

BLISS

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1. Introduction

Blockchain is a technological innovation that is transforming industries and provides opportunities for collaboration in completely new ways. The World Economic Forum estimated that by 2027, 10% of economic transactions will be supported by blockchain technology¹.

The demand on ICT professionals to understand and require blockchain related skills in the workplace is therefore evolving rapidly and ICT professionals will need to be acquainted with blockchain technology in order to keep up with the demands of the EU labour market.

BLISS is an Erasmus+ project that aims to address this challenge by delivering a modular curriculum and Open Educational Resources (OERs) on blockchain technology, to increase the relevance of VET provision for ICT professionals to match their competences with the latest ICT developments and promote their employability.

The principal BLISS project activities has been:

- Analysis of current and future skills and knowledge needs to develop updated and tailored to occupational needs, blockchain related, learning outcomes.
- Development of the structure of a curriculum on the technologies and practical applications of blockchains.
- Creation of pedagogical materials to be offered as Open Education Resources.
- Development, testing, and delivery of Vocational Open Online Course (VOOC) infrastructures on blockchain technology applications, promoting the adoption of innovative practices in VET.
- Involvement of key policy makers & stakeholders for the validation of BLISS units of learning outcomes as well for supporting the integration of blockchain skills into the European e-Competence Framework.
- Sharing and validation of outputs with multiplier events, inviting target groups to uptake BLISS results and to act as further disseminators.

1.1 BLISS objectives

As defined in the application form, the BLISS objectives are:

¹ Global Agenda Council on the Future of Software & Society - Deep Shift Technology Tipping Points and Societal Impact - Survey Report, September 2015 http://www3.weforum.org/docs/WEF_GAC15_Technological_Tipping_Points_report_2015.pdf (page 24)

1. Strengthen key transversal competences for ICT professionals, namely initiative and entrepreneurship and updated digital skills by designing a comprehensive and up-to-date training course in blockchain technology application.
2. Introduce modern training delivery methods and innovative open access educational resources (eg VOOC infrastructures), enabling learners to acquire and self-assess blockchain related skills.
3. Facilitate the integration of blockchain requirement into the EU certification and standardization schemes.

1.2 Bliss target

As defined in the application form, the BLISS project addresses the following targets:

- ICT professionals in need of C-VET,
- I-VET students aspiring to get employed as blockchain developers,
- VET providers,
- Sector representatives.

1.3 BLISS results

The BLISS consortium – co-financed by the European Community in the Erasmus+ programme - aiming to improve the skills and competences of ICT professionals:

- carried out a **survey** to detect the knowledge and skills required by blockchain technology; it investigated, in particular, on the current gap between the requests of companies and the training of IT professionals;
- developed **educational resources and materials** to meet the demands of the world of work and to overcome existing professional mismatches,
- developed a **course** on blockchain skills needs that will support the large scale open access and participation in training activities for ICT professionals. The [BLISS VOOC](#) is an online course designed to help ICT professionals to learn the theoretical concepts of blockchain technology and its practical applications. **It is organised into 4 learning unit:**
 1. Blockchain essentials.
 2. Blockchain platforms.
 3. Business merits, challenges and implications of blockchain technology.
 4. Practical design and development of blockchain applications.

1.4 Aim of this paper

This position paper is addressed to bodies and stakeholders that are active in the ICT sector and/or participate in policy making consultation (key sectoral players, national regulatory authorities for certification, NQF agencies, social partners and qualifications awarding bodies).

It aims:

- to influence policy-making towards initiatives seeking to increase the provision of high quality skills and competences for ICT professionals,
- to bring closer the world of VET with the needs of the labour market strengthening the skills-employment linkage.

In particular, it draws attention to the growing importance of quality training on the blockchain theme.

The purpose of the position paper is also to refer the competences required for the blockchain to the European e-Competence framework (e-CF). e-CF constitutes the European standard for ICT professionals, aimed to provide a common language to describe knowledge, skills and competences required by the ICT workforce.

