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BLISS project

Université Claude Bernard Lyon 1

BLISS

Definition of BLISS learning outcomes based on training needs analysis (O1-T3-d)

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3 Acronyms and abbreviations

AUF	Francophone University Association
BASSCOM	Bulgarian Association of Software Companies
BECI	Brussels Enterprise Commerce and Industry
BLISS	Blockchain skills for ICT professionals
BT	Business Training
CEPIS	Council of European Professional Informatics Societies
C-VET	Continuous Vocational Education and Training
CEDEFOP	European Centre for the Development of Vocational Training
ECVET	European Credit system for Vocational Education and Training
EDCAB	European Digital Currency & Blockchain Technology Forum
EQF	European Qualification Framework
EU	European Union
EUA	European Universities Association
EUA	Utrecht Network, European University Association
EuroCIO	European CIO Association
FEBELFIN	Belgian Financial Sector Federation
FEDERGON	House of Training, Federation of HR Service Providers
GSRT	General Secreteriat for Research and Technology
IAU	International Universities Association
ICT	Information and Communications Technology
IEEE	Institute of Electrical and Electronics Engineers
IFIP	International Federation for Information Processing
IT STAR	Regional ICT Association in Central, Eastern & Southern Europe
I-VET	Initial Vocational Education and Training
KPI	Key Performance Indicator

LERU	League of European Research Universities
M.Sc.	Master of Science
MOOC	Massive Open Online Course
NIST	National Institute of Standards and Technology (USA)
OER	Open Educational Resources
POC	Proof of Concept
POV	Proof of Value
UCBL	Claude Bernard University Lyon 1
UT	University of Tartu
VET	Vocational Education and Training

4 Introduction

The dynamic penetration of blockchain technology across the major sectors of the EU economy has created the need for up-skilling ICT professionals so that they are able to understand and work on blockchain applications.

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 first intellectual output of the project comprises tasks that work towards defining the specifications (i.e. learning outcomes) for the BLISS course curriculum. The current report is the outcome of the intellectual output O1-T3, which is based on the results of two other previous deliverables, also part of the O1-T3, which are the following documents (available in appendix):

- BLISS_O1_T3a_Online_Questionnaire_Data_Analysis_2019-01-08-V2-FINAL
  BLISS_O1_T3-a2_Analysis of evidence gathered in O1-T2 (desk research)_2018-04-29

The first document provides the analysis of the results of the online questionnaires (field research), while the second document provides the analysis of the results of the skill mismatches (desk research) between blockchain skill demand (i.e. through the analysis of job vacancies descriptions) and blockchain skill supply (i.e. by analysing existing training programs).

In the next section, we summarise the most important findings of each analysis presented in the two abovementioned deliverables. Then, section 4

provides the definitions of the learning outcomes of the project BLISS VET program on blockchain technology in the form of statements of what ICT professionals should know, understand and be able to do upon the completion of the BLISS course. The definitions of the learning outcomes rely on the European reference frameworks and standards (EQF and ECVET) to develop the learning outcomes in terms of definitions of knowledge, skills and competences.

Finally, section 5 presents guidelines on how to prepare learning units corresponding to the BLISS learning outcomes.

5 Synthesis of findings regarding the data analysis on the online questionnaire responses and the data analysis of the skill mismatches

In this section, we bring out the main findings of the analysis on the online questionnaire responses (field research), which is detailed in the report entitled *BLISS O1-T3a: Online Questionnaire Data Analysis-2019-01-08-V2-FINAL* [1], as well as the analysis of the results of the skill mismatches (desk research) between blockchain skill demand and blockchain skill supply, which is detailed in the report entitled *BLISS O1-T3-a2: Analysis of evidence gathered in O1-T2 (desk research)-2018-04-29* [2].

According to the respondents of the questionnaire, the five most needed field knowledge for working on blockchain applications and related services are, in decreasing order (Figure 1):

- *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 %).

