emerging technologies and business innovation sources, it identifies and classifies impacts of new technologies at various levels and then it evaluates the impacts of new technologies using best practices and tools with the engagement of business stakeholders		
Knowledge	K6 The new emerging technologies (e.g. distributed systems, virtualisation, mobility, data sets)		
Skills	S8 Understand the impact of new technologies on business (e.g. open/big data, dematerialisation opportunities and strategies) S9 Understand the business benefits of new technologies and how this can add value and provide competitive advantage (e.g. open/big data, dematerialisation opportunities and strategies)		
Learning Objectives The learner will be able to...	Learning Content		Evidence examples (Level 4)
A1_LU6_1	Monitor new technologies trends	Methods to identify and monitor the main sources of market and technology research Technology lifecycle and maturity (e.g. Hype curve Gartner, TRL scale, ...)	Provide an analytical document reporting the innovation of
			Provide an analytical document reporting the

	<p>Exemplificative lists of references and related main contribution of:</p> <ul style="list-style-type: none"> - Significant networks/hub/research centre - Sectorial events and webinar or online courses - Technical communities 	<p>a new technology based on the information collected from different sources and explaining the business impact of the new technology</p>	<p>innovation of a new technology based on the information collected from different sources and explaining the business impact of the new technology</p>
	<p>Case studies of technology lifecycles</p>		
<p>A1_LU6_2</p> <p>Classify business impacts of technologies</p>	<p>Impacts on business models</p>		
	<p>Impacts on business factors (benefits, costs, markets, ...)</p>		
	<p>Impacts on processes and organization</p>		
	<p>Impacts on Information Systems architecture</p>		
	<p>Impacts on human resources</p>		
	<p>Impacts on customers</p>		
	<p>Case studies of impacts classification of specific ICT solutions</p>		

A1_LU6_3 Evaluate impacts of new technologies on business	Strategic dimensions for the evaluation of new technologies role in a defined business		
	Evaluation models of new technologies (e.g. BCG matrix, SWOT model, ...)		
	New technologies benefits classification		
	Added value and competitive advantages related to new technologies		
	Impacts evaluation through practices, methodologies and tools (e.g. BIA – Business Impact Analysis, questionnaires, ...) identified for each classification		
	A business case: models and methods to create		
	Case studies of impacts evaluation of specific ICT solutions		

COMPETENCE:	A.1_IS and Business Strategy Alignment
LEARNING UNIT:	LU 7 – Cost-benefit feasibility analysis of ICT solutions
General description:	This LU is focused on evaluating the cost-benefits trade-off of an ICT solution. The LU is aimed at describing how to manage cost-benefit analysis in different ICT sourcing policies and models, taking into account evolving trends and innovations. Moreover, it gives an overview of methods to identify and qualify correctly ICT costs and benefits and, finally, it gives an overview of methods to evaluate correctly ICT costs and benefits trade-off
Knowledge	K2 Trends and implications of ICT internal or external developments for typical organisations
Skills	S6 Analyse feasibility in terms of costs and benefits

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU7_1	Describe impact of different contexts on ICT costs-benefits analysis	ICT sourcing policies and models	Provide a document comparing ICT costs-benefits analysis in at least two different contexts from quantification issues up to trade-off evaluation	Provide a document comparing ICT costs-benefits analysis in at least two different contexts from quantification issues up to trade-off evaluation
		Insourcing and outsourcing trends		
		Insourcing context and costs-benefits analysis		
		Outsourcing context and costs-benefits analysis		
		Outsourcing of ad hoc solution		
		Outsourcing of the shelf solutions		
A1_LU7_2	Identify and qualify ICT costs-benefits	Costs identification methods (category of costs and criteria)		
		Benefits identification methods (category of benefits and criteria)		
		From identification to qualification of costs and benefits		
		Case studies of identification and qualification of ICT costs-benefits		
A1_LU7_3	Quantify ICT costs-benefits	Costs quantification methods (e.g. benchmark, market analysis, RFQ - request for quotation, standard costs, internal budget, ...)		
		Benefits quantification methods (e.g. benchmark, market analysis, KPI proxy indicators, ...)		
		Case studies of ICT costs-benefits quantifications		
A1_LU7_4	Evaluate ICT costs-benefits trade-off	Methods to evaluate economic costs-benefits trade-off (e.g. Net Present Value, Internal Rate of Return, Profitability Index, Discount rate, Payback Period, Return on Investment, ...)		
		Methods to evaluate non economic costs-benefits trade-off (e.g. cost-benefit matrix, ranking methods, ...)		
		Case studies of ICT costs-benefits evaluations		

COMPETENCE:	A.1_IS and Business Strategy Alignment	
LEARNING UNIT:	LU 8 – ICT Sourcing models	
General description:	This LU is aimed at providing key elements in order to be able to evaluate at what extent the ICT sourcing model can influence on the business alignment	
Knowledge	K5 The issues and implications of sourcing models	
Skills	-	
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 5)
A1_LU8_1 Recognise and frame sourcing models	Introduction to IT Supply chain	
	IT Supply management Unit and IT Department: organizational models	
A1_LU8_2 Decide appropriate sourcing models	Insourcing vs outsourcing	Describe a real case of ICT supplier catalogue categorized
	Sourcing models (internal, knowledge, capacity, execution, service)	
	Supplier categorization	
	Criteria for correct decision on the most appropriate model against a given context (Kraljic matrix, project relevance, supplier risk, technological knowledge)	
	Case studies of sourcing models and supplier categorization	
A1_LU8_3 Manage supplier relationship	Service Level Agreement (SLA)	Describe and example of SLA ad OLA with a description of the
	Operational Level Agreement (OLA)	

		Service Levels management process	related management processes
		Supplier interaction model (performance vs strategic potential)	
A1_LU8_4	Manage cloud computing sourcing	Cloud computing: service models (IaaS, PaaS, SaaS)	Share cloud computing service selection documentation
		Cloud computing: sourcing models (Private, Public, Community, Hybrid - and integration issues)	
		Cloud computing sourcing and service models selection criteria (customization, control, flexibility, capex vs opex, speed)	
		Cloud computing supply chain: actors and roles	
		Case studies of cloud computing sourcing	

COMPETENCE:	A.1_IS and Business Strategy Alignment
LEARNING UNIT:	LU 9 - Business strategy, Business models and the ICT-Business strategy alignment
General description:	This LU is focused on the alignment between the business strategy, the business models and the ICT strategy. For this reason, the LU provides an overview about business strategies and strategic drivers that influence a strategy definition and about what is a business model and give examples of relevant business models. Then, it explains how to identify the best business model for a strategy and how to use business model identification frameworks and, finally, it provides an overview on how to develop an ICT strategy according to the business vision and strategy, how to deploy and continuously improve it
Knowledge	K1 Business strategy concepts K3 The potential and opportunities of relevant business models
Skills	S4 Contribute to the development of ICT strategy and policy, including ICT security and quality S5 Contribute to the development of the business strategy

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 5)
A1_LU9_1	Recognise the key issues of a business strategy	What is business strategy	Describe the analysis of the coherence between a business model and the related IT strategy
		Main trends in business strategies	
		Strategic drivers	
		Case studies of different business strategies	
A1_LU9_2	Recognise the key issues of business models	High level structure of a business model	
		Value proposition	
		Revenues models	
		Relevant Business models	
A1_LU9_3	Identify a coherent business models for the organization strategy	Case studies of different business models	
		Business model patterns for developing strategies	
		Business model identification and development frameworks (Business model brainstorming, business model canvas)	
A1_LU9_4	Formulate ICT vision, goals and objectives aligned to business strategy	Case studies of business model identification for a specific business strategy	
		Enterprise strategic objectives and ICT role alignment	
		ICT vision and mission definition according to business strategy objectives	
A1_LU9_5	ICT Strategy deployment and continuous alignment	Industry best practices evaluation and application	
		Scope definition within each ICT function	
		ICT trends deployment to develop the ICT strategy	
		ICT function KPIs monitoring	Identify key elements to evaluate the alignment between the ICT strategy and the business strategy in a real case

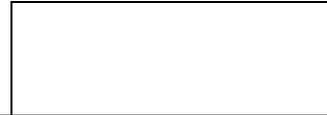
COMPETENCE:	A.1_IS and Business Strategy Alignment		
LEARNING UNIT:	LU 10 – Analysis of future development of business, customer needs and technology application		
General description:	This LU is aimed at analysing the future ICT trends. In particular, the LU gives methods to evaluate a reference, it gives insights about the main indicators to be monitored for future trend and, then, it gives examples and insights for structuring a tool to evaluate impact of future trends		
Knowledge	–		
Skills	S1 Analyse future developments in business process and technology application S3 Identify and analyse long term user/customer needs		
Learning Objectives The learner will be able to...	Learning Content		Evidence examples (Level 5)
A1_LU10_1 Identify the key references	Methods to identify the main sources of future development of business, customer needs and technology application		Share some documents reporting how various methods have been applied in order to identify and monitor future development in business processes, technology applications and market trends
	Exemplificative lists of references and related main contribution of: – Significant networks/hub/research centre – Sectorial events and webinar – Communities		
A1_LU10_2 Identify the key parameters to be analysed in a trend monitoring	Technology lifecycle and maturity (e.g. Hype curve Gartner, TRL scale, ...)		
	Startup ideas evaluation methodologies		
	Methods to monitor the main news about technology application in specific sectors		
	Methods to monitor user/customer evolution trends		
Case study of monitoring of new trends in business/ customer needs/ technology application			



A1_LU10_3

**Analyse ICT and
business impact
of future trends**

Examples of approaches to evaluate impacts on business and ICT of customer needs, technology application and business models



A.6 – Application Design

A.6_Application Design						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Requirements engineering					
LU 2	Requirements formalisation					
LU 3	Object-Oriented analysis and design					
LU 4	Data modelling techniques					
LU 5	User interface design					
LU 6	Application design related to development models					
LU 7	Application integration and innovative technologies					
LU 8	Costs and time estimation for application development					
LU 9	Application design process management					

	not present in the eCF 3.0 standard
COMPETENCE:	A.6_Application Design
LEARNING UNIT:	LU 1 - Requirements engineering
General description:	An ICT application is a computer program or set of programs designed to help people perform an activity. The application should comply with its requirements that is what it should to. This LU presents and discusses how to collect the requirements, taking into consideration all relevant aspects.
Knowledge	K1 Requirements modelling and needs analysis techniques
Skills	S1 Identify customers, users & stakeholders
	S2 Collect and formalise functional and non-functional requirements

Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU1_1 Define properly the context of an application	What is an application and why it is needed	Describe the scenario of a real application (needs, context, stakeholders) and his/her own role as cooperating in the activities or Pass a scenario questionnaire based on a case study for a typical application (e.g. : e-Commerce web application, Payroll application ...)	Present and discuss a formal scenario document (needs, context, actors, stakeholders) carried out for real application	Present and discuss a formal document including scenario, functional and non functional requirements specification, and constraints of a real application and describe how it was built, highlighting his/her role as a leader or coordinator
	Application as organisation / business need			
	Applications as processes			
	Applications maintenance and new applications			
	The role of technologies			
A6_LU1_2 Identify customers, users and stakeholders, and their perspective	Actors involved in requirements specification	Pass a scenario questionnaire based on a case study for a typical application (e.g. : e-Commerce web application, Payroll application ...)	Present and discuss a formal scenario document (needs, context, actors, stakeholders) carried out for real application	Present and discuss a formal document including scenario, functional and non functional requirements specification, and constraints of a real application and describe how it was built, highlighting his/her role as a leader or coordinator
	The customer and his objectives			
	The sponsor role			
	The users perspective			
	Other stakeholders in the organisation			
A6_LU1_3 Collect functional requirements	Requirements engineering	Discuss how functional requirements were collected in a real situation and his/her own role in requirements collection or Pass a scenario questionnaire	Present a formal requirements specification document, including functional and non functional requirements and constraints, and describe how it was built	Present and discuss a formal document including scenario, functional and non functional requirements specification, and constraints of a real application and describe how it was built, highlighting his/her role as a leader or coordinator
	From business requirements to application specifications and design			
	Source of requirements: interviews, documents, activities observation			
	Importance of understanding the process			
	Data needs			
	Requirements consistency			
	What customer and users won't probably tell you			

		Requirements classification: value requirements and priorities	covering functional requirement collection sources and activities	(sources, actors, ...) carried out for a real application	
		Requirements documentation and approval			
A6_LU1_4	Identify and collect non functional requirements	Fit for purpose and fit for use	Present and discuss non functional requirements and constraints of a real application and his/her own role in the activities or Pass a questionnaire on non functional requirements and constraints and their impact	Discuss the impact of requirements changes and how they are managed in a real organisation	Present and discuss a structured documentation of requirements change history of an application
		Non functional requirements types			
		Security requirement			
		Non functional requirements quantification			
		Techniques for weighting non functional requirements			
A6_LU1_5	Design applications according to constraints	Time, cost and quality constraints			
		Technical constraints			
		Organisational constraints			
		Legal and regulatory constraints			
A6_LU1_6	Manage requirements change	Why requirements can change			
		Requirements management			
		Modifications tracking and documentation			

COMPETENCE:	A.6_Application Design			
LEARNING UNIT:	LU 2 - Requirements formalisation			
General description:	Requirements for an application must be formalised, in order to ensure that they are clearly defined and compliant to needs, and can therefore be approved for development. This LU provides the guidelines and good practices for a structured effective formalisation, and specifically the widely used UML diagrams.			
Knowledge	K5 Languages for formalising functional specification			
Skills	S2 Collect, formalise and validate functional and non-functional requirements			
	S6 Design functional specification starting from defined requirements			
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU2_1 Identify documentation needs and models	Application Design Phases	Present and discuss examples of structured documentation (UML, DFD, ...) produced for a real application and her/his own role in the activities or pass a test based on a questionnaire or a case study requiring to produce a set of diagrams	Present and discuss an example of structured design documentation produced for a real application, including formal representations (UML diagrams, DFDs, Flow charts, ...).	Present and discuss an example of structured design documentation of a real application, including formal representations (UML diagrams, DFDs, Flow charts, ...) and describe how it was built, highlighting his/her role as a leader or coordinator.
	Feasibility Study			
	Detailed requirements collection			
	Technical design			
	Documentation for each phase			
	Textual documentation			
A6_LU2_2 Apply UML formalisation principles	Documentation using modelling languages			
	Modelling and design with UML			
	Visualization of a system's architecture			
	Components, activities, interactions, user interfaces			
	Object Model, Functional Model and Dynamic Model			
The set of diagrams				