2. Training needs addressed as emerging from the BLISS Research

The expansion of blockchain technology across the major sectors of the EU economy² has brought the need for up-skilling ICT professionals so that they are able to perceive and work on blockchain applications.

The first intellectual output of the BLISS project comprises tasks to define work towards defining the specifications (i.e. learning outcomes) for the BLISS course curriculum.

2.1 Data analysis on the online questionnaire responses

A first activity of the BLISS consortium has been a survey.

The report "Data Analysis on the Online Questionnaire Responses" presents the analysis of the data collected from the responses to an online questionnaire regarding blockchain technology skills. This questionnaire addressed the relevant stakeholders:

1. to capture their perceptions on skills requirements for blockchain technology applications,

² See, for example, Banking Is Only The Beginning: 55 Big Industries Blockchain Could Transform - <https://www.cbinsights.com/research/industries-disrupted-blockchain/>

2. and to determine the most valued and needed digital skills for ICT professionals as regards blockchain technology.

Here an indicative list of respondents to whom the consortium is addressed:

- Executives from ICT companies (e.g. Coin Market Cap, Smith + Crown, e-Estonia)
- VET providers, career-related stakeholders and other educational and training entities
- Trainers on ICT and business related issues
- Social partners and sector representatives (e.g. professional associations)
- Representatives from VET national and EU authorities
- ICT professionals employed in companies building and offering blockchain-related products and services
- ICT freelancers (e.g. programmers, architects), entrepreneurs
- Academics, researchers and consultants

The respondents placed field knowledge for working on blockchain applications and related services in this order:

- Security in blockchain environments (14.65 %),
- Principles and paradigms of distributed systems (14.42 %),
- Fundamentals of cryptography (13.27 %),
- Different types of smart contracts (incl. legal applications) (11.21 %),
- Blockchain consensus protocols (10.76 %),
- Coding languages used in blockchain platforms (10.30 %),
- Privacy in blockchain environments (9.84 %),
- Blockchain economic models (6.86 %),
- Blockchain use cases in financial services (3.43 %),
- Blockchain use cases in public services (3.43 %),
- Blockchain use cases in banking services (1.83 %).

Another question of the survey was about the most important skills to work as ICT blockchain professional. The respondents - see Fig. 2 - placed the proposed skills in this order:

- Evaluate the setting (potentials and limitations) where a blockchain application may be used (18.40 %),
- Develop use cases of blockchain technology to accommodate for distinct business needs (16 %),
- Develop proof of concepts for envisioned blockchain projects (14.67 %),
- Assess and review security risks and threats (11.47 %),
- Lead organizational changes to support the deployment of blockchain applications (9.33 %),
- Communicate the merits of distributed systems to potential client (8.80%),

- Develop smart contracts using Ethereum platform (8.53 %),
- Communicate on blockchain economic model (6.67 %),
- Make recommendation to improve security (6.13 %).

2.2 Definition of BLISS learning outcomes

At the end of the analysis phase we defined 13 learning outcomes for the BLISS curricula, which consider the results of the analysis of the responses to the questionnaire and the results of the training needs analysis, as well as the recommendations from the e-CF and the 2017 CEDEFOP handbook *Defining, writing and applying learning outcomes*.

Table 1 - The Learning Outcomes defined in the BLISS Project.

LO#	Learning outcome description
LO 1	Give an account of the advantages and disadvantages of the features of a specific blockchain application, namely in terms of security, decentralization and consensus attainment
LO 2	Autonomously explain the operation of a smart contract in a given blockchain scenario
LO 3	Evaluate the feasibility of implementing the specified decentralized blockchain application within a suitable blockchain platforms
LO 4	Plan and design the specifications of a decentralized blockchain application for a given scenario
LO 5	Interpret the legal, regulatory and consumer challenges to wider blockchain adoption and conformance
LO 6	Monitor the intervention of blockchain technology in business models
LO 7	Analyse blockchain SWOT (Strengths, Weaknesses, Opportunities, Threats) for specific industry scenarios
LO 8	Intelligibly present Blockchain industry business models
LO 9	Communicate business opportunities behind the limits of the blockchain
LO 10	Critically evaluate the technical options for blockchain solution suitable to varied practical scenarios
LO 11	Report on the feasibility of selected blockchain solution to the specific scenarios
LO 12	Account for optimization of application development, maintenance and performance by employing design patterns and by reusing proved solutions
LO 13	Autonomously report on the advancement of the application development