Not far behind one finds *Coding languages used in blockchain platforms* (10.30 %). With less than 10% of the answers there are *Privacy in blockchain environments* (9.84 %), *Blockchain economic models* (6.86 %), and in equal position *Blockchain use cases in financial services* (3.43 %) and *Blockchain use cases in public services* (3.43 %). Finally, with the least number of answers, we find *Blockchain use cases in banking services* (1.83 %).

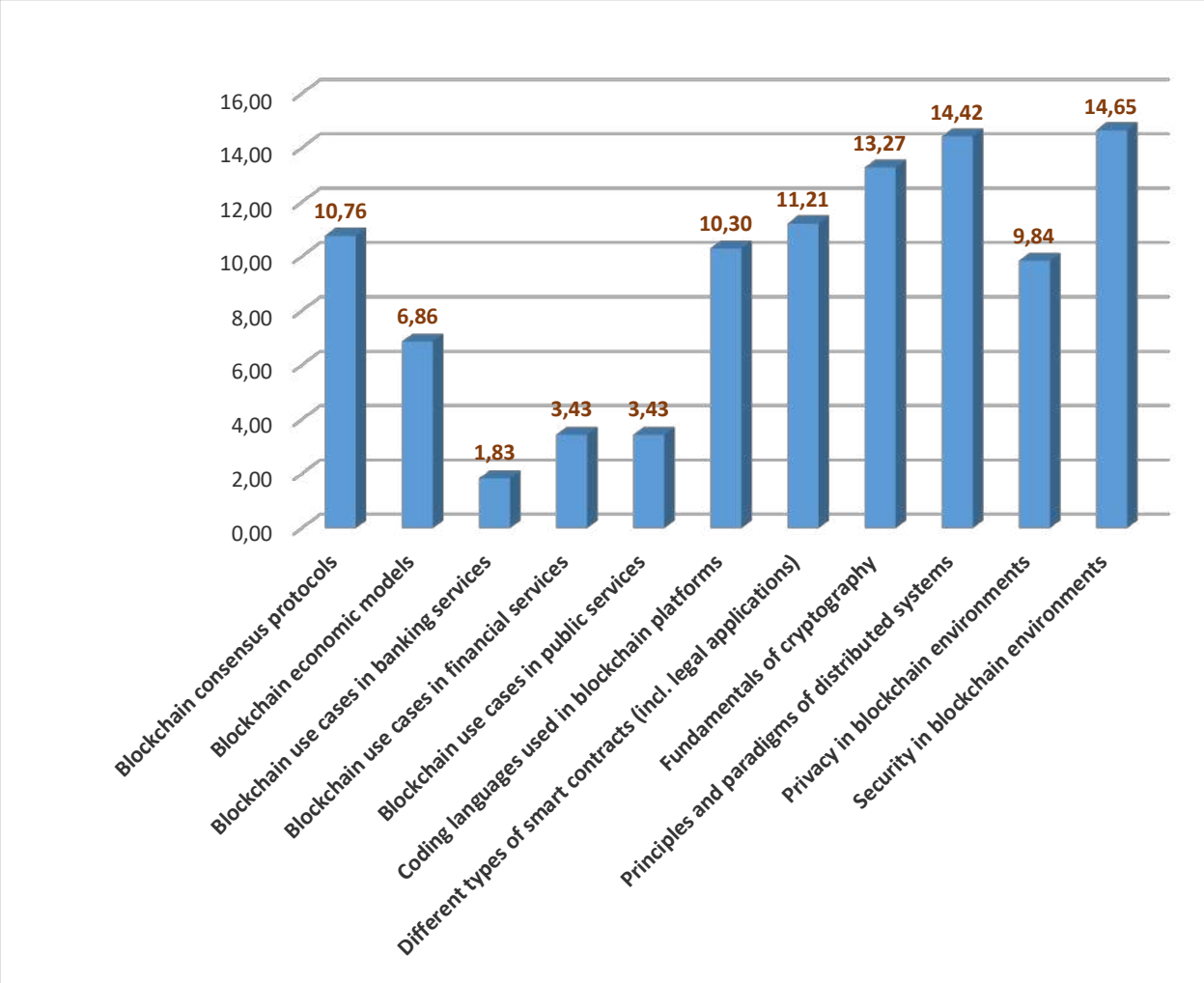

Figure 1. Total of the answers regarding the field knowledge needed for working on blockchain applications and related services (in %).