A6_LU2_3	Produce a formal documentation using UML Structure and Behaviour Diagrams	Class Diagram		and their purpose.	Discuss the effectiveness of the documentation produced.
		Component Diagram			
		Object Diagram			
		Activity Diagram			
		Use Case Diagram			
		Interaction Diagram			
		Sequence Diagram			
		Communication Diagram			
A6_LU2_4	Produce a formal documentation using other techniques	DFD techniques			
		DFD: Functions, Data Flows, Archives, External Agents			
		Flow Chats			

COMPETENCE:	A.6_Application Design
LEARNING UNIT:	LU 3 – Object Oriented analysis and design
General description:	Analysis and design of an application must be supported by methods for modelling the required properties and behaviours. This LU describes the widely accepted Object Oriented paradigm, which can be used as a reference in all steps of the design.
Knowledge	K5 Languages for formalising functional specification
Skills	S6 Design functional specification starting from defined requirements

Learning Outcomes The learner will be able to...		Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU3_1 Categorize analysis and design methods	Modelling specifications and requirements	Present examples of analysis and design using OO for a real application or pass a test based on a questionnaire or a case study addressing the OO principles and diagrams	Present an example of analysis and design using OO for a real application, discussing the relations with the input in term of requirements and the output for detailed design and development	Present an example of analysis and design using OO for a real application, discussing the reasons for using the OO paradigm and her/his own role as a leader/coordinator
	Specification languages: natural, formal, diagrammatic			
	Analysis methods and models			
	Traditional function oriented methods			
	The Object Oriented paradigm			
A6_LU3_2 Describe properties using the Object Oriented paradigm	Entities and Objects			
	Behaviour of an Object			
	Encapsulation, messages, methods, information hiding			
	Object as a Class, Class hierarchies			
	State of an object			
A6_LU3_3 Describe behaviours using Object Oriented paradigm	Instantiation and inheritance			
	Actor roles			
	Use case model			
	Interface and control objects			
	State transition			
	Client role and server role			
	Collaboration and responsibility			
A6_LU3_4 Design applications considering Object Oriented development principles	Events, conditions, actions			
	Object Oriented programming languages and standards			
	Cohesion and coupling			
	Objects Reuse			
	Frameworks and patterns			



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COMPETENCE:	A.6_Application Design			
LEARNING UNIT:	LU 4 – Data modelling techniques			
General description:	Data are one of the most valuable asset of an organisation, and they represent the resources applications are about. Data to be used by a new application must be clearly identified and integrated in a consistent data model. This LU provides the principles and techniques for data modelling, as one of the main tasks for the design of any type of application.			
Knowledge	K7 DBMS, Data Warehouse, DSS, ... etc.			
Skills	A1 Design and integrate data models			
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU4_1 Define a Data Model and its components	What a Data Model is	Present and discuss the data model for a real application, possibly integrating new and existing data, and explain her/his own role in the design or pass a questionnaire or a case study based on defining a simple realistic data model	Present and discuss the data model for a real application, discussing the method used in data gathering, model design, naming conventions, data integration etc.	Present and discuss the high level data model for a real application area, discussing the rational of the model, the integration with other application areas, the supporting data dictionary, and other relevant aspects
	Information and data			
	Applications as process models, data as resource models			
	Local views			
	Data Modelling as a semantic issue			
	Data and Metadata			
	Entities, Attributes and Relationships			
	Entities classification, specialisation, generalisation			
	Types of attributes			
Identifier attributes, key attributes				
A6_LU4_2 Build a Data Model using E-R techniques	The Entity-Relationship (E-R) Model			
	Entities, Relationships and Attributes representations			
	Data Model elements identification			
	1:1, 1:M, M:M Relationships			
	Design rules and options			

		Completeness and consistency verification			
A6_LU4_3	Apply normalisation process for building a Data Model	Normalisation objectives			
		A relational view of data			
		Definition of Normal Form (NF)			
		Candidate keys, primary key and foreign keys			
		Functional dependency			
		Normalised Relations, 1st. 2nd and 3rd NF			
		Normalisation process			
		Beyond the 3rd NF			
		Normalisation as a verification of an E-R Model			
		Denormalisation			
A6_LU4_4	Identify, collect and document data and related properties	Data gathering			
		Synonyms and homonyms			
		Data naming			
		Data ownership			
		Data domain and constraints			
		Data security and protection needs			
		Data dictionary, metadata repository			
A6_LU4_5	Collaborate to non-operational Database design	Operational and non-operational data	Present and discuss her/his own experience cooperating in a real DWH, DSS or Big Data design or pass a questionnaire on DWH, DSS, Big	Present an example of DWH or DSS and explain how it has been built and/or and Open Data / Big Data application in the real world	Present examples in real world of DWH, Data Marts or DSS, and discuss the needs they address, how they have been built and the main problems that possibly arose in
		Non-operational data modelling			
		DWH, Data Mart and Decision Support System (DSS)			
		Architecture and design options			
		On Line Analytical Processing (OLAP)			
		Star schema: facts and dimensions			
		Data extraction, transformation and loading (ETL)			

		Internal and External sources	Data, data models properties and design	explaining her/his role in the design	making them effective
		Data Mining and Data Intelligence			
		Implementation options			
A6_LU4_6	Contribute to identify data needs and to design Open Data / Big Data applications	Techniques for extracting meanings from unstructured information			Discuss Big Data and analytics opportunities in a real context and how they are implemented
		Data quality dependency and assurance			
		Heterogeneous sources correlation			
		Large amount of attributes and dimensions impacts			
		Complex analytics			
		Languages and tool for Big Data			

COMPETENCE:	A.6_Application Design				
LEARNING UNIT:	LU5 - User interface design				
General description:	The user interface is the space where humans and computer applications interact. For an effective usage it must be easy, efficient and enjoyable (user-friendly) to operate. This LU provides guidelines and good practices for the design of interfaces that maximise the user experience.				
Knowledge	K4 User interface design principles				
	K9 Threat modelling techniques				
Skills	A2 Design user interface and interaction flow				
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)	
A6_LU5_1	Define usability principles	Definition of "usability" according to standards	Show and discuss different examples of user	Show and discuss the user interface flow	Present and discuss the user interface flow for
		Users types and profiles			

	according to users profiles	User experience	interface and dialog produced for a real application or pass a questionnaire or a case study asking to design the user interface for a simple realistic web-based application	and its details for a real application and the process for the design, considering the possible different roles of users and the security needs	a real application and the process for the design, including the possible different roles of users and the security needs, and highlight her/his role as leader/coordinator
		User Interface types			
		Efficient, understandable, easy to use, easy to learn			
A6_LU5_2	Design user interface according to HCI and perception principles	Human-Computer Interaction principles and methodologies			
		Perceptual principles and mental models			
		Attention and memory principles			
		Cognitive principles and psychology			
		Human Centred Design and User Centred Design			
		Recognition principles			
		Individual and environmental factors			
		User skills, experience, expectation			
		Ergonomy principles			
A6_LU5_3	Apply User Centred approach to user interface design	The User Centred approach			
		Designer perspective and User perspective			
		The User model for a task and a process			
		Appropriate feedback to actions			
		Undo options, help, error messages			
		Usage of a prototype			
		Design by iteration			
		Usage of a methodology for interface design			
		Task analysis			
		Tasks sequence			
		Path sequences			
A6_LU5_4	Evaluate appropriate	Menus			
		Free form text			

	form objects and graphics in user interface	Selection modes			
		Prompts			
		Graphic visualisation options			
		Data graphical presentation			
A6_LU5_5	Define and describe appropriate security requirements	Application security needs			
		Authentication and authorization			
		Threat identification and analysis			
		Application decomposition			
		Security controls			
		Risks and security measures			

COMPETENCE:	A.6_Application Design		
LEARNING UNIT:	LU 6 - Application design related to development models		
General description:	Based on requirements, a specific development model can be selected. This LU provides an overview of the different development models, discussing when each of them is appropriate and what is the impact on the design process.		
Knowledge	K2 Software development methods and their rationale (e.g. prototyping, agile methods. reverse engineering, etc.)		
Skills	S4 Evaluate the use of prototypes to support requirements validation		
	S7 Evaluate the suitability of different application development methods for the current scenario		
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU6_1	Software engineering principles	Present and discuss real world	Present and discuss real world
	Development model and development cycle		

	Describe reasons for different development models	Requirements and constraints impact on development	<p>experiences of design for development according to different development models (waterfall, incremental, prototyping, agile) and discuss the rational to choose the model.</p> <p>Discuss the impact of the development model on design, estimations, planning etc.)</p>	<p>experiences as leader or coordinator of design for development according to different development models (waterfall, incremental, prototyping, agile) and discuss the rational to choose the model.</p> <p>Discuss the impact of the development model on design, estimations, planning etc.), and how the different situations can have to be managed towards stakeholders and technical people.</p>
A6_LU6_2	Design applications according to a waterfall model	The waterfall model		
		Waterfall model phases		
		Waterfall model advantages and limitations		
		Waterfall process organisations		
A6_LU6_3	Design according to non waterfall models: Incremental, iterative, spiral, RAD	The incremental model		
		The iterative model		
		The spiral model		
		RAD development model		
		Non waterfall design process implications		
A6_LU6_4	Use prototyping techniques when appropriate	Purpose of a prototype		
		Horizontal and vertical prototypes		
		Requirements to include in a prototype		
		Benefits and risks in prototyping		
		Review and iterations		
		Impact of prototyping on design process		
A6_LU6_5	Manage design and development according to the Agile model	Agile principles		
		Agile methods		
		Flow of work management: Scrum, Kanban, other		
		Interactions in Agile development		
		Agile project management		
		Prerequisites for using the Agile model		
		Time and costs management in Agile development		
A6_LU6_6	Evaluate development model based on	Development models comparison		
		Requirements stability		
		Requirements accuracy		
		Time constraints		

	application requirements	Skills constraints		
		Organisation constraints		
A6_LU6_7	Manage design and development according to a DevOps approach	What is and why DevOps	Discuss the viability of a DevOps approach in a real context	
		DevOps toolchain		
		Comparison with Agile model		
		Culture requirements		
		Tools requirements		

COMPETENCE:	A.6_Application Design			
LEARNING UNIT:	LU 7 - Application integration and innovative technologies			
General description:	An application consists of a set of logical layers, often running on different system platforms. This LU provides the guidelines for designing an application in a Service Oriented environment, and consistently integrate it with other existing applications. Design for innovative technologies (mobile, IOT, industry 4.0, robotics) is also taken into consideration.			
Knowledge	K6 Existing applications and related architecture			
	K8 Mobile technologies			
	U1 Impact of new technologies on application design			
Skills	A4 Ensure correct integration in a complex environment			
	A4 Evaluate impact of new technologies on application design			
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU7_1 Identify and design the logical layers	The layers of an application	Present a real multitier SOA	Present and discuss a real multitier	Present and discuss a real multitier
	Presentation layer			
	Application layer			

	of an application	Business layer	application, its design implication and her/his own role in the activities	application, including integration, security and other requirements and constraints	application, including integration, security and other requirements and constraints, highlighting her/his role as a leader or coordinator
		Data access layer			
		Design issues			
		Layer integration and interfaces			
A6_LU7_2	Design a multitier application	The client-server model	or Pass a questionnaire on distributed applications		
		Three tier applications, multitier applications			
		Distribution on different servers /platforms			
		Functions and data distribution			
		Web application layers			
A6_LU7_3	Design applications in a Service Oriented environment	Components and services			
		Attributes of a service			
		Service interface and protocols			
		Web services			
		Service reusability			
		Service discovery			
		Services repository			
		Design an application as a service			
		Include services in the application design			
A6_LU7_4	Apply design techniques to mobile devices and multichannel applications	Mobile applications peculiarities	Present own experiences in the design of mobile or other innovative applications or Pass a	Present and discuss the design of multichannel, mobile or other innovative applications achieved	Present and discuss the design of multichannel, mobile or other innovative application achieved as a
		Mobile apps requirements and constraints			
		Mobile apps integration			
		Multichannel applications			
		Consistency and integration in multichannel applications			
		Security issues			

A6_LU7_5	Collaborate to the design of applications using innovative technologies	Design for IOT	questionnaire on mobile and other innovative applications design	leader or coordinator
		Design for robotics		
		Machine intelligence and machine learning		
		Industry 4.0 environment		
		More innovative technologies		

COMPETENCE:	A.6_Application Design		
LEARNING UNIT:	LU 8 - Costs and time estimation for application development		
General description:	Costs and time for developing and running an application must be taken into consideration to ensure the achievement of the expected target. This LU provides guidelines and methods for costs and time estimations as a significant task in the design process.		
Knowledge	K3 Metrics related to application development		
Skills	S3 Apply estimation models and data to evaluate costs of different software lifecycle phases		
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)
A6_LU8_1 Classify time and costs of an application	Business value of an application	Present a formal document listing and quantifying benefits and costs of a real application, and discuss the process and methods used for estimations	Present a complete formal document listing and quantifying benefits and costs of a real application, discuss the process and methods used for
	Benefits and costs related to an application		
	Time to market		
	The lifecycle of an application		
A6_LU8_2 Identify expected	Benefit categories		
	Tangible benefits		
	Intangible benefits		

	benefits of an application	Mandatory applications Approaches for getting estimations and evaluate benefits		estimations and the roles involved in the process
A6_LU8_3	Estimate development costs	Development costs categories Development sources impact Direct and indirect costs in development Development effort Infrastructure costs Development project costs Cost constraints		
A6_LU8_4	Estimate operation costs	Operation costs categories Change management costs Operation services TCO concepts and evaluation	If not included in the documentation produced, discuss the operation costs implied	
A6_LU8_5	Evaluate development effort and time	Development effort and time estimation Experts estimation Experience based estimation Estimation by analogy Decomposition and WBS Evaluations considering the development method Time constraints Application size and development effort Computation techniques: Function Points Conversion of counts in time estimations	Present a development plan considering effort and time estimations, discussing the roles involved in planning	Present a development plan considering effort and time estimations, discussing the roles involved in planning and highlighting her/his own role as leader or coordinator
A6_LU8_6	Planning application development	Time, costs and quality relations to constraints Development schedule and application release Negotiation according to constraints		