3. The BLISS OERs and VOOC

The BLISS consortium has produced Open Educational Resources that have been used to produce aVOOC (Vocational Open Online Course). It has been piloted during the project time.

The VOOC is freely available in:

- Bulgarian, <https://www.openlearning.com/courses/bliss-vooc-bg-version-/>
- Dutch, <https://www.openlearning.com/courses/bliss-vooc-nl-version-/>
- English, <https://www.openlearning.com/courses/bliss-mooc/>
- Estonian, <https://www.openlearning.com/courses/bliss-vooc-ee-version-/>
- French, <https://www.openlearning.com/courses/bliss-vooc-fr-version-/>
- Greek, <https://www.openlearning.com/courses/bliss-vooc-gr-version-/>
- Italian, <https://www.openlearning.com/courses/bliss-vooc-it-version-/>

BLISS - Blockchain Skills for ICT Professionals



Fig 1 - The BLISS VOOC homepage.

The course can be followed by individual users but is designed in particular to be used by a teacher with their students.

The course includes a commitment of 10-15 hours per week for 6 weeks.

It consists of four learning units. The units have:

- An introduction (videolesson)
- Chapters (slides, texts, videos)
- Case studies

- Theory questions (with answers)
- Practical exercises and/or Work assignments (if a class follows the course the teacher can correct the exercises)
- A questionnaire (automatic correction)