Regarding the four most important skills to work as ICT blockchain professional, the respondents valued the most, in decreasing 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 %).

The other skills obtained less than 10 % of the answers, with the first of them being *Lead organisational changes to support the deployment of blockchain applications*, which obtained 9.33 % of the answers.

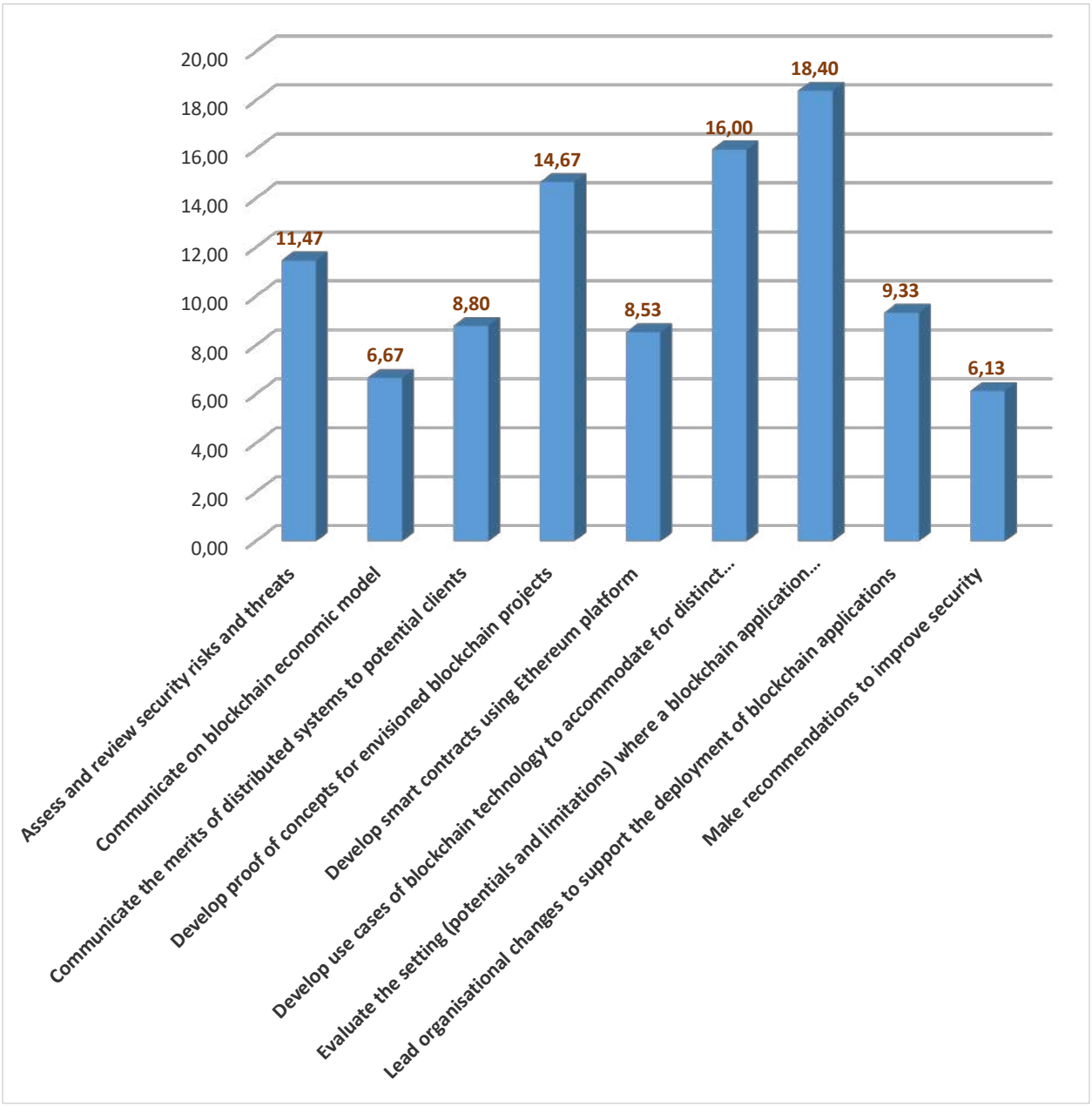

Figure 2. Total of the answers regarding the most important skills to work as ICT blockchain professional (in %).

As we highlighted in the report *BLISS_O1_T3-a2_Analysis of evidence gathered in O1-T2 (desk research)_2018-04-29*, the majority of the existing

training programs approach blockchain from an introductory level, focusing mainly on essential concepts (such as blockchain terminologies, distributed ledger, block structure, mining of cryptocurrencies) and addressing primarily cryptocurrencies use cases, such as Initial Coin Offering and their usage, resulting in individuals acquiring a very limited subset of blockchain-related skills.

On the other hand, the majority of the existing training programs are paid, preventing to effectively verify the content of the training programs. Hence, the analysis of the training programs was done based on the publicly available plan of the courses.

Regarding the skill mismatches (Figure 3), the biggest ones concern the *soft and communication skills*, with a balance value of -118,10, the *development and design of specific solutions using blockchain technology*, with a balance value of -52,78, and the *development and implementation of a blockchain-based Proof of Concepts* (POC), with a balance value of -27,10. These findings indicate, on one hand, there