	Risks evaluation in application development		
	Plan for contingency		

COMPETENCE:	A.6_Application Design	
LEARNING UNIT:	LU 9 – Application design process management	
General description:	Application design is a part of the application lifecycle, and must follow a structured process defining roles, flow options and activities, being also consistent with the organisation. This LU discusses the design process in different environments, and how to manage it.	
Knowledge	U2 Application design organisation and monitoring	
Skills	S5 Design, organize and monitor the overall plan for the design of an application	
	A5 Contribute to define a process and a methodology for application design	
Learning Outcomes The learner will be able to...	Learning Content	Evidence examples (Level 3)
A6_LU9_1 Act in a structured environment for application design	Application design organisation	Present and comment the design and development process flow in a real organisation, considering new applications and maintenance, and sourcing options
	Application process design	
	Roles and responsibilities in application design	
	Documents and communication	
A6_LU9_2 Identify possible different process flows	New applications vs maintenance	Present and discuss the documents used for planning, communication and monitoring for the design of a real application
	Development methods dependencies	
	Sourcing options dependencies	
A6_LU9_3 Design, organize and monitor the overall plan	Design phases planning	Present and discuss the documents used for planning, communication and monitoring for the design of a real application
	Stakeholders involvement activities	
	Techniques for ensuring resource availability	
	Techniques for ensuring effective communication with stakeholders	
	Overall design plan monitoring activities	
	Deliverables completeness review	
	Deliverables acceptance	

		Project management principles in the design process	
A6_LU9_4	Collaborate to establish and improve the design process	Application design policy	Comment a real design process as part of a consistent application lifecycle process aligned with organisation's policies and rules
		Alignment with organisation policies and rules	
		Design process activation	
		Design process integration in the whole application lifecycle process	
		Design process communication	
		Design process evaluation, review and improvement	

A.7 – Technology Trend Monitoring

A.1_IS and Business Strategy Alignment						
Learning Unit Title	Learning Unit Title	Learning Unit Title				
		1	2	3	4	5
LU 1	New emerging technologies and business impacts					
LU 2	The impact of data driven systems and transparency					
LU 3	The impact of technology driven decentralization					
LU 4	Convergence of Operational Technology and Information Technology					
LU 5	Analysis of future development of business, customer needs and technology application					

 not present in the eCF 3.0 standard

COMPETENCE:	A.7_Technology Trend Monitoring
LEARNING UNIT:	LU 1 – New emerging technologies and business impacts (LU 6 of A.1)
General description:	This LU aims at giving tools to evaluate the impact of new technologies on the business. In particular, the LU provides tools and methods to keep oneself updated by overviews and insights about new/emerging technologies and business innovation sources, it identifies and classifies impacts of new technologies at various levels and it evaluates the impact of new technologies using best practices and tools with the engagement of business stakeholders
Knowledge	K1 Emerging technologies and the relevant market applications
	K2 Market needs
	K3 Relevant sources of information (e.g. magazines, conferences and events, newsletters, opinion leaders, on-line forum, etc.)
Skills	S1 Monitor sources of information and continuously follow the most promising
	S3 Identify business advantages and improvements of adopting emerging technologies

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A1_LU6_1 Monitor new technologies trends	Methods to identify and monitor the main sources of market and technology research Technology lifecycle and maturity (e.g. Hype curve Gartner, TRL scale, ...) Exemplificative lists of references and related main contribution of: - Significant networks/hub/research centre - Sectorial events and webinar or online courses - Technical communities Case studies of technology lifecycles	Provide an analytical document reporting the innovation of a new technology based on the information collected from different sources and explaining the business impact of the new technology	Provide an analytical document reporting the innovation of a new technology based on the information collected from different sources and explaining the business impact of the new technology
A1_LU6_2 Classify business impacts of technologies	Impacts on business models Impacts on business factors (benefits, costs, markets, ...) Impacts on processes and organization Impacts on Information Systems architecture Impacts on human resources Impacts on customers Case studies of impacts classification of specific ICT solutions		
A1_LU6_3 Evaluate impacts of new technologies on business	Identify strategic dimensions for the evaluation of new technologies role in a defined business Evaluation models of new technologies (e.g. BCG matrix, SWOT model, ...)		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	Classify benefits of new technologies Identify added value and competitive advantages related to new technologies Use best practices, methodologies and tools (e.g. BIA, Questionnaires, ...) to evaluate the impacts identified for each classification Models and methods to create a business case Case studies of impacts evaluation of specific ICT solutions		

COMPETENCE:	A.7_Technology Trend Monitoring
LEARNING UNIT:	LU 2 – The impact of data driven systems and transparency
General description:	Transparency refers to a world where everyone, every organisation and every government knows about everyone else. This LU explains the impact on for example data, data integrity, privacy and competition and the consequences for collaboration tools, habits and arrangements.
Knowledge	K2 Market needs K5 Applied research programme approaches
Skills	S1 Monitor sources of information and continuously follow the most promising S2 Identify vendors and providers of the most promising solutions; evaluates, justifies and proposes the most appropriate S3 Identify business advantages and improvements of adopting emerging technologies

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
<p>A7_LU2_1</p> <p>Explain how transparency is changing business and society VS central or decentral organised organisations</p>	<p>The impact of the data driven society / how the abundance of data is changing the way organisations do business</p> <p>Business value of data</p> <p>Threats and opportunities for data strategy</p> <p>Data driven business case modelling</p> <p>Relating business requirements to the IT infrastructure</p>	<p>Case study presentation based on organisation of the participant followed by an interview</p>	<p>Case study presentation based on organisation of the participant followed by an interview</p>
<p>A7_LU2_2</p> <p>Describe the logics of exponential growth of technology and its impact</p>	<p>History and theory of Technology Assessment</p> <p>Applying Technology Assessment</p> <p>Technology as an evolutionary process</p> <p>The Law of Accelerating Returns</p> <p>Singularity</p>		
<p>A7_LU2_3</p> <p>Explain the role of people and systems in a network society</p>	<p>History and theory of Network Society development</p> <p>Societal developments and consequences for individuals and organisations</p> <p>New ways of working</p>		

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
		Digital maturity and critical IT capabilities		
		Engaging peers and colleagues		
A7_LU2_4	Explain how co-creation works	How co-creation is a result of transparency / the connected customer		
		Tools for co-creating		
		Digital skills needed for co-creating		

COMPETENCE:	A.7_Technology Trend Monitoring
LEARNING UNIT:	LU 3 - The impact of technology driven decentralization
General description:	Radical decentralization refers to a world where data (blockchain), production, energy, work, learning, companies etc. more and more will be organised in a decentralized way. The consequences are huge and disruptive. More than ever before a radical merge of different technologies fosters this global megatrend. This is directly effecting work, products, rights, tax, etc.
Knowledge	K1 Emerging technologies and the relevant market applications
	K2 Market needs
	K5 Applied research programme approaches



Skills	S1 Monitor sources of information and continuously follow the most promising
	S2 Identify vendors and providers of the most promising solutions; evaluates, justifies and proposes the most appropriate

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
A7_LU3_1 Analyse the relationship between decentralization and technology	The paradigm of centralization versus decentralization How power is shifting to networks/humans The megatrend of decentralization - general The megatrend of decentralization - sector specific Technology that underpins decentralization	Examination: create a 360 degrees feedback analysis of the organisation of the participant	Examination: create a 360 degrees feedback analysis of the organisation of the participant
A7_LU3_2 Analyse the impact of decentralization on business processes	the changing balance between IT and business fragmentation of IT standards, decision-making, and buying power controlling security The effect of technology driven decentralization on democratization		
A7_LU3_3 Recognise digital as in the new normal	Working in a tech environment Integration of tools and processes New ways of working New labour arrangements and contracts		
A7_LU3_4 Apply blockchain logics	Theoretical principles of blockchain Where to apply blockchain technology		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	How to apply blockchain technology		

COMPETENCE:	A.7_Technology Trend Monitoring		
LEARNING UNIT:	LU 4 – Convergence of Operational Technology and Information Technology		
General description:	Convergence of Operational Technology and Information Technology results in the next wave of technology and the third stage of Internet. It involves digitization of the physical world through IoT, 3D printing, smart cities, singularity, Blockchain, Wearables, AR/VR and Quantified Self. Where media and technology adopted technology before and benefited of it, this next wave of technology leads to digitization of another part of the economy like production, cities and homes.		
Knowledge	K2 Market needs		
Skills	S2 Identify vendors and providers of the most promising solutions; evaluates, justifies and proposes the most appropriate		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	
A7_LU4_1 Recognize the potential of the convergence of Operational Technology and Information Technology	History of Smart Systems	Examination: produce an analysis of the impact of convergence on the participant's role, organisation and business processes	
	Digitization of our physical environment		
	Learning about the extra dimension: 3D and 4D		
	The different phases/stages of the Internet		



	New business models	
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<p>A7_LU4_2</p> <p>Demonstrate the impact of the convergence on the role of the IT department</p>	Identifying IT critical capabilities	
	Overview of technologies resulting from the convergence of Operational Technology and Information Technology	
	Agile infrastructure and operations	
	Installing governance and process models	
	Managing data and security	
	Re-skilling of resources	
<p>A7_LU4_3</p> <p>Identify the impact of the convergence on the role of humans in business processes</p>	Redefining what it means to be human	
	Man versus Machine data processing	
	The need for new roles and different skills	
	Change management	

COMPETENCE:	A.7_Technology Trend Monitoring
LEARNING UNIT:	LU 5 - Analysis of future development of business, customer needs and technology application
General description:	This LU is aimed at analysing the future ICT trends. In particular, the LU gives methods to evaluate a source, it gives insights about the main indicators to be monitored for future trends and it gives tools to evaluate the impact of future trends
Knowledge	K1 Emerging technologies and the relevant market applications K2 Market needs

	K3 Relevant sources of information (e.g. magazines, conferences and events, newsletters, opinion leaders, on-line forum, etc.)	
Skills	S1 Monitor sources of information and continuously follow the most promising	
	S3 Identify business advantages and improvements of adopting emerging technologies	
Learning Objectives The learner will be able to...		Evidence examples (Level 5)
A1_LU10_1	Identify the key resources	Share some documents reporting how various methods have been applied in order to identify and monitor future development in business processes, technology applications and market trends
A1_LU10_2	Identify the key parameters to be analysed in a trend monitoring	
A1_LU10_3	Analyse ICT and business impact of future trends	



	needs, technology application and business models	
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B.3 – Testing

A.1_IS and Business Strategy Alignment						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU1	Fundamentals of Testing					
LU2	Testing Throughout the Software Life Cycle					
LU3	Testing Design Techniques					
LU4	Tool Support for Testing					
LU5	Test Management					

 not present in the eCF 3.0 standard

COMPETENCE:	B3_Testing
LEARNING UNIT:	LU 1 – Fundamentals of Testing
General description:	This LU aims at providing a general idea of what is testing and an explanation of the main testing principles and processes. The psychological factors influencing testing are also described.
Knowledge	K1 Techniques, infrastructure and tools to be used in the testing process K2 The lifecycle of a testing process U6 Techniques and tools for documentation and results of tests of ICT systems U7 Techniques and tools for monitoring test programmes and results
Skills	S4 Prepare and conduct tests of ICT systems

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)
B3_LU1_L01 Describe key concepts and terms of testing	1.1. Importance of testing and key terms	Exam to evaluate if the testing concepts are acquired and if the connections between testing and software quality are understood	
B3_LU1_L03 Explain objectives of testing along life cycle distinguishing between testing and debugging	1.2. What is Testing?	Exam to evaluate if the definitions of testing and debug are acquired	Exam to evaluate the understanding of the testing objectives within the life cycle
B3_LU1_L05 Describe fundamental testing process	1.3. Testing principles and fundamental process	Exam to demonstrate if the fundamentals of testing process are acquired	Study of a case with questions about testing process involved in it or experience in organizing testing processes

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)
B3_LU1_L06 Describe the psychological factors which influence testing including differences in mind-sets of developers and testers	1.4. Psychology of Testing	Exam to demonstrate that the basics of psychological factors are acquired	Exercises and case studies on psychological factors

COMPETENCE:	B3_Testing
LEARNING UNIT:	LU 2 – Testing Throughout the Software Life Cycle
General description:	This LU provides a description of the main software development models in the life cycle and their connection to testing processes. As a consequence, the description and comparison of test levels, test types and maintenance testing is provided.
Knowledge	K2 The lifecycle of a testing process U5 Sound methods and techniques for designing different sorts of tests (functional, integration, performance, usability, stress etc.) U8 Methods for designing test to be compliant to national and international standards defining quality criteria K3 The different sorts of tests (functional, integration, performance, usability, stress etc.) U11 Methods and techniques for adapting testing procedures and plans to web, cloud and mobile technologies and environmental requirements U12 Methods and tools for reviewing performance of testing and audits compliance with procedures and national and international standards defining quality criteria U13 Methods for defining and organizing testing processes in an organization along the life cycle U14 Methods for creating and developing internal procedures supporting testing processes along the life cycle

Skills	S2 Manage and evaluate the test process
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Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
B3_LU2_L01 Explain the relationship between the development model adapted to the project and the test activities and work products in the life cycle	2.1. Software Development Models and testing	Exam to evaluate if the relation between the development model adapted to projects and the tests activities and work products are understood and to determine if the foundations of adaptation of testing processes are acquired		Experience on practical application (implementation/adaptation) of development and testing models
B3_LU2_L02 Adapt the testing processes and their connection to the development model and products to complex projects or specific environments (Web, cloud, etc.)				
B3_LU2_L03 Describe and compare the different levels	2.2. Test Levels	Exam to determine if	Exercise on practical	Experience on practical application