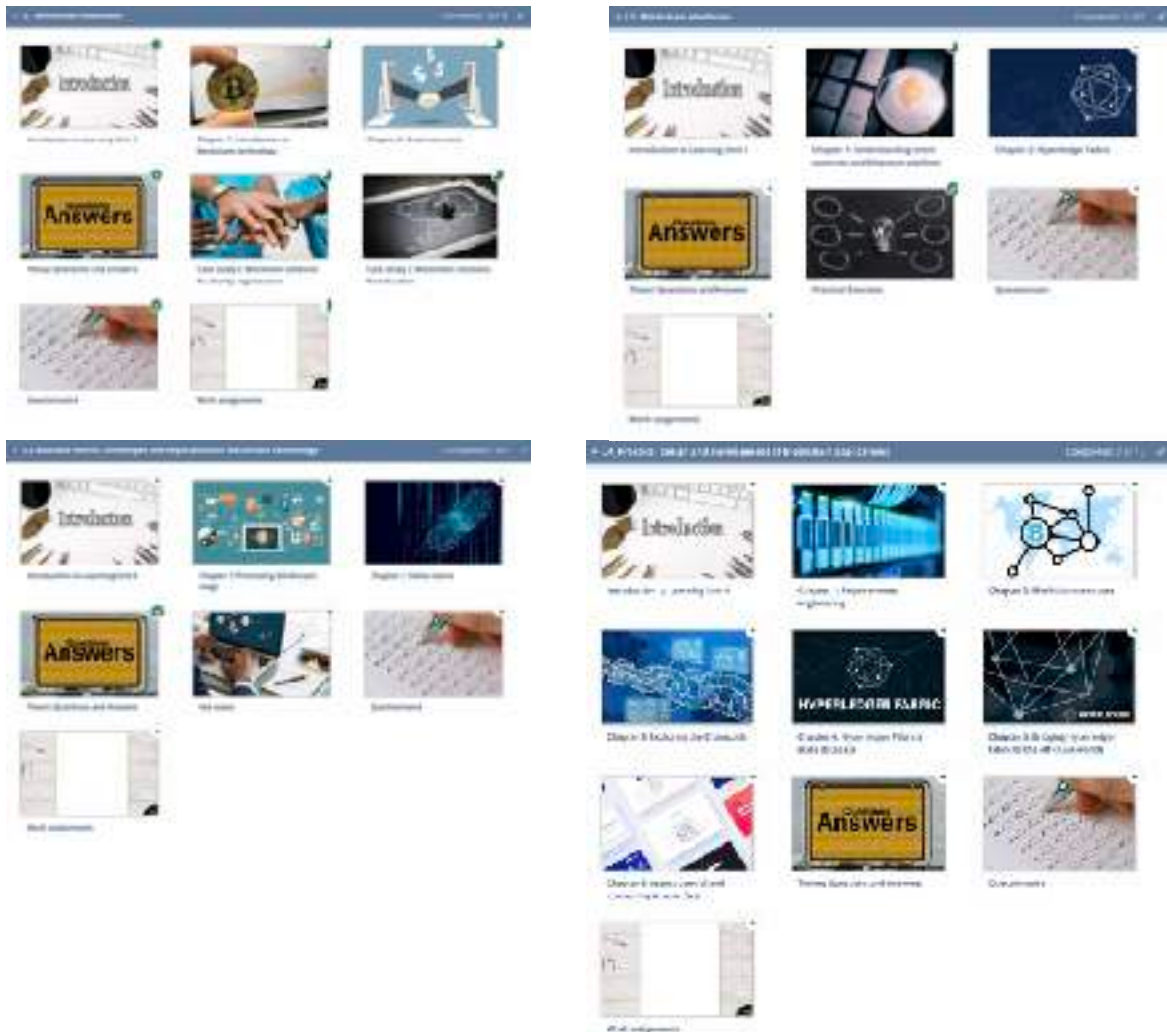


Fig. 2 - The four learning units.

The four learning units - see Fig. 4 - are:

- Blockchain essentials.
- Blockchain platforms.
- Business merits, challenges and implications of blockchain technology.
- Practical design and development of blockchain applications.

4. e-CF and Blockchain

4.1 The e-Competence framework

The European e-Competence Framework (e-CF) - <https://www.ecompetences.eu/it/> - is a reference framework of ICT competences that can be used and understood by ICT user and supply companies, ICT practitioners, managers and HR departments, the public sector, educational and social partners across Europe. The last version, 4.0, has been released in 2020.

"The European e-Competence Framework provides a basic, clear and sound orientation for all type of organisations in the public and private sector who need to communicate and take decisions about recruitment, career paths, training, curricula, assessment, etc. It is also very useful for designing and promoting learning programs and clearer responses to competence needs from ICT organisations, professions and professional perspective".

(From www.ecompetences.eu)

Starting from 2016 e-CF is a European norm: EN 16234:2016. Ora: **EN16234-1:2019 "e-Competence Framework (e-CF)"**.

The e-CF is organized in 4 dimensions:

- **Dimension 1:** 5 competence areas derived by business processes: **Plan, Build, Run, Enable** and **Manage**.
- **Dimension 2:** the **41 e-competences** grouped in the five areas (41 are the e-competences defined in e-CF 4.0; they were 40 in e-CF 3.0, 36 in e-CF 2-0 and 32 in e-CF 1.0).
- **Dimension 3:** Proficiency levels of each e-Competence; the 5 levels - e-1 to e-5 - are related to EQF levels 3-8 as in the following table.

Table 2 - The e-CF and EQF levels.

e-CF level	EQF related level
e-5	8
e-4	7
e-3	6
e-2	4 & 5

e-1	3
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- **Dimension 4:** Samples of knowledge and skills relate to e-Competences in dimension 2. They are provided to add value and context and are not intended to be exhaustive.

Table 3 shows the dimensions 1, 2 and 3, from “e-Competence framework 4.0”³. The e-Competences (dimension 2) are listed in the second columns and grouped in 5 areas (dimension 1, column 1).