is a significant shortage of intangible skills, which are required to communicating the challenges, opportunities and the business models of blockchain technology to customers and within own organisation. On the other hand, designing, development and delivery of blockchain technology solutions, POC and use cases will also have to be considered more in depth in terms of learning objectives that the BLISS project curriculum will need to accomplish.

Other blockchain skill demands, such as *Blockchain platforms, programs and protocols*, in particular Ethereum blockchain development, *Operating blockchain systems* and *Distributed ledger technologies* received the following positive balance values +1,27, +32,34 and +33,06 respectively. Though these skills present better coverage by existing blockchain training than the

abovementioned ones, it seems important to consider them in the BLISS project curriculum, as currently the demand for these blockchain skills outpaces workforce skill supply.

On the other side, a major part of the group of *Blockchain essentials for ICT professionals* (*Introduction to Blockchain Technology and theory*, *Understanding of Ethereum and the inner workings of the EVM, Security infrastructure and protocols, Cryptography engineering information security*), part of the group of *Blockchain platforms, programs and protocols* (in particular, *Basic theoretical knowledge on Ethereum blockchain Technology* and *Hyperledger Fabric*) and the group of *Practical applications of blockchain, namely in finance, accounting and public services*, display the highest degrees of coverage ranging from +87,86 to +51,11. Even so, these skills should be covered by the BLISS course curricula, albeit to a less extent.