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
of testing and their relation to test types		the different levels of testing are understood	application of test levels	(implementation/adaptation) of test levels and test types
B3_LU2_L04 Describe and compare test types (functional, non-functional, structural and others)	2.3. Test Types	Exam to evaluate if the concepts on the different test types are acquired	Exercise where the comparison and description of the different test types is applied to specific situations	
B3_LU2_L05 Describe maintenance and regression testing referencing indicators and connection to test types	2.4. Maintenance Testing	Exam to demonstrate that the difference between maintenance and regression testing and their connection with test types were understood		Experience on practical application (implementation/adaptation) of maintenance testing



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COMPETENCE:	B3_Testing	
LEARNING UNIT:	LU 3 – Testing Design Techniques	
General description:	The aim of this LU is to provide a basic description of the main test case design techniques (including black-box, white-box and experience-based techniques). This LU also describes the proper specification and documentation of test design	
Knowledge	K4 National and international standards defining quality criteria for testing U6 Techniques and tools for documentation and results of tests of ICT systems U8 Methods for designing test to be compliant to national and international standards defining quality criteria	
Skills	S3 Design tests of ICT systems S5 Report and document tests and results	
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
B3_LU3_L01 Compare and describe test design elements (test case design, specification and procedure)	3.1. The Test Development Process	Exam to evaluate that the design elements are understood Experience in creating and using all the test design elements
B3_LU3_L02 Evaluate the quality of test cases according to indicators and appropriateness to		Exam to evaluate that the concepts on quality of test cases are acquired Study of a case with questions about quality of test cases for a

project and applicable standards		specific situation Experience in analysing and managing quality of test cases
<p>B3_LU3_L03</p> <p>Translate test cases into a complete and structured test procedure specification</p>		<p>Exercise to understand generation of test procedure specifications from elements of test cases design</p> <p>Experience in developing test procedure specifications</p>
<p>B3_LU3_L04</p> <p>Describe and compare specification-based (black-box) and structure-based (white-box) test design techniques</p>	<p>3.2. Categories of Test Design Techniques and How to Choose Them For Each Situation</p>	<p>Exam to evaluate that the concepts on the different test design techniques are acquired</p> <p>Exercise to evaluate adequacy of using each test type in specific situations</p> <p>Experience on practical application (implementation/adaptation) of test techniques to different situations</p>

<p>B3_LU3_L05</p> <p>Design test cases for specific situations and software models using specification-based testing (equivalence partitioning, boundary value analysis, etc)</p>	<p>3.3. Specification-based or Black-box Techniques</p>	<p>Exam to evaluate that the concepts on the different techniques of specification-based testing are acquired</p> <p>Exercises to design test cases using specification-based testing for specific situations</p>
<p>B3_LU3_L06</p> <p>Design test cases for specific flow and structure models using structure-based testing controlling coverage indicators (statement, decisions, etc.)</p>	<p>3.4. Structure-based or White-box Techniques</p>	<p>Exam to evaluate that the concepts on the different techniques of structure-based testing are acquired</p> <p>Exercises to design test cases using structure-based testing for specific situations</p>
<p>B3_LU3_L07</p> <p>Design test cases using complementary techniques (experience-based)</p>	<p>3.5. Experience-based and other complementary techniques</p>	<p>Exam to evaluate that the concepts on the different techniques of experience-based testing are acquired</p> <p>Exercises to design test cases using experience-based testing for specific situations</p>

<p>B3_LU3_L08</p> <p>Document all needed items of the test design according to applicable standards</p>	<p>3.6. Documentation of test design</p>	<p>Exam to evaluate that the concepts on complementary techniques for test case design are acquired</p> <p>Exercises to document all the items of a test design according to applicable standards</p> <p>Experience on documentation of test designs</p>
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COMPETENCE:	B3_Testing				
LEARNING UNIT:	LU 4 – Tool Support for Testing				
General description:	The aim of this LU is to provide a classification of the main test tools and how to introduce them into the organisation's testing processes.				
Knowledge	U1 Techniques, infrastructure and tools to prepare tests of an ICT system U3 Techniques, infrastructure and tools to deploy and execute the planned test of an ICT system U7 Techniques and tools for monitoring test programmes and results U9 Methods and tools for supervising execution of plans for testing ICT systems ensuring proper procedures and documentation U12 Methods and tools for reviewing performance of testing and audits compliance with procedures and national and international standards defining quality criteria K.3.4 Methods and tools for reviewing performance of testing and audits compliance with procedures and national and international standards defining quality criteria				
Skills	S2 Manage and evaluate the test process S4 Prepare and conduct tests of ICT systems				
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)
B3_LU4_L01 Describe and compare the different types of test tools explaining their support to testing and development processes		4.1. Types of Test Tools	Exam to evaluate if the concepts of the different types of test tools were acquired and if the support of test tools	Practical exercises of the use of tools to support testing activities	Experience in managing and planning test tool support to development processes

		to testing and development is understood		
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B3_LU4_L02	Explain the support of each type of test tools to testing (preparation, design, execution, reporting and monitoring) and development processes			
B3_LU4_L03	Describe practical considerations, risks and benefits for test automation and tool support	4.2. Effective Use of Tools: Potential Benefits and Risks	Exam to evaluate if the concepts of test automation and tool support are acquired	Experience in managing test automation and use of test tools
B3_LU4_L04	Explain principles, factors and recommendations for test tool support implementation in organizations	4.3. Introducing a Tool into an Organization	Exam to determine if the concepts on the adaption of test tools is understood	Study of a case with questions about principles, factors and recommendations for test tool support and implementation
B3_LU4_L05	Explain adaptation of tools to applicable standards, complex projects or special			

environments (cloud, web, etc.)		in relation to the case.	
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COMPETENCE:	B3_Testing
LEARNING UNIT:	LU 5 – Test Management
General description:	This LU aims at providing an insight of test management processes, including the planning of testing, test strategies, management and monitoring of test plans.
Knowledge	<p>U1 Techniques, infrastructure and tools to prepare tests of an ICT system</p> <p>U2 Techniques to adapt tests to each specific ICT system</p> <p>U3 Techniques, infrastructure and tools to deploy and execute the planned test of an ICT system</p> <p>U4 Standard techniques, methods and tools for managing test programmes</p> <p>U6 Techniques and tools for documentation and results of tests of ICT systems</p> <p>U7 Techniques and tools for monitoring test programmes and results</p> <p>U9 Methods and tools for supervising execution of plans for testing ICT systems ensuring proper procedures and documentation</p> <p>U10 Methods and techniques for adapting testing procedures and plans to complex testing programmes and projects</p> <p>U11 Methods and techniques for adapting testing procedures and plans to web, cloud and mobile technologies and environmental requirements</p> <p>U12 Methods and tools for reviewing performance of testing and audits compliance with procedures and national and international standards defining quality criteria</p> <p>U14 Methods for creating and developing internal procedures supporting testing processes along the life cycle</p> <p>U15 Expert methods for guiding and advising personnel on testing activities</p> <p>U16 Methods for developing and managing test plans, at least for complex projects</p>

Skills

- S1 Create and manage a test plan
- S2 Manage and evaluate the test process
- S4 Prepare and conduct tests of ICT systems
- S5 Report and document tests and results

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
B3_LU5_L01 Plan a test team (leader and testers) and evaluate possibility of independent testing	5.1. Test Organization		Exam to evaluate that basic concepts on test team organization are acquired	Study of a case with questions about team configuration and independent testing	Experience in managing and organizing test teams
B3_LU5_L02 Create test plan according to applicable standards determining objectives, best test approach and schedule for the specific project	5.2. Test Planning and Estimation		Exam to evaluate that basic concepts on test planning are acquired Exam to evaluate that basic concepts on test plan	Exercise to create a test plan to demonstrate that all concepts were acquired Exercise to detail partially, a test plan to demonstrate	Experience in implementing/adapting test plans Experience in managing test plans
B3_LU5_L03 Detail a test plan with specific schedule of					

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 1)	Evidence examples (Level 2)	Evidence examples (Level 3)	Evidence examples (Level 4)
<p>activities (preparation and execution), their entry/exit criteria and supervision based on metrics and/or experts</p>			<p>scheduling and control are acquired</p>	<p>that all concepts were acquired</p>	
<p>B3_LU5_L04 Explain monitoring and supervision of test preparation and execution using appropriate metrics and reporting according to applicable standards</p>	<p>5.3. Test Progress Monitoring and Control</p>	<p>Exam to evaluate that basic concepts on test metrics and reporting are acquired</p>	<p>Study of a case with questions about the use of appropriate metrics and reporting methods</p>	<p>Experience in managing test preparation and execution</p>	

<p>B3_LU5_L05</p> <p>Describe the connection between configuration management and testing processes in the test plan</p>	<p>5.4. Configuration Management</p>		<p>Exam to evaluate if the connection between configuration management and testing processes is understood</p>	<p>Experience in software configuration management</p>	
<p>B3_LU5_L06</p> <p>Describe the connection between risk management and evaluation and the testing processes in the test plan</p>	<p>5.5. Risk and Testing</p>		<p>Exam to evaluate if the connection between risk management and evaluation processes is understood</p>	<p>Experience in managing risks within the execution of test plans</p>	
<p>B3_LU5_L07</p> <p>Describe and organize the reporting of incidents and its connection to defect-tracking and debugging</p>	<p>5.6. Incident Management</p>	<p>Exam to determine if incident reporting, defect-tracking and debugging processes are understood</p>	<p>Study of a case with questions about reporting incidents, defect-tracking and debugging</p>	<p>Experience in managing incidents, defect-tracking and debugging</p>	

D.2 – ICT Quality Strategy Development

D.2_ICT Quality Strategy Development						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Principles of Quality Management and Process Management					
LU 2	Quality Management Models and Standards (CMM, COBIT, ISO, ITIL)					
LU 3	Processes Institutionalization					
LU 4	Process and Product Quality Management					
LU 5	Quality Assurance of Service/Project Management Processes					
LU 6	Quality assurance in agile environment (Scrum, XP, Kanban and others)					
LU 7	Formulation / adopting of Quality Management Strategy for the organization					

 not present in the eCF 3.0 standard

COMPETENCE:	D.2. ICT Quality Strategy Development
LEARNING UNIT:	LU 1 – Principles of Quality Management and Process Management
General description:	LU 1 provides the definitions and explanation of Quality management principles and components. For the learner is important to understand that the quality management is a continuous process that has different price levels at each project phase. The strategic thinking is the key tool for the quality management.
Knowledge	U1 Quality Strategy formulation and continuous process improvement of the organization K2 The information strategy of the organisation
Skills	S3 Apply relevant standards and best practices to maintain information quality

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
<p>D2_LU1_1</p> <p>Define and explain the principles of process based quality management</p>	Definition, components and price of quality	<p>Demonstrate good understanding and ability of adaptation of the key definitions, principles and concepts of process based quality management to the organizational context</p>	<p>Demonstrate good understanding and ability of adaptation of the key definitions, practices and concepts of process based quality management to the organizational context and strategies</p>
	Corporate excellence		
	Process management		
	Cost of quality		
	Cost of conformance and cost of non-conformance		
	Cost categories		
	Software project lifecycle		
	Process perspective		
<p>D2_LU1_2</p> <p>Support and maintain quality assurance strategy</p>	What is a strategy?	<p>Outline the key elements of quality assurance strategy; Provide examples and best practices of quality strategy process</p>	<p>Outline the key elements of quality assurance strategy; Provide examples and best practices of quality strategy process</p>
	Strategic thinking		
	Strategy represented as vision, mission, value gap and objectives		
	Strategy formulation process		
	Distinction between strategy and operations		
	Responsibilities in quality management strategy		
	What is quality?		
	Quality attributes		
	Process based quality approach		
	TQM		

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
	Continuous process improvement		
D2_LU1_3 Translate quality management strategy into operational terms	Balanced scorecard -4 perspectives	Formulate and measure the benefits of QS implementation	Formulate and measure the benefits of QS implementation
	How quality strategy supports (is aligned to) the business strategy		
	Process maturity vs heroic efforts		
	KPIs		
	Common quality issues in IT		
	Typical product defects		
	Typical process issues inconsistencies		

COMPETENCE:	D.2. ICT Quality Strategy Development
LEARNING UNIT:	LU 2 – Quality Management Models and Standards (CMMI, COBIT, ISO, ITIL)
General description:	LU2 introduce the learner to the key ICT quality management models and standards. It explains what is the difference between model, standard and framework
Knowledge	U2 Differences and similarities of formalized quality management models
	K1 The major information technology industry frameworks – COBIT, ITIL, CMMI, ISO – and their implications for corporate ICT governance
Skills	A1 Apply relevant standards and best practices to maintain quality (able to recognize the objectives and needs addressed by the different quality management standards, models, frameworks and schemes)

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D2_LU2_1 Define the scope of QM	Categorization of QM	Define the scope of QM in organizational context	Define the scope of QM in organizational context
	Standards, models, frameworks, certification schemes		
	Scope of QM		
	General business, IT specific		
	Information security		
	IT services		
	Market recognition of different models		
D2_LU2_2 List and define key QM models	ISO family ISO 9000; ISO9126; ISO 38500 and ISO 20000	Name the key QM models and outline the differences and similarities among them. Able to select models that best fit to certain environments	Name the key QM models and outline the differences and similarities among them. Able to select models that best fit to certain environments
	CMMI family: CMMI for Development, CMMI for Services, CMMI for acquisition		
	Other models: COBIT, ITIL, Scrum and Kanban		

COMPETENCE:	D.2. ICT Quality Strategy Development
LEARNING UNIT:	LU 3 – Processes Institutionalization
General description:	For the quality strategy development and quality management on organizational level, the institutionalization of the processes is the most significant result. Institutionalization is the process of creating consistency and uniformity across the organization with respect to the process implementation. It helps in the same standards to be followed by

	every group and individual in the organization. This LU leads the learner through the necessary steps and components giving an explanation of practices and methods			
Knowledge	U3 Corporate ICT governance – implication of processes in corporate strategy and operations U1 Quality Strategy formulation and continuous process improvement of the organization			
Skills	A2 Design and apply policies and plans in order to institutionalize processes S1 Define an ICT quality policy to meet the organisation’s standards of performance and customer satisfaction objectives 3 Apply relevant standards and best practices to maintain information quality			
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D2_LU3_1	Explain the concept of process institutionalization	Process of process institutionalization	Outline the key steps of process institutionalization	Outline the key steps of process institutionalization
		Performed process, managed process, defined process		
		Relationships and components		
D2_LU3_2	Identify the process of transforming identifiable input work products into identifiable output work products	Perform specific practices	Develop a process for specific work product	Develop a process for specific work product
D2_LU3_3	Support the process of institutionalization of managed processes	Establish an Organizational Policy	List and describe the good practices of process institutionalization	Refer the good practices of process institutionalization, Provide examples for
		Plan the Process		
		Provide Resources		
		Assign Responsibility		