Table 3 - The e-CF scheme, dimensions 1, 2 and 3.

Dimension 1 (e-CP areas)	Dimension 2 (e-Competence identifier)	Dimension 3 (e-Competence proficiency levels)				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. Information systems and Business Strategy Alignment					
	A.2. Service Level Management					
	A.3. Business Plan Development					
	A.4. Product/Service Planning					
	A.5. Architecture Design					
	A.6. Application Design					
	A.7. Technology Trend Monitoring					
	A.8. Sustainability Management					
	A.9. Innovating					
	A.10. User Experience					
B. BUILD	B.1. Application Development					
	B.2. Component Integration					
	B.3. Testing					
	B.4. Solution Deployment					
	B.5. Documentation Production					
C. RUN	B.6. ICT systems Engineering					
	C.1. User Support					
	C.2. Change Support					
	C.3. Service Delivery					
	C.4. Problem Management					
D. ENABLE	C.5. Systems Management					
	D.1. Information Security Strategy Development					
	D.2. ICT Quality Strategy Development					
	D.3. Education and Training Provision					
	D.4. Purchasing					
	D.5. Sales Development					
	D.6. Digital Marketing					
	D.7. Data Science and Analytics					
	D.8. Contract Management					
	D.9. Personnel Development					
	D.10. Information and Knowledge Management					
D.11. Needs identification						
E. MANAGE	E.1. Forecast Development					
	E.2. Project and Portfolio Management					
	E.3. Risk Management					
	E.4. Relationship Management					
	E.5. Process Improvement					
	E.6. ICT Quality Management					
	E.7. Business Change Management					
	E.8. Information Security Management					
	F.9. Information Systems Governance					

³ <https://www.ecompetences.eu/it/e-cf-overview/>

The five columns of dimension 3 indicate the levels of competence concerned for each e-competence.

For example: competence *B1. Application development* belongs to the Build area and can be at three different levels: e-1, e-2 and e-3.

4.2 e-CF and blockchain

Blockchain technology allows to redesign processes in many fields.

Changes - made possible by the blockchain, or Distributed Ledger Technologies - are not limited to technology, but must include operational, strategic, business and governance components. This is why knowledge and skills related to blockchain impact many different e-competences.

In Fig. 4 we have highlighted the principal e-Competence that should require knowledge and skills related to blockchain.

A. PLAN	→ A.1. Information Systems and Business Strategy Alignment	D. ENABLE	D.1. Information Security Strategy Development
	A.2. Service Level Management		→ D.2. ICT Quality Strategy Development
	→ A.3. Business Plan Development		→ D.3. Education and Training Provision
	A.4. Product/Service Planning		D.4. Purchasing
	→ A.5. Architecture Design		D.5. Sales Development
	→ A.6. Application Design		D.6. Digital Marketing
	→ A.7. Technology Trend Monitoring		D.7. Data Science and Analytics
	A.8. Sustainability Management		D.8. Contract Management
	A.9. Innovating		D.9. Personnel Development
	A.10. User Experience		D.10. Information and Knowledge Management
B. BUILD	→ B.1. Application Development		D.11. Needs Identification
	B.2. Component Integration	E. MANAGE → E.1. Forecast Development	
	→ B.3. Testing	E.2. Project and Portfolio Management	
	→ B.4. Solution Deployment	E.3. Risk Management	
	B.5. Documentation Production	E.4. Relationship Management	
	B.6. ICT Systems Engineering	E.5. Process Improvement	
C. RUN	C.1. User Support	E.6. ICT Quality Management	
	→ C.2. Change Support	→ E.7. Business Change Management	
	C.3. Service Delivery	E.8. Information Security Management	
	C.4. Problem Management	E.9. Information Systems Governance	
	C.5. Systems Management		

Fig 3. e-Competences that requires knowledge and skills related to blockchain.



4.3 European ICT professionals role profiles

The e-CF, from version 1.0 onwards, has been developed within CEN. In the same context it was also developed the European ICT Professional Role Profile (now version 2 - 2016).