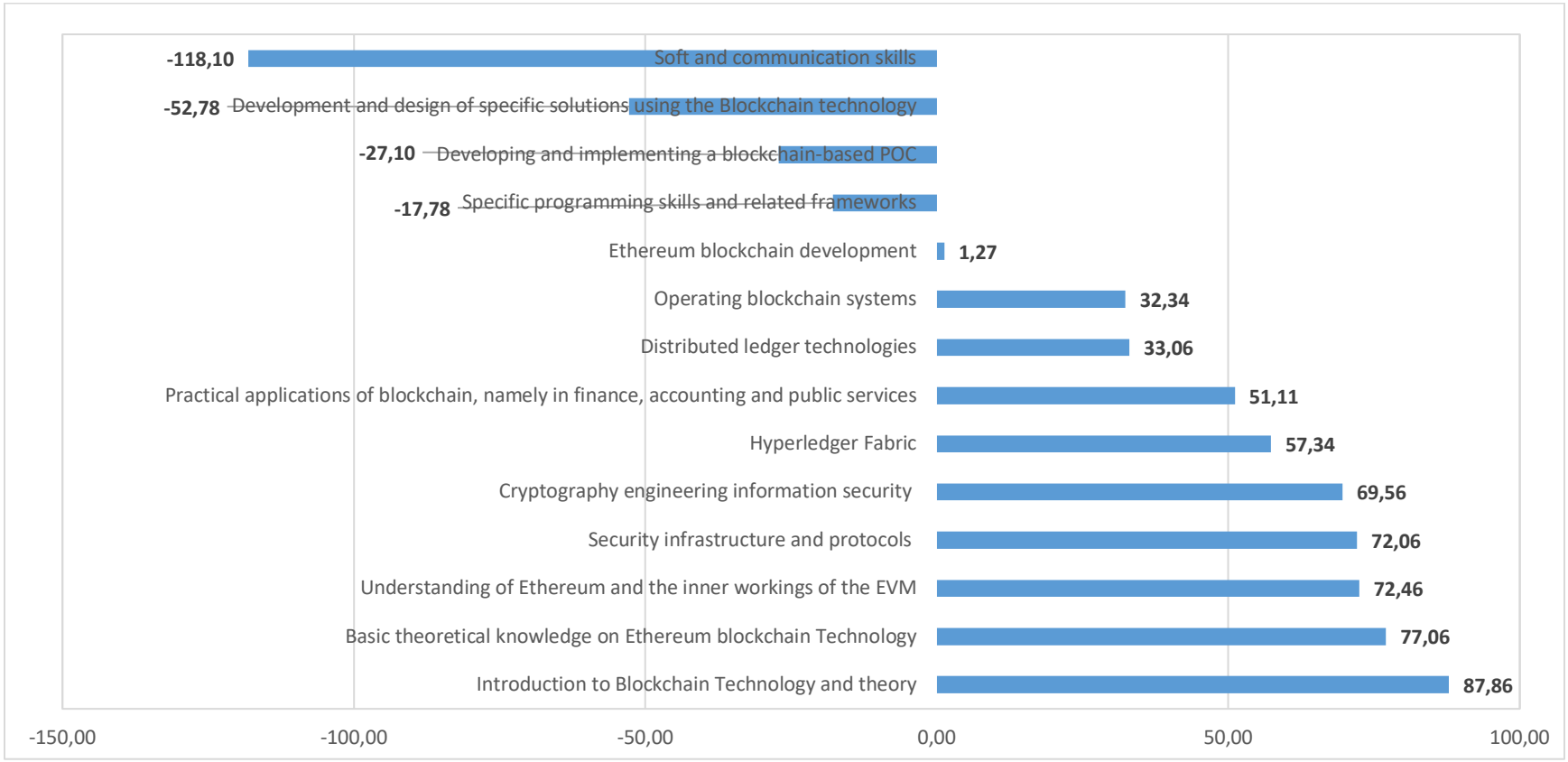

Figure 3: Balance values per skill requirement from the most negative to the most positive.

6 Definition of learning outcomes

Aligned with the provisions of the project Application Form and the O1-T1 deliverable, the definition of the BLISS learning outcomes is based on the European Qualification Framework (EQF) [3], as the latter acts as a translation device to make national qualifications more readable and comparable across Europe, aiming to promote workers' and learners' mobility between countries and facilitate their lifelong learning. The EQF relates different countries' national qualifications systems and frameworks together around a common European reference – its eight reference levels based on **"learning outcomes"** (defined in terms of knowledge, skills and competences). Learning outcomes do not describe the learning target or the learning path, but the result following the completion of a learning process.