		Train People		each one in the context of specific processes
		Control Work Products		
		Identify and Involve Relevant Stakeholders during the execution of the process		
		Monitor and Control the Process		
		Objectively Evaluate Adherence		
		Review Status with Higher Level Management		
D2_LU3_4	Support the description of a defined process	Establish a Defined Process	Participate proactively in the design, description and collecting process related strategy and experience	Moderate the design, description and collecting process related strategy and experience
		Collect Process Related Experiences		

COMPETENCE:	D.2. ICT Quality Strategy Development
LEARNING UNIT:	LU 4 – Process and Service Quality Management
General description:	LU4 juxtaposes performed process with work products or services. It answers the question why the well managed processes are necessary to have a product with good quality and where is the place of those relations in the QM strategy
Knowledge	U4 Key elements of the quality management process of the organisation
	U1 Quality Strategy formulation and continuous process improvement of the organization
Skills	A3 Objectively evaluate performed processes, work products and services
	S2 Identify quality metrics to be used

Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D2_LU4_1	Objectively evaluate processes and services	Establish and maintain clearly stated criteria for the evaluations	Understand definition of objective evaluation	Present objective evaluation. Design process for objective evaluation
		Objectively evaluate the designated performed processes		
		Objectively evaluate the designated work products and services		
		Key Quality Indicators - planning and implementation		
D2_LU4_2	Provide objective insight	Communicate quality issues and ensure resolution of noncompliance issues	Provide example of record of the quality insurance activity and main stakeholders	Record the quality insurance activity and main stakeholders
		Analyse the noncompliance issues to see if there are any quality trends that can be identified and addressed		
		Ensure that relevant stakeholders are aware of the results of evaluation and the quality trends in a timely manner		
		Establish and maintain records of the quality assurance activities		

COMPETENCE:	D.2. ICT Quality Strategy Development
LEARNING UNIT:	LU 5 – Quality Assurance of Service/Project Management Processes
General description:	LU5 goes down in the performance of the ICT organization units - establishment of the quality assurance at the project management level or micro level. This LU puts the QM concepts together with PM components. It is important to provide this comparison because PM impacts every aspect in one organization - management, productivity, HR, engineering, culture and so on
Knowledge	U5 Quality Strategy execution on service/project level

	K3 Different service models (SaaS, PaaS, IaaS) and operational translations (i. e. Cloud Computing)		
Skills	A1 Apply relevant standards and best practices to maintain quality of services/projects		
	S2 Identify quality metrics to be used		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)	Evidence examples (Level 5)
D2_LU5_1 Establish and assure (maintain) quality of service/project planning process in the organization	Establish estimates	Develop an example of service/project plans according to predefined policies and plans	Apply project monitoring and control practices in a case study
	Scope of the service/project		
	Type of projects and SLA, service models (SaaS, PaaS, IaaS), work product, tasks, efforts, costs		
	Develop a service/project Plan		
	Budget and schedule		
	Service/project risks		
	Data management		
	Service/project resources		
	Knowledge and skills management		
Stakeholder and obtain commitment to the plan			
D2_LU5_2 Supervise (maintain) quality of service/project monitoring and control process	Monitor Service/Project Against Plan	Describe the service/project life cycle and how to manage the quality through the entire service/project lifecycle	Case study on establishing and maintain quality metrics
	Manage Corrective Actions to Closure - Analyse, Plan, Manage		
D2_LU5_3 Support and manage (maintain) quality of	Manage Requirements - Understanding, commitment	Define and describe how to ensure the	Requirements case study
	Requirements changes		
	Bidirectional traceability		

requirements management process	Inconsistencies	quality of the requirements	
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COMPETENCE:	D.2. ICT Quality Strategy Development		
LEARNING UNIT:	LU6 – Quality assurance in agile environment (Scrum, XP, Kanban and others)		
General description:	LU6 introduces the high level management to QM strategy aspects in agile environment. It describes what is agile environment and how QM components should be applied in this environment		
Knowledge	U6 Quality management in agile environment		
Skills	A4 Able to manage quality in agile environment		
Learning Objectives The learner will be able to...	Learning Content		Evidence examples (Level 5)
D2_LU6_1	Align the specifics of agile quality management in project/ organizational context	Overview of agile principles and frameworks: Agile manifesto and agile principles	Present the key agile principles and how they ensure quality or Case study
		How Agile is different than the traditional QM: Processes, Lifecycle, Roles; Culture, Responsibilities.	
D2_LU6_2	Apply QM in agile frameworks (Scrum and Kanban)	Quality management in Scrum: Pillars; Events; Roles	Present how the quality is managed in agile frameworks such as SCRUM and KANBAN or Case study
		Quality management in Kanban: Workflow; Controls; Team	
COMPETENCE:	D.2. ICT Quality Strategy Development		
LEARNING UNIT:	LU 7 – Formulation / adopting of Quality Management Strategy for the organization		

General description:	The last LU gives the learners skills for adoption of QM strategy in organization. What is the place of QM strategy in the business strategy of the organization, what are the good practices in adoption of QM strategy, how to maintain continuous process improvement according the established strategies are some of the questions this LU answers		
Knowledge	U7 Process of formulation or alignment of QM strategy in organization K2 The information strategy of the organisation U7 Process of formulation or alignment of QM strategy in organization K2 The information strategy of the organisation		
Skills	A5 Able to define or adopt QM strategy in organization S1 Define an ICT quality policy to meet the organisation's standards of performance and customer satisfaction objectives S2 Identify quality metrics to be used		
	A5 Able to define or adopt QM strategy in organization		
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 5)
D2_LU7_1	Formulate and / or adopt QM strategy in organization	Alignment of QM strategy to the Business strategy Implementing strategy map for QM: Perspectives, Strategic objectives, Strategic KPIs	Produce a case study - translate the QM strategy into operational terms - strategy map, initiatives, KPIs
D2_LU 7_2	Implement QM models	Quality Management initiatives Planning and Implementing QM models and standards: Identify process gaps; Implement and validate improvements; Certify organization; Maintain continuous process improvement.	

E.8 – Information Security Management

E.8_Information Security Management						
Num	Learning Unit Title	Proficiency Level				
		1	2	3	4	5
LU 1	Current security scenarios and ISM role					
LU 2	Technological security: attacks and countermeasures					
LU 3	Infosecurity governance and standard					
LU 4	Application level security					
LU 5	Vulnerability evaluation in real-world					
LU 6	Security in new technologies					
LU 7	The overall risk and incident management process					
LU 8	Information security project management					
LU 9	Digital identity security					
LU 10	Legal aspects in information security					
LU 11	Forensics					
LU 12	Elements of Information Security Governance and Risk planning					

 not present in the eCF 3.0 standard

COMPETENCE:	E.8_InformationSecurityManagement
LEARNING UNIT:	LU 1 - Current security scenarios and ISM role

General description:	The learning unit aims to offer an outline of the main aspects of the today information security, considering also the evolution of attacks and threats. In particular, it offers an overview of the most common misconceptions, like only experts can make attacks, the antivirus can always protect, malware comes from bad websites, the wake ring is computers but not humans. The LU depicts also the role of the information security manager in an organization.	
Knowledge	K5 Security detection techniques, including mobile and digital and cloud	
	K6 Cyber attack techniques and counter measures for avoidance	
Skills	-	
Learning Objectives The learner will be able to...	Learning Content	Evidence example (Level 2)
E8_LU1_1 Define Information security and the role of the IS manager	What is information security	Provide a sound and comprehensive definition of information security
	The role of the IS manager	
E8_LU1_2 List the trends in cyber attacks techniques and the current threats	The evolution of the information security	Describe in short the history of information security, naming relevant evolutionary steps and analysing at least one famous attack
	Overview of the main common threats and cyber attacks	
E8_LU1_3 Recognize misconceptions by examples	Malware is everywhere	Give examples of information security issues related to specific technological areas/paradigms
	How simple could be to make a cyber attack	
	How secure is mobile as an example of relevant area)	
	profit-driven malware and the special attention to payments methods	
	As an example, how robust is antivirus and 0 day vulnerability	
	Malware not only is "bad" websites	

		The link between cyber attacks and the human factor: social network and phishing	
		Security of objects other than PC/mobile: Scada, IoT, automotive	
		New approaches, technologies and standards	
E8_LU1_4	Recognize the new and sustainable approach to IS management	Common obstacles are posed to the Infosecurity manager operations	Describe the role if the Information Security Manager (or equivalent) in your organization Identify relevant obstacles and propose ways to circumvent them
		The Does/Don'ts of the IS manager	
		The proactive mode as a way to generate value for the IS management in enterprise (and make it recognizable)	
		"Caveats"	
E.8_LU1_5	Outline legal aspects of information security management	Privacy rules in EU	outline the rules on data privacy and the definition of control on workers
		Privacy shield	

COMPETENCE:	E.8_InformationSecurityManagement
LEARNING UNIT:	LU 2 - Technological security: attacks and countermeasures
General description :	The learning unit aims to give an insight of information security in enterprises, underlining its different components. The learning unit will It starts from the common attackers techniques till to the modern "APT" (Advanced Persistent Threats), which are commonly used today in Cybercrime attacks, and which are used to compromise the integrity of information systems. Together with the attacks techniques, the learning unit will show also the corresponding available countermeasures.
Knowledge	K3 the critical risks for information security management

	K5 security detection techniques		
	K6 cyber attack techniques and counter measures for avoidance		
Skills	S2 analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack		
	S5 apply monitoring and testing techniques		
	S7 implement the recovery plan in case of crisis (implement the response techniques in case of attack)		
	A4 collect and process technical requirements for cyber defence and mitigation of risks		
Learning Objectives The learner will be able to...		Learning Content	Evidence examples (Level 2)
E8_LU2_1 Identify the Information Security Role in modern Enterprises	Information security, underlining the security objectives in Enterprises	Characteristics and strength of the attacker (Hacker) and the defender (Security Expert) relation between: risk, vulnerability, threat and countermeasure	Identify the most important element of information security in enterprises
E8_LU2_2 Categorize the attacker in order to identify at which level of security the enterprise needs to comply	The common stages of cyber security attacks	The cyber attackers by characteristics and motivation The high level hacking patterns	In a case study, categorize the attackers
E8_LU2_3 Explain a security model in enterprises	The importance of a data-centric point of view in a security context	The importance of a multi layered security approach	Describe Defence in depth approach
E8_LU2_4 Describe the fundamental components of security	Data security elements	Network security components Server security approach and tools Client security requirements The edge defence	List all key components of security needed in enterprise environments

		The edge defence	
E8_LU2_5	Recognize the security governance pillars and relations	Key elements for security monitoring, management and assessment	Relate the security governance activities and the main support tools
E8_LU2_6	List advanced attacks and threats models	What is an Advanced Persistent Threat	Give example of advanced attacks and their consequences
		Description of advanced attacks	
		What is ransomware and what are the consequences	
E8_LU2_7	List most advanced countermeasures for specific security areas	Mobile device security	Match example of vulnerabilities and possible countermeasure
		Wi-Fi security assessment	
		Workstation and browser security	
		Industrial Control System security models	
E8_LU2_8	Identify limits of technological malware protection tools	Description of main characteristics of malware protection tools	Identify characteristics, strength and weakness of a certain malware protection tool and consequently identify ways for improving it
		Description of strength and weaknesses of malware protection tools	
		Description of innovative technologies and methods for improving malware detection and protection	
		What human sensor network are	

COMPETENCE :	E.8_InformationSecurityManagement
LEARNING UNIT:	LU 3 – Infosecurity governance and standard

General description:	The learning unit aims to give an overview of the current standards and best practices in information security governance. It starts from an overview of the information security governance and its relation with business and its KPI. The learning unit also relates the governance with the information security strategy. Finally, the standard 27001 is presented, in particular regarding the audit process and how to perform it.
Knowledge	K4 The ICT internal audit approach
	K1 The organisation's security management policy and strategy and its implications for engagement with customers, suppliers and subcontractors
	K2 The best practices and standards in information security management
Skills	S1 document the information security management policy, linking it to business strategy, including data protection
	S4 Perform security audit
	A3 define security audit procedure

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
E8_LU3_1 Outline security governance	Importance of Information security governance	Give example of the security governance (outcomes, goals and metrics) in your company
	Outcomes of information security governance	
	Business goals and information security goals	
	Information security governance metrics	
E8_LU3_2 Distinguish between roles and responsibilities in security governance	Boards of directors/ senior management	Distinguish between different roles and responsibilities
	Executive management	
	Steering Committee	
	Chief Information Security Officer	
E8_LU3_3	Information security strategy objectives	

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
<p align="center">Recognize security strategy</p>	Information security strategy development	<p align="center">Give example of security strategy in your company</p>
	Strategy constraints	
	Action plan to implement strategy	
<p align="center">E8_LU3_4 Create an Information Security Management Systems</p>	The ISO 27000 family of standard and their role for an Information Security Management System (ISMS)	<p align="center">Describe what an Information Security Management System is and the main reference standards to consider in the ISO 27000 family Outline what are the main requirements of an ISMS based on the ISO 27001</p>
	The implementation of an ISMS based on the ISO 27001 standard: Clauses 4-10 Appendix A: Security Controls	
<p align="center">E8_LU3_5 Outline audit process for certification</p>	<p>The Certification Audit and the ISO 19011: Different types of audit The main process: stage 1 and stage 2 The collection of evidences Reporting</p>	<p align="center">Explain the approach and the main steps in the auditing process based on the ISO 19011</p>

COMPETENCE:	E.8_InformationSecurityManagement
LEARNING UNIT:	LU 4 – Application level security