"The European ICT Professional Role Profiles make a key contribution to increasing transparency and convergence of the European ICT Skills landscape. Incorporating the competences of the European e- Competence Framework (e-CF, EN 16234-1) as a main component of profile descriptions, the 30 ICT Professional Role Profiles provide a generic set of typical roles performed by ICT Professionals in any organisation, covering the full ICT business process.

Complementary to the e-CF, the European ICT Professional Role Profiles contribute to a shared European reference language for developing, planning and managing ICT Professional needs in a long-term perspective and to maturing the ICT Profession overall.

The profiles are a flexible tool for ICT professional development and profile construction. They are not intended to represent a rigid standard".

(From CWA 16458-1:2018 European ICT professionals role profiles
Part 1: 30 ICT profiles)

As shown in Fig. 3, the document (CWA 16458-1:2018) identifies, at the first generation level, seven families of IT profession profiles:

- Process improvement,
- Business,
- Technical,
- Design,
- Development
- Service & Operation,
- Support.

At the second level, families generate 30 profiles (generation 2).

With reference to the first and second generation, each organization can define the most useful profiles for its specific context (third generation).

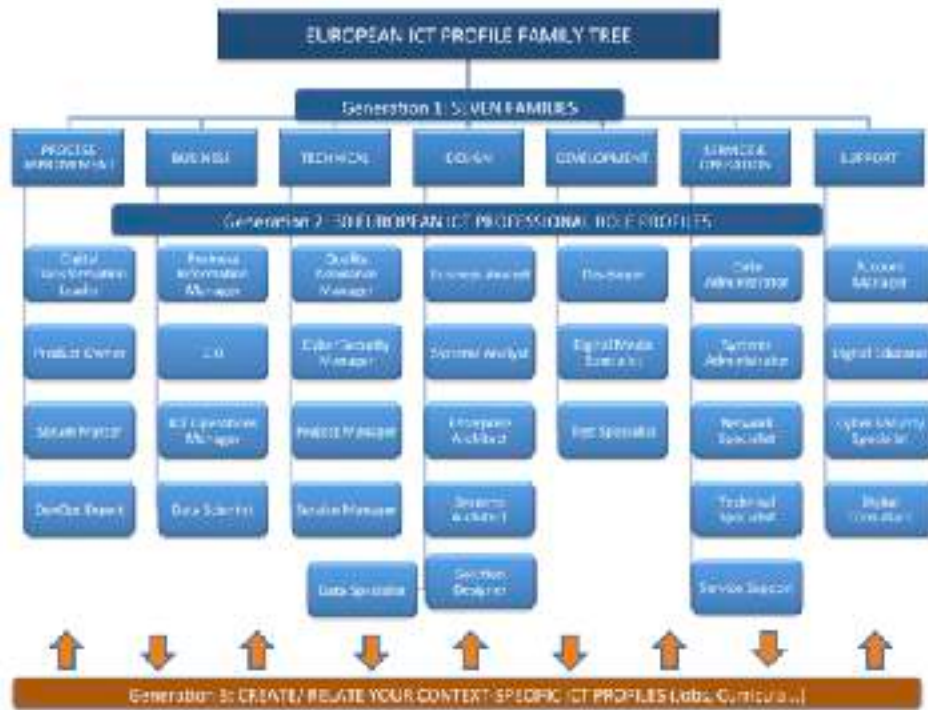


Fig 4. Thirty profiles (generation 2) in seven families (generation 1) at the top of the European ICT Profile Family Tree.

4.8 Blockchain and the ICT professionals role profiles

One of the 30 ICT profiles (second generation) is “Developer”. This is certainly a profile that requires to be articulated in the third generation. If developers, regardless of what they develop, have some common competences, they require different knowledge and skills based on the particular technology they develop for.

In this articulation many companies should define a profile of blockchain developer.

But many other profiles could be affected by blockchain. Fig. 5 shows the principal ones.



Fig 5. Job profiles profiles affected by blockchain.

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