According to the 2017 CEDEFOP handbook *Defining, writing and applying learning outcomes* [3], learning outcomes are "statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competences". We recall their definition, as mentioned in the O1-T1 deliverable:

- **Knowledge**: The outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices related to a field of work or study. According to the EQF, knowledge is described as theoretical and/or factual.
- **Skill**: The ability to apply knowledge and use know-how to complete tasks and solve problems. According to the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical skills (involving manual dexterity and the use of methods, material tools and instruments).

- **Competence:** The proven ability to use knowledge, skills and attitudes, in work in study situations and in professional and personal development. According to the EQF, competence is described in terms of responsibility and autonomy.

While learning outcomes promote overall transparency and help to clarify the intentions of learning processes, the CEDEFOP handbook [4] also points out some criticism to the learning outcomes approach. Among other imperfections, "it can be argued that learning outcomes can inhibit the learning process, for example when indicating (too) restricted a threshold level. Too much specificity and detail, it is argued, also makes it difficult to give room for innovation and exploit the unexpected present in any situation" ([4], page 39). Indeed, the learning outcomes approach is seen, by some constructivist schools of thought, as 'policy hype' and as a threat to high quality education, training and innovation. To try to improve these flaws, (Biggs, 1999; Biggs and Tang, 2007, [4] page 40) stress the importance of aligning learning outcomes statements to teaching and learning practices as well as to assessment tasks. Aligning learning outcomes to teaching and learning is about connecting the abstract idea of a learning outcome to what teachers actually do to help students learn, and the things that students do to learn.

In fact, learning-outcomes-based approaches have different origins and have been promoted by different schools of thought. While the behaviouristic tradition emphasises learning outcomes as result-oriented, full-ended, clearly observable and (objectively) measurable, the constructivist approach will emphasise the need for learning outcomes to be process-oriented and open-ended, limiting quantified measurability.

The CEDEFOP handbook [4] also emphasises *the writing and articulation of learning outcomes must be followed by implementation, through teaching, learning and assessment*. Learning outcomes statements form an important part of curricula. They guide teachers in the teaching process, for example supporting the choice of methods, and they inform learners about what they are expected to know/do and understand after a given learning activity.

The definitions and descriptions of learning outcomes as used in curricula are statements and expressions of intentions. They are not outcomes of learning, but desired targets. Achieved learning outcomes can only be identified following the learning process, through assessments and demonstration of achieved learning in real life, for example as the result of following the training.

The European e-Competence Framework (e-CF) [5] - version 3.0 claims to be the first sector-specific implementation of the EQF, arguing to provide a reference of 40 competences as required and applied at the Information and Communication Technology (ICT) workplace, using a common language for competences, skills and capability levels that can be understood across Europe. The e-CF is used as guidance in the formulation of the BLISS learning outcomes as presented in the next section.

6.1 Formulation of the BLISS learning outcomes

It is worth to emphasise, in line with the provisions of the project Application Form and the O1-T1 deliverable [6], the project BLISS aims to strengthen the key competences of ICT professionals (namely initiative, entrepreneurship and communication skills), rather than focus on the technical and coding skills associated with blockchain technology, which risk being outdated by the time

the project will make available its results to its target groups. To this end, we propose 13 learning outcomes for the BLISS curricula, which consider the results of the analysis of the responses to the questionnaire [1] and the results of the training needs analysis [2], as well as the recommendations from the e-CF [5] and the 2017 CEDEFOP handbook *Defining, writing and applying learning outcomes* [4]. The learning outcomes are described in Table 1.

Table 1. Evidence-based Learning outcomes.

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 de advancement of the application development

The learning outcomes are specified hereafter, in Table 2 to Table 14, in terms of *Knowledge* and *Skills* according to the EQF. These correspond to statements of what ICT professionals should know, understand and be able to do upon the completion of the BLISS course. Regarding *Competences*, we consider the recommendations of the e-CF, which is regarded as an ICT sector-specific implementation of the EQF. We also specify an *Abstract* for each learning outcome, which is inspired by the structure of the e-CF *Aims*.