General description:	<p>The learning unit takes into account the direct result of security issues that comes from the common practice to implement verification and assessment solely on IT infrastructure level and systems, neglecting the application layer. The latter, in the light of the gradual conversion to a web fruition / Mobile oriented, it is often the key of access to systems by attackers. The LU provides the elements to assess the motives and techniques related to modern cyber attacks, showing how you can effectively defend applications legacy and those based on web paradigm. In particular, the LU presents the principles of the Secure Software Development Lifecycle and how they are applied in the application development.</p>	
Knowledge	<p>K1 The organisation's security management policy and strategy and its implications for engagement with customers, suppliers and subcontractors</p> <p>K3 The critical risks for information security management</p> <p>K4 The ICT internal audit approach</p> <p>K5 Security detection techniques, including mobile and digital and cloud</p> <p>K6 Cyber attack techniques and counter measures for avoidance</p>	
Skills	<p>S5 Apply monitoring and testing techniques</p> <p>S7 Implement the recovery plan in case of crisis (implement the response techniques in case of attack)</p> <p>S2 Analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack</p>	
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
E8_LU4_1 Webapp – Analyse the most frequent security patterns and SSDL	Comparison of the principles of the Secure Software Development Lifecycle (SSDL) and how to avoid the basic attack principles and patterns. The most frequent security patterns and counter solutions are presented	Give examples of how to apply SSDL in order to avoid attacks or Any certification or partial experience in SSDL (vendor based, e.g. Oracle or MicrosoE7:E11ft or open, e.g. OWASP)

<p>E8_LU4_2</p> <p>Webapp – Outline solutions to the most common SSDL problems and risks</p>	<p>Programs manages assets and therefore the development of better programs and processes is a fundamental step to improve the resilience of the enterprise data space. The SSDL is driven by the risk reduction and requirement of data integrity. The course outline how to solve these problems</p>	<p>Give examples of how to apply SSDL in order to avoid attacks or Any certification or partial experience in SSDL (e. g. OWASP)</p>
<p>E8_LU4_3</p> <p>Webapp – Illustrate the integration of the SSDL process with Agile Management best practices</p>	<p>A novel project management process is presented that includes security of the software since the early phases of development. The presented process is integrated with the agile project management and ranges from the requirements collection to the code development</p>	<p>Give examples of agile process of development with security features</p>
<p>E8_LU4_4</p> <p>Webapp – Breakdown of the supplier selection processes</p>	<p>Breakdown of the SSDL processes to select the services of the external suppliers, also for mobile platforms. The methodology described is general for any platform and operative system</p>	<p>Give example of breakdown</p>
<p>E8_LU4_5</p> <p>Webapp – Examine the attack techniques and tactics</p>	<p>Most of the modern techniques used to attack the code are presented and discussed</p>	<p>A certification or a partial experience in offensive security or given a webapp, list all possible attacks to it</p>
<p>E8_LU4_6</p> <p>Legacy app – Analysis of the most frequent security patterns and SSDL</p>	<p>Participants will compare the principles of the Secure Software Development Lifecycle (SSDL) and how to avoid the basic attack principles and patterns. The most frequent security patterns are deeply analysed and counter solutions are presented</p>	<p>Give examples of how to apply SSDL in order to avoid attacks or Any certification or partial experience in SSDL (vendor based, e. g. Oracle or Microsoft)</p>

<p>E8_LU4_7</p> <p>Legacy app - Outline solutions to the most common SSDL problems and risks</p>	<p>Programs manages assets and therefore the development of better programs and processes is a fundamental step to improve the resilience of the enterprise data space. The SSDL is driven by the risk reduction and requirement of data integrity. The course outline how to solve these problems</p>	<p>Give examples of how to apply SSDL in order to avoid attacks or Any certification or partial experience in SSDL (vendor based, e.g. Oracle or Microsoft or open, e.g. OWASP)</p>
<p>E8_LU4_8</p> <p>Legacy app - Illustrate the integration of the SSDL process with Agile Management best practices</p>	<p>A novel project management process is presented that includes security of the software since the early phases of development. The presented process is integrated with the agile project management and ranges from the requirements collection to the code development</p>	<p>Give examples of agile process of development with security features</p>
<p>E8_LU4_9</p> <p>Legacy app - Breakdown of the supplier selection processes</p>	<p>Breakdown of the SSDL processes to select the services of the external suppliers, also for mobile platforms. The methodology described is general for any platform and operative system</p>	<p>Example of breakdown</p>
<p>E8_LU4_10</p> <p>Legacy app - Examine the attack techniques and tactics</p>	<p>Most of the modern techniques used to attack the code are presented and discussed</p>	<p>Share a certification or a partial experience in offensive security or given a webapp, list all possible attacks to it</p>
<p>E8_LU4_11</p> <p>Use the base reverse code engineering techniques to break software</p>	<p>Use the same methodologies used by attackers to crack the applications is an useful knowledge that can be reused to understand the real level of robustness behind the vendors declarations, and improves the ability to better select the suppliers or software services and modules</p>	<p>Knowledge of hacking techniques, ethical hacking or programming experience in ASM or offensive security or in a case study explain how to use reverse engineering</p>

<p>E8_LU4_12</p> <p>Recognize how assets are handled by application and how cracking process works</p>	<p>Participants will recognize how assets are handled by most common applications and will also learn the process of application cracking, in order to steal assets using spoofing and tampering of legacy application and web sites</p>	<p>Knowledge of hacking techniques, ethical hacking or (certification) programming experience in ASM or offensive security (certification) or in a case study explain how crack an application</p>
<p>E8_LU4_13</p> <p>Explain the common protection problems of applications</p>	<p>Explains the common problems of applications and will start to understand which are the most common problematic areas of code development and applications, from the attacker's point of view</p>	<p>Knowledge of hacking techniques, ethical hacking or programming experience in ASM or offensive security or give examples of protection problems</p>
<p>E8_LU4_14</p> <p>Discussion of protection techniques and base protection solutions</p>	<p>The course will discuss the efficiency of the most common protection techniques and how to bypass the simpler ones. The track will also summarize the base elements of the operative system security, with a special attention to Microsoft Windows</p>	<p>Knowledge of hacking techniques, ethical hacking or programming experience in ASM or offensive security or match vulnerabilities of an application with common protection techniques and discuss if these are enough to protect the application</p>
<p>E8_LU4_15</p> <p>Examine the reverse code engineering techniques and their usage in real exploits</p>	<p>The course will examine which are the base techniques and technologies and tools used to reverse engineer the applications, how to create a crack and how embody it into a malware. The methods used are the same used by real crackers to exploit, and deceive applications and systems</p>	<p>Knowledge of hacking techniques, ethical hacking or programming experience in ASM or offensive security or give examples of methods used by crackers</p>

COMPETENCE:	E. 8_InformationSecurityManagement	
LEARNING UNIT:	LU 5 - Vulnerability in real world	
General description:	The learning unit deals with the vulnerabilities that affects now systems and organizations. The learner will than know how to relate vulnerability and risks/attacks, considering both technological and human factors, and how to execute a vulnerability assessment and a penetration test. The learning unit aims also to illustrate the changing paradigms of attack from an approach aimed primarily looking for flaws in the technology to one which instead relies on the human factor to undermine the company's perimeter defences. More generally, it addressed the issue of availability of "social" information for attacks supported by techniques of social engineering.	
Knowledge	U4 Vulnerability assessment techniques	
	K4 The ICT internal audit approach	
	K5 Security detection techniques, including mobile and digital and cloud	
	K6 Cyber attack techniques and counter measures for avoidance	
Skills	A1 Perform vulnerability assessment	
	S2 Analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack	
	S5 Apply monitoring and testing techniques	
	S7 Implement the recovery plan in case of crisis (implement the response techniques in case of attack)	
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
E8_LU5_1 Identify the goal and the benefits of a Security Assessment	Bugs, misconfigurations and configuration errors	Be able to put in relation vulnerability and security risks providing examples
	Vulnerability in a cyber security point-of-view	
	The relation between security vulnerability, risks and time to underline the importance of Security Patching process	

E8_LU5_2	Describe the main phases in a Security Assessment	The Security Assessments in a security framework	List the key elements needed to start a Security Assessment activity
		The definition of the main Security Assessment phases, providing detailed requirements and output for each phase	
		Effort needed to reach the desired quality of the Assessment outputs	
		The role of NDA and Liability Waiver	
E8_LU5_3	Distinguish Vulnerability Assessment vs Penetration Tests	Difference between Security Assessment activities: VA, PT and custom assessment	Give example of Vulnerability Assessment output and describe process
		The key elements for evaluate an assessment activity	
		The concept of Advanced Persistent Threat tests	
		Pro and cons of PT and VA	
E8_LU5_4	Execute a vulnerability assessment and a penetration test	Description of a real-word case study	Execute a short vulnerability assessment and a penetration test
E8_LU5_5	Illustrate the concept of Social Driven Vulnerability Assessment	How to organize, evaluate and performs social driven vulnerability assessments	In a case study, give examples on how to execute a social driven vulnerability assessment, offensive hacking certification; participation to courses on cyber sociology; previous execution assessments of the human element of security in enterprises
		Legal and ethical implications and the available instruments	
E8_LU5_6	Explain the modern attack strategies	How to contrast the problem of social engineering attacks through assessment methodologies	Offensive hacking certification; participation

	exploiting social engineering	Risk acceptance and mitigation	to courses on cyber sociology; previous execution assessments of the human element of security in enterprises or give examples of how to exploit social engineering in attacks
		Analysis and improvements of the modern techniques of defence and mitigation vs classic ones	
E8_LU5_7	Illustrate Social Engineering 2.0	Concepts of social engineering 2.0 and its relation to the other human sciences	Offensive hacking certification; participation to courses on cyber sociology; studies on social engineering; give examples of social engineering
E8_LU5_8	breakdown of the attack strategies for the mobile world	Connections of the mobile world with cybercrime	Offensive hacking certification; participation to courses on cyber sociology; previous execution assessments of the human element of security in enterprises. give examples of social engineering and mobile
		Role of the social engineering in modern cybercrime in the mobile world	
E8_LU5_9	Describe the modern defence strategies and describe some real attacks that are based on social engineering	Most moderns attack strategies of cybercrime and cyberterrorism, with a special attention to targeted attacks and the role of social engineering	Offensive hacking certification; participation to courses on cyber sociology; participation to study groups or standardization bodies on cybercrime (e.g., APWG, ESET, ECSO, Microsoft DCC). Give examples of possible countermeasure to social engineering attacks
		Relations with the enterprise integrity and defences	
		Importance of the human element in modern attacks and defence systems	

COMPETENCE:	E. 8_InformationSecurityManagement	
LEARNING UNIT:	LU 6 – Security in new technologies	
General description:	The learning unit aims to explore some security issues arising from the massive spread of the cloud paradigm, smart / mobile, and IoT. These issues not only alongside aspects of technological security, but also “social” issues, as well as phenomena of “consumerization” and the user’s habit of insecure behaviour. Moreover, the technological evolution dynamic light always new phenomena (biometrics more usable, blockchain for payments and transactions, etc.) and consequently new risks and opportunities. The LU aims to provide a taxonomy of possible threats to the infrastructure, devices and applications, deepening methodological approaches, tools and organizational solutions for proper management of security in these areas.	
Knowledge	K5 Security detection techniques, including mobile and digital and cloud	
	K6 Cyber attack techniques and counter measures for avoidance	
	K4 The ICT internal audit approach	
	K3 the critical risks for information security management	
Skills	S5 Apply monitoring and testing techniques	
	S7 Implement the recovery plan in case of crisis (implement the response techniques in case of attack)	
	S2 analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack	
	A4 collect and process technical requirements for cyber defence and mitigation of risks	
	S3 establish a risk management plan to feed and produce preventative action plans	
S4 Perform security audit		
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 2)
E8_LU6_1	Summarize of the current landscape The status of the cybercrime targeting the mobile terminals	Certifications of ethical hacking or offensive

<p>of mobile security and related cybercrime activities.</p>	<p>The main attack techniques used for the principal mobile platforms</p> <hr/> <p>Trends and future evolutions</p>	<p>security, experiences in reverse code engineering of mobile apps; participation to study groups or standardization bodies on cybercrime (e.g.. APWG, ESET, ECSO, Microsoft DCC) or give example of possible threats to mobile applications</p>
<p>E8_LU6_2</p> <p>Define Cloud Computing Model according to NIST</p>	<p>A Cloud Computing model based on NIST guideline</p> <hr/> <p>The key elements, components and model types (SaaS,PaaS,IaaS)</p> <hr/> <p>Relation and differences between Cloud Computing and the other ICT service Models (outsourcing, hosting, etc.)</p> <hr/> <p>The infrastructural difference between Enterprise Cloud Providers and Main Stream Cloud Providers (i.e. Google, Amazon, Facebook, etc.)</p>	<p>Be able to distinguish a Cloud Computing services against other kind of service models by the identification of the key characteristics</p>
<p>E8_LU6_3</p> <p>Identify Cloud Computing trends and security concern</p>	<p>Review of a public survey about Cloud Computing concern in a Security point-of-view</p>	<p>Give examples of the main concern about Cloud Computing security</p>
<p>E8_LU6_4</p> <p>Criticize Cloud Computing needs – a reliable opinion</p>	<p>Analysis in a critical perspective of the reasons that leads a migration from ICT services to a Cloud Computing models</p> <hr/> <p>The most famous Cloud Computing fails as lesson learned</p> <hr/> <p>An analytical approach for evaluate if externalize a service and with which model</p>	<p>Analyse a set of case studies in order to tell when a CC adopt is really necessary</p>

E8_LU6_5	Manage Security Risks in Cloud Computing projects	Analysis and comparison of Cloud Computing SLA's with the requirements of Business Impact analysis	In a case study, perform a full Risk Analysis of Cloud Computing services
		The top threat in Cloud Computing Environments to be considered during a Risk Evaluation	
		A model to address Cloud Computing-oriented risk analysis	
E8_LU6_6	Explain what is Blockchain	What is Blockchain	Give an example of use case with the block chain and identify information security risks
		What is Bitcoin	
		What is a transaction	
		What it Ethereum and other "general purpose" Blockchain	
		What are smart contracts	
		Privacy and security within transaction	
		Scalability	
Possible use case			
E8_LU6_7	Recognize IoT threats	The IoT paradigm opens a whole new world of vulnerabilities and risks, and adds new access ways to ICT infrastructures	Provide an original analysis about OWASP top 10 IoT risk contextualization to a chosen object (smartwatch, SOHO router, etc.)
		The IoT risks are mostly related to non IoT components of the technological/organizational infrastructure	
		Overview of IoT specific risks examples	
		Overview of IoT related (but not affecting IoT devices) risks examples	
		Standards and guidelines (focus on OWASP Top 10 IoT vulnerabilities)	

COMPETENCE:	E. 8_InformationSecurityManagement													
LEARNING UNIT:	LU 7 – The overall risk and incident management process													
General description:	The learning unit aims to show how the information security manager must help the management in risk management for the enterprise. The risk assessment techniques and methodologies will be described and tested in case studies in order to provide also theoretical / practical elements to define and implement an effective balance between the effort of contrasting risks and how critical assets are. the learning unit deals also with how to manage incidents, i.e. in case of risk happening. The learners will learn the incident management process and methodologies and apply them in a case study.													
Knowledge	K3 The critical risks for information security management													
	U1 Security incident management best practices and standards													
	K4 The ICT internal audit approach													
Skills	S2 Analyse the company critical assets and identify weaknesses and vulnerability to intrusion or attack													
	A2 Define security audit procedure													
	S4 Manage of security incident in order to prevent future re-occurrence and assure business continuity													
	A4 collect and process technical requirements for cyber defence and mitigation of risks													
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%; text-align: center;">Learning Objectives The learner will be able to...</th> <th style="width: 33%; text-align: center;">Learning Content</th> <th style="width: 33%; text-align: center;">Evidence examples (Level 3)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">E8_LU7_1 Explain the meaning of risks for information systems</td> <td>What is a risk from a Information Security point of view</td> <td rowspan="2" style="text-align: center;">Define risks in Information Security and common expectations of Top Management from a Risk Assessment</td> </tr> <tr> <td>The role of the Information Security Manager for dealing with risks</td> </tr> <tr> <td rowspan="3" style="text-align: center;">E8_LU7_2 Apply a risk assessment process and methodologies</td> <td>What are the main component and steps for managing risks</td> <td rowspan="3" style="text-align: center;">Describe why is complex to execute a risk assessment and the main approaches for evaluating it</td> </tr> <tr> <td>Main approaches to identify and evaluate risks</td> </tr> <tr> <td>The limits of methodologies and the role of standards</td> </tr> </tbody> </table>			Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	E8_LU7_1 Explain the meaning of risks for information systems	What is a risk from a Information Security point of view	Define risks in Information Security and common expectations of Top Management from a Risk Assessment	The role of the Information Security Manager for dealing with risks	E8_LU7_2 Apply a risk assessment process and methodologies	What are the main component and steps for managing risks	Describe why is complex to execute a risk assessment and the main approaches for evaluating it	Main approaches to identify and evaluate risks	The limits of methodologies and the role of standards
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E8_LU7_2	Apply a risk assessment process and methodologies	What are the main component and steps for managing risks Main approaches to identify and evaluate risks The limits of methodologies and the role of standards	Describe why is complex to execute a risk assessment and the main approaches for evaluating it											

E8_LU7_3 Apply a practical example to execute a risk assessment	A concrete example of a methodology	Give examples of the main problems dealing with asset, threats, vulnerabilities and countermeasures and give proposal on how to solve that problems
	How to deal with asset, ownership and asset value	
	How to deal with threats	
	How to deal with vulnerabilities and countermeasures	
E8_LU7_4 Define Security Incident Management and Risk, Identify security incident Goals according with ENISA documentations	List of main key definition and term to able to a common understanding	Define key terms for the Incident Management process
	The CERT team genesis and main goals	
	The roles and the dynamics in an Incident Response Team	
E8_LU7_5 Describe incident management process and key activities	Description of incident management services as Reactive, Proactive and Quality management services	Describe the main incident management services
E8_LU7_6 Develop a incident management process	Description of the main steps to be performed during an Incident Handling	Starting from a case study develop the process of incident handling identifying the main task that must be done
	Deep focus on Triage phase as the key element for the right management of the entire process	
	The incident resolution circular process	
E8_LU7_7 Practice the incident management on a Case Study / exercise	A customized incident handling process	Give example of a complete Incident management process

COMPETENCE :	E.8_InformationSecurityManagement
LEARNING UNIT:	LU 8 – Information Security Project Management
General descriptio n:	The learning unit aims to provide the fundamental elements at the base of a proper integrated management of information security in an enterprise. In particular, the organizational aspects (creation of teams / units of information security and their position in the company organization), the economic and financial analysis of the investments, the implementation and management of information security projects (project management), performance measurement of the initiatives and the identification of corrective measures aimed at continuous improvement of information security management system.
Knowledge	U6 Estimation techniques for economic and financial evaluation of security projects
	K1 the organisation's security management policy and strategy and its implications for engagement with customers, suppliers and subcontractors
Skills	A6 Apply the information security plan
	A7 Monitor the implementation of information security plan and manage the information security team.
	A3 Collect and process technical requirements for cyber defence and mitigation risks
	A10 estimate costs of information security actions

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)
E8_LU8_1 Create the project charter in order to officially initiate a project	What is a project charter: definition and meaning	Provide a project Charter of a security project
	How to create a project charter: information needed and accuracy level	

Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)
<p>E8_LU8_2</p> <p>Describe how to prepare the schedule for the project and how to modify it on the base of context's changes</p>	<p>The six steps to create the project schedule: WBS set up - Activities relationships identification - Activities estimation - Preliminary scheduling - Resources assignment and scheduling improvements - Budget definition</p> <p>The creation of the WBS: detail on methods and approaches</p> <p>How to create a schedule for information security projects: focus on scheduling calculation and responsibility assignment</p>	<p>Provide the AWBS of a security project, a security project schedule</p>
<p>E8_LU8_3</p> <p>Describe how to monitor and control a project</p>	<p>Purpose of monitoring and controlling project work on information security projects</p> <p>The three baselines of a project</p> <p>The earned value technique to measure progress</p> <p>Corrective actions to keep a project on track</p>	<p>Apply EVM on a case study security project</p>
<p>E8_LU8_4</p> <p>Analyse the risks of a project</p>	<p>Purpose of project risk analysis</p> <p>Threats versus opportunities</p> <p>The steps of project risk analysis process: identification - qualitative analysis - quantitative analysis - response identification</p> <p>Monitoring and controlling risk responses</p>	<p>Provide a risk register of a security project</p>
<p>E8_LU8_5</p> <p>Organize an effective closure</p>	<p>Collecting lessons learned</p>	<p>Share the lesson learned of a security project</p>

E8_LU8_6 Recognize infosecurity peculiarity in project management	Clarify the “commitment issue” and the problem of having the right stakeholders at the table	Integrate the project management documentation of a sample project with specific statements covering the information security aspects in the different PM phases
	the volatility of the schedule	
	rolling priorities for infosecurity initiatives	
	Impacts of the infosecurity PM activities peculiarities on the control/monitoring tasks	
	Specific infosecurity projects risks	
the closing of an infosecurity project and enabling follow-up		

COMPETENCE:	E. 8_InformationSecurityManagement										
LEARNING UNIT:	LU 9 - Digital identity security										
General description:	The learning unit touches the issues related to the “digitization” of identity (including on state initiatives “unique identity”, eg. SPID). The course also addresses issues related to the construction of appropriate authorization models for access to systems (with specificities of the SAP environment, as an example of application with an extremely pushing role management) without neglecting the aspects related to the availability of the network-related information to the person, and legal issues on data privacy.										
Knowledge	U2 Data integrity and privacy										
	U3 How to protect digital identity										
Skills	A8 Define action to protect digital identities and sensitive data										
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #0056b3; color: white;">Learning Objectives The learner will be able to...</th> <th style="background-color: #0056b3; color: white;">Learning Content</th> <th style="background-color: #0056b3; color: white;">Evidence examples (Level 3)</th> </tr> </thead> <tbody> <tr> <td rowspan="4" style="vertical-align: top;"> E8_LU9_1 Define the digital identity lifecycle </td> <td>What is a digital identity (similarities and differences with the physical identity concept)</td> <td rowspan="4" style="vertical-align: top;"> Define “digital identity” describing a contextualization in own organization or provide some related certification (like CIAM or similar) </td> </tr> <tr> <td>Enrolment/provisioning vs authentication</td> </tr> <tr> <td>Relationships among Identities and applications</td> </tr> <tr> <td>SPID: an Italian experience</td> </tr> </tbody> </table>			Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)	E8_LU9_1 Define the digital identity lifecycle	What is a digital identity (similarities and differences with the physical identity concept)	Define “digital identity” describing a contextualization in own organization or provide some related certification (like CIAM or similar)	Enrolment/provisioning vs authentication	Relationships among Identities and applications	SPID: an Italian experience
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 3)									
E8_LU9_1 Define the digital identity lifecycle	What is a digital identity (similarities and differences with the physical identity concept)	Define “digital identity” describing a contextualization in own organization or provide some related certification (like CIAM or similar)									
	Enrolment/provisioning vs authentication										
	Relationships among Identities and applications										
	SPID: an Italian experience										



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E8_LU9_2	Classify authentication methods and their reliability	Different types of credentials	Describe and comment the authentication strategy adopted in own organization or provide some related certification (like CIAM or similar)
		The correct choice and the different needs (strength vs usability, etc.)	
		The Level of Assurance	
		How technology advance enables continuous improvements and bypasses the trade-off	
E8_LU9_3	Describe Identity management in autonomous or federated contexts	The concept of federated Identity and identify enabled scenarios	Describe and comment a specific authentication approach/standard or provide some related certification (like CIAM or similar)
		The different roles (focus on the Identity Provider role)	
		Standards: SAML	
		Standards: Open stack	
		Focus: openID, Oauth	
		The correct management strategy and the proper standard	
E8_LU9_4	Outline the Identity exposure risks on social medias	The risks of personal exposure	Identify and discuss the social media management strategy of own organization, highlighting relevant security issues
		How to collect/steal identity information	
		The risks of enterprise exposure	
		What happens not properly addressing the social media identity of the enterprise	
		Some rules for a sustainable management of the corporate exposure on SM	
E8_LU9_5	Outline of the base cryptography criteria, application limits and intrinsic weakness of modern cryptographic systems	The base elements of modern cryptographic systems	Give examples of attacks to cryptographic systems or Certifications of ethical hacking or offensive security or experiences in the implementation of cryptographic systems
		Better look from the ground at the logics of symmetric and asymmetric crypto systems	
		The logics of modern attacks to crypto systems and their evolution	

COMPETENCE :	E.8_InformationSecurityManagement	
LEARNING UNIT:	LU 10 – Legal aspects in information security	
General description:	The learning unit aims to give an overview of the legal and regulation aspects of information security. The LU analyse the new data privacy European regulation and its administrative and technological implications in companies, in order to let the learners understand the consequences and the action for their own companies. The data privacy will be analysed also considering regulations in data transfers. The LU depicts also the regulation on informatics crimes (at European level with some details for Italy), digital forensics and how it can be applied in organizations.	
Knowledge	U5 Legal aspects and implication in security projects and data privacy	
	K7 Computer forensics	
Skills	A7 Assess the compliance of the plans and policies with the current regulations and with the organization information security strategy	
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
E8_LU10_1 Describe the European new regulation GDPR and its relation to the current Italian regulation on data Privacy (Privacy code)	Rules on data management according to data type	List the main topics of the European and Italian regulations of data privacy
	Rules on data transfer	
	Rights of the involved person	
	Security and data violation	
	Code of conduct	
	Certifications	
	Control Authorities	
Protections and penalties		
E8_LU10_2	Technical and business consequences of the GDPR	

	Apply the regulations on data privacy	Analysis of the consequences of the GDPR on contrast to the cybercrime activities	Application of the GDPR to the company digital data
E8_LU10_3	Outline the Privacy in data transfer between US and EU	Safe Harbour	Distinguish between the two regulations in data transfer
		Privacy shield	
E8_LU10_4	Distinguish between different types of violations and define the responsibility regime	Definitions of the different types of violations (civil, penal, administrative, ...)	Distinguish the different types of violation and the corresponding consequences for involved people
		Corresponding regulations for each type of violations	
		Examples of violations and consequences in ICT	
E8_LU10_5	Recognize an informatics crime and outline the current related regulations	Definition of the informatics crime	Recognize informatics crimes between a list of actions, recognize when and how the administrative responsibility applies
		List of the related European and Italian regulations	
		Italian regulation on Administrative responsibility in informatics crimes	
		Focus on informatics crimes	
E8_LU10_6	Apply the current related regulations to prevent informatics crimes in companies	Confindustria guidelines on informatics crimes	Application of the administrative responsibility regulation to the company organization (descriptions, tools, guidelines and required documentation) The ethic code created for your company
		Application of the Administrative responsibility and corresponding regulations	
		Practical examples	
		Technical and methodological tools for the application	
		The Organization model	
E8_LU10_7	Outline regulations on digital forensics	The ethic code	Provide examples of evidences that can be used in civil and penal legal actions and relate them to the current regulation
		The evidence concept	
		The evidence of cyber crimes in Italian regulation	
		Evidence in civil legal action	
		Evidence in penal legal action	
		Italian penal law and cyber crimes	
Digital forensic in a civil and penal legal action			
E8_LU10_8		digital forensic in company	

Outline regulations on digital forensics in a company	how to prepare for the digital forensic	Provide examples of application of digital forensic in companies
	the company digital forensic phases	
	examples of main guidelines on digital forensic in companies	

COMPETENCE:	E.8_InformationSecurityManagement	
LEARNING UNIT:	LU 11 – Forensics	
General description:	The information security manager must help the management in risk management for the enterprise. Therefore, an apparatus for the prevention and the contrast must be associated to an organization able to manage the possibility of a computer security incident, both from a technological point of view (identification, recognition and mitigation) and from a possible follow-up of a legal nature, according to the dictates of the computer-forensics. The learning unit aims to show the current techniques for digital forensic, not only in the enterprise environment, but also considering mobile and cloud. The learners will be involved in the discussion of real situations and case studies in order to apply the acquired knowledge.	
Knowledge	K7 Computer forensics	
Skills	A9 assess the compliance of the plans and policies with the current regulations and with the information security strategy of the organization	
Learning Objectives The learner will be able to...	Learning Content	Evidence examples (Level 4)
E8_LU11_1 Describe digital forensics context nowadays	What is digital forensics	List the digital forensics techniques, principles and process
	Evolution of digital forensics techniques	
	Basic principles of digital forensics	
	General digital forensics process	
	Useful tools and methods	
E8_LU11_2 Explain mobile forensics approaches	What are main mobile forensics approaches	Recognize in which way the digital forensic is different from mobile one
	Difference between traditional digital forensics and mobile forensics	
	Useful tools and methods	

E8_LU11_3	Explain cloud forensics approaches	What are main cloud forensics approaches	Recognize in which way the digital forensic is different from cloud one
		Difference between traditional digital forensics and cloud forensics	
		Useful tools and methods	
E8_LU11_4	Describe case studies of digital forensics	Real forensics case example	Provide an example of digital forensics in your company, with the indication of the process used, tools and techniques
		Digital evidence collection	
		Digital evidence analysis	
		Reporting best practices	
COMPETENCE :	E.8_InformationSecurityManagement		
LEARNING UNIT:	LU 12 - Elements of Information Security Governance and Risk planning		
General description:	The learning unit deals with the relationship between the information security plan and the information security strategy. The learners will understand what are the drivers of the choices that can be made in an information security strategy and how they have to translate those choices in the information security plan. Moreover, the learning unit will show how the information security plan will become a mean to measure the correct implementation of the information security strategy.		
Knowledge	K1 the organisation's security management policy and strategy and its implications for engagement with customers, suppliers and subcontractors		
	K4 the ICT internal audit approach		
Skills	S3 Establish a risk management plan to feed and produce preventative action plans		
	S7 Establish the recovery plan		
	A8 Estimate costs of information security actions		
	A9 Develop the information security plan in accordance with the information security Strategy/ Policy		
Learning Objectives The learner will be able to...	Learning Content		Evidence examples (Level 4)
	Priorities from business		

E. 8_LU12_1	Identify/understand the Information Security Strategy	The necessity of a good comprehension of the ICT strategy and assets (and evolution)	Define all the main initiatives that define the information security strategy for your enterprise Alt: CISA/CISM certification
		Synergies among the different “mid-level” strategies (ICT, risk, data management, etc.)	
		The main action areas of the information security strategy	
E8_LU12_2	Create the Information Security Program from Strategy	Definition of the action areas of the Program and properly involvement of the stakeholders	Discuss the design aspects of the information security program Alt: CISA/CISM certification
		Definition of initiatives, priorities, timeframes and budgets	
		Communication of the Strategy and the Program	
E8_LU12_3	Conduct and Integrate the Program with the Risk Management	Definition of the risk plan as the result of a risk assessment	Discuss a specific risk mitigation initiative identified in your enterprise, clarifying the relationship with: mitigated risks, accepted/residual risk. Alt: CISA/CISM certification
		Clarification of the importance of the “residual risk”	
		Conduction/execution of the Plan in the a Information Security Program	
E8_LU12_4	Measure and test the strategy effectiveness	Measurement, metrics and indicators	Describe possible security measurement plan for information security. Alt: CISA/CISM certification
		Available frameworks for information security measurement	
		Measures development template and catalogue	
		Information Security measurement implementation	

Annex II – Checklist for the peer review

LEARNING UNIT (LU) PLAN		Peer Review Outcome	Added Comments
1	Learning Units are clearly and objectively referred to a set/subset of Skills and Understanding of the related Competence.		
2	Their title doesn't coincide with an Understanding's or Skill's one		
3	The identified set of LUs completely cover all the Understanding, Skills and all that is needed to learn and act that competence		
4	Each LU reply to the requirement of homogeneity, self-explicating resource, modularity		
5	Each LU is clearly linked to one or more proficiency levels		
6	Each LU is generally described and clearly introduced		
LEARNING OBJECTIVES (LO):		Peer Review Outcome	Added Comments
7	The title always contains a verb , as the LO replies to a specific "problem" a learner should be able to face and solve if the learning outcomes of the LU are actually acquired.		
8	The set of identified LOs entirely covers the learning outcome of the LU (<i>exhaustivity</i>)		
LEARNING CONTENT (LC):		Peer Review Outcome	Added Comments
9	Any content identified for the LO defines a specific topic that is needful for facing the "problem solving" proposed by the LO		
10	The content doesn't report any "Exercises" or any other resource that don't directly deal with/define a specific topic concerning the LO.		
GENERAL DESCRIPTION OF EACH LU:		Peer Review Outcome	Added Comments
11	It includes the description of the LOs contained in the LU and their main contributions to the LU.		
12	The "main contributions" really increase the comprehension on what is the added value of the LO against the overall LU (eg <i>what does it provide to the learner? How does it help the learner increasing his/her performance in acting the related competence ?</i>)		
EVIDENCES:		Peer Review Outcome	Added Comments
13	They provide a clear example of proof that a learner can think to produce for further assessment		
14	The set of identified evidences are significant and entirely cover the LU's scope.		

Annex III – Bloom’s Taxonomy Action Verbs

Bloom's Taxonomy Action Verbs						
Definitions	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Bloom's definitions	Remember previously learned information	Demonstrate an understanding of the facts	Apply knowledge to actual situations	Break down objects or ideas into simpler parts and find evidence to support generalisations.	Compile component ideas into a new whole or propose alternative solutions.	Make and defend judgments based on internal evidence or external criteria.
Verbs	<ul style="list-style-type: none"> • Arrange • Define • Describe • Duplicate • Identify • Label • List • Match • Memorize • Name • Order • Outline • Recognise • Relate • Recall • Repeat • Reproduce • Select • State 	<ul style="list-style-type: none"> • Classify • Convert • Defend • Describe • Discuss • Distinguish • Estimate • Explain • Express • Extend • Generalize • Give examples • Identify • Indicate Infer Locate Paraphrase Predict Recognise Rewrite Review Select Summarize Translate 	<ul style="list-style-type: none"> • Apply • Change • Choose • Compute • Demonstrate • Discover • Dramatize • Employ • Illustrate • Interpret • Manipulate • Modify • Operate • Practice • Predict • Prepare • Produce • Relate • Schedule • Show • Sketch • Solve • Use • Write 	<ul style="list-style-type: none"> • Analyze • Appraise • Breakdown • Calculate • Categorize • Compare • Contrast • Criticize • Diagram • Differentiate • Discriminate • Distinguish • Examine • Experiment • Identify • Illustrate • Infer • Model • Outline • Point out • Question • Relate • Select • Separate • Subdivide • Test 	<ul style="list-style-type: none"> • Arrange • Assemble • Categorize • Collect • Combine • Comply • Compose • Construct • Create • Design • Develop • Devise • Explain • Formulate • Generate • Plan • Prepare • Rearrange • Reconstruct • Relate • Reorganize • Revise • Rewrite • Set up • Summarize • Synthesize • Tell • Write 	<ul style="list-style-type: none"> • Appraise • Argue • Assess • Attach • Choose • Compare • Conclude • Contrast • Defend • Describe • Discriminate • Estimate • Evaluate • Explain • Judge • Justify • Interpret • Relate • Predict • Rate • Select • Summarize • Support • Value

Annex IV – Focus Group format

Date:

Organized by: **ALL partners involved in LU development**

Organization	Date

Target audience and figures: **external stakeholders and experts (VET, Trade association/Union, enterprises)**

Objectives: **content and methodology validation**

The Focus Group aims to propose the outcome of the Learning Unit Set to externals and to validate with them the overall *comprehension, clearness and completeness* for a learner to achieve a specific competence or part of it at a certain proficiency level. Details and quantitative validation will be extensively focused during the pilots (WP5). The Focus Group will provide a working context with different roles from the VET trainer up to the HR officer to get some valuable consideration on the methodology and the content obtained.

The eCQP is the competence reference. Each Competence LU set, that is to say the LU plan, the Learning Outcome, Learning Content and Evidence for each unit, are the outcome under validation.

Due to the extension of the content, the Focus Group will mainly focus on an excerpt of the competence LU set. The activities hereunder proposed aim to lead the participants through a validation of a few key points affecting content and methodology followed in WP4:

- *significance of the competence LU plan vs effectiveness in achieving the related competence.* That's to say, the LU Plan is functional to go through a learning path, whatever long and articulated it can be, and achieve all the skills, knowledge and attitude to act it in a given proficiency level.
- *significance of the Learning Outcome in relation to the Learning Unit.* That is to say, The Learning Outcome are functional to match the LU purposes. The Learning

Outcome are understandable and clearly identified compared with the Learning Content.

- *significance of the evidence in order to clarify how to demonstrate a certain Learning Outcome related to the given competence or better to a part of it (Competence (Learning Unit)).*

Materials and Resources:

- General documents delivered to attendants:
 - Project brochure
 - Project text Summary
 - eCF 3.0 brochure
 - Printed survey/questions/issues list
 - Summary of the 15 selected e-competences
- Specific documents for the FG activities (specifically for the competence under evaluation):
 - e-Competence Qualification Profile
 - LU Plan (final format included in the DLV)
 - List of LU with only their description, Knowledge and Skills
 - One LU in full version but with the empty list of evidence, replaced by some specific questions
 - if needed, but apart, the list of evidences already designed for the given LU.
 - printed activity questionnaire.

Activities and tasks:

The activity focuses on a specific competence. If parallel groups are planned, the FG can work on more competences in parallel.

The overall activity is divided in 3 parts from a general introduction to the competence up to a more specific analysis of the LU info.

PART A: raising AWARENESS ON THE COMPETENCE and its related learning plan.

- what does the Competence deal with?
- what do the Learning Units mean?

The attendants are divided in smaller groups (3-4 people). Each group is assigned to a competence

NOTE: alternatively, this part can be done in plenary and afterwards (Part B and PART C) smaller groups can work on more than one Learning Unit.

The participants are provided with the e-CQP, the related LU plan (format as DLV), the list of LU descriptions plus the related K and S.

They are asked to read some specific parts and then discuss together on how to answer a given question:

1. read carefully the eCQP descriptions: especially the competence one and the related proficiency levels' description.
2. read carefully the overall Plan of Learning Units with the help of their descriptors
3. compare the LU plan with the Competence purposes and proficiency level
4. answer the question hereunder:

FG_Part A	NOT AT ALL	FEW	ENOUGH	YES COMPLETELY
Q.1. At what extent are the designed Learning Units coherent and functional to identify a full learning path of the competence?				
Comments, feedback:				
Suggestions, adjustment:				

If PART A is managed in groups, then a plenary follow up may be planned.

PART B: going into depth on how the LEARNING UNIT is designed in compliancy with the achievement of the competence:

- what does the Unit want a learner to be able to?
- what content does the Learning Unit deal with?

The attendants are divided in smaller groups (3-4 people). Each group is assigned to a Learning Unit related to the previous competence directly evaluated.

The participants are provided with the full LUX design, including Learning Outcome (LO), Learning Content (LC) and a blank column of list of evidence (the PART C aims to work specifically on the evidences).

They are asked to read some specific parts and then discuss together on how to answer a few given question:

1. read carefully the LO and related Content.
2. compare the LO with the LU purposes and linked proficiency levels
3. answer the questions hereunder:

FG_Part B	NOT AT ALL	FEW	ENOUGH	YES COMPLETELY
Q.2. Is it clear the difference between Learning Outcome and Learning Content?				
Q.3. How clearly are the Learning Outcome formulated? Are they fully comprehensible from your point of view?				
Q.4. At what extent are the designed Learning Outcome coherent and functional to identify a full learning path of the Unit?				
Comments, feedback:				
Suggestions, adjustment:				

After the group work, a plenary follow up session may be planned.

PART C: going into depth on what EVIDENCES should be identified:

- what evidence better demonstrates the achieved Learning Outcome?
- what evidence specifically from the real work experience might be provided for proving the achieved Learning Outcome?

The attendants go on working in the smaller groups (3-4 people) previously defined.

The participants are provided with the full LUX design, including Learning Outcome (LO), Learning Content (LC) and a blank column of list of evidence.

They are asked to contribute on two issues:

- a) to evaluate the significance of three given category of evidences LO by LO

FG_Part C.a) Q.5 How relevant is each evidence category for a learner to prove the actual achievement of the Learning Outcome? Please, insert a cross and rate each evidence category	RATE	THEORETICAL TEST	EXERCISES, CASE OF STUDIES, SIMULATION (THEORETICAL APPLICATION)	DOCUMENTATION / PRODUCTS / RESULTS FROM WORK EXPERIENCE
LO x	NOT AT ALL			
	FEW			
	ENOUGH			
	YES, completely			
Any comment, feedback:				

- b) to think about real work experiences directly managed or come across and to provide examples of evidences that might be produced in order to prove the achieved Learning Outcome

FG_Part C.b) Q.6 If you review your own experience on real work contexts that exploit such competence (or part of), what product/ result/ documents might be provided for a learner to demonstrate the achieved learning outcome? Please, add as many examples as you can find and cross the LO potentially addressed.	LO1	LO2	LO n
Evidence example 1				
.....				
Evidence example n				
Any comment, feedback:				

The Part C.b) is planned to get a valuable contribution from externals in order to identify significant evidences.

At competence leader discretion, afterwards the attendant can be provided with the list of evidences till now produced for the competence. The comparison may help identifying matching and inconsistency on how evidences can be produced in a *significant* and *feasible*

way. The outcome of such a task is expected to contribute and to have a positive impact on the methodology to identify evidences within the WP4.

After the group work, a plenary follow up session may be planned.

Duration: 75' – 135'

Accordingly with the available time, the opportunity to alternate team work in multiple groups and plenary follow up sessions as well as the quality of the discussion with participants, the meeting can last differently.

Overalls, the meeting shouldn't last too much and the attendants, as external stakeholders and potential users from different perspectives, should be able to catch the fundamentals of the work proposed in a smart but sufficient way to form an opinion.

A brief calculation as follows show an estimated minimum and maximum duration:

- Introduction of some basics 15'
- Part A 20' – 40'
- Part B 20' – 40'
- Part C.a) 10' – 20'
- Part C.b) 10' – 20'