Table 2. Specification of the BLISS learning outcome 1.

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**		
Abstract	Defines the essential blockchain characteristics. Addresses the fundamental features of blockchain applications		
e-CF Competence(s)	B1. Application Development (to verify)	e-CF/EQF levels	e-CF 2 / EQF 4
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Introduction - Blockchain terminologies - Distinction between databases and blockchain ledgers *Cryptographic component* - Cryptography, hash functions and digital signatures *Consensus components* - Principles and paradigms of distributed systems - Blockchain consensus algorithms *Blockchain structures* - Blockchain structure - Types of blockchain		- Identify blockchain characteristics in a given setting - Analyse existing blockchain applications according to a given context - Critically evaluate cryptography features to a blockchain application - Identify crucial security attributes in a blockchain - Differentiate decentralized autonomous systems, such as distributed ledgers suitable to a given blockchain application	

Table 3. Specification of the BLISS learning outcome 2.

LO 2	**Autonomously explain the operation of a smart contract in a given blockchain scenario**		
Abstract	Defines the essential blockchain characteristics. Addresses the fundamental features of blockchain applications		
e-CF Competence(s)	B1. Application Development (to verify)	e-CF/EQF levels	e-CF 2 / EQF 4
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Smart contract theory - Smart Contract Theory and architecture - Architectures and decentralized autonomous systems *Smart contract application* - Existing blockchain applications, related structures and architectures		- Select consensus algorithms suitable for specific blockchain applications - Formalise and assess smart contracts adequate to given blockchain contexts	

Table 4. Specification of the BLISS learning outcome 3.

LO 3	**Evaluate the feasibility of implementing the specified decentralized blockchain application within a suitable blockchain platforms**		
Abstract	Selects appropriate technical options for blockchain design and implementation. Specifies, refines, updates and makes available a formal approach to design solutions, necessary to develop and operate a blockchain application		
e-CF Competence(s)	B1. Application Development and A6. Application Design (to verify)	e-CF/EQF levels	e-CF 2 / EQF 4
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Platform foundations - Characteristics of blockchain platforms (permissioned, public, etc.) - Blockchains programming paradigm - Architectural aspects, accessibility, and visibility		- Identify the differentiating characteristics of the various blockchain platforms - Analyse and characterise different blockchain protocols according to given criteria - Select and formalise requirements of a blockchain protocol for specific scenarios	

Table 5. Specification of the BLISS learning outcome 4.

LO 4	**Plan and design the specifications of a decentralized blockchain application**		
Abstract	Selects appropriate technical options for blockchain design and implementation. Specifies, refines, updates and makes available a formal approach to design solutions, necessary to develop and operate a blockchain application		
e-CF Competence(s)	B1. Application Development and A6. Application Design (to verify)	e-CF/EQF levels	e-CF 2 / EQF 4-5
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Ethereum platform - Ethereum blockchain setup - Smart Contract cycle - Use Case implementation *Hyperledger platform* - Hyperledger blockchain setup - Smart Contract cycle - Use Case implementation		- Plan and design the specifications of a decentralized blockchain application for a given scenario	

Table 6. Specification of the BLISS learning outcome 5.

LO 5	**Interpret the legal, regulatory and consumer challenges to wider blockchain adoption and conformance**		
Abstract	Introduces how the characteristics of blockchain technology can disrupt and/or innovate existing business models and business processes. Examines existing blockchain-based use cases in industries such as finance, public services, provenance, supply chains etc.		
e-CF Competence(s)	E.7 Business Change Management	e-CF/EQF levels	e-CF 3 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Policy and regulation - Blockchain and Public Policy, Central Banks & governmental regulations - Implications of blockchains for governments, policy makers, law professionals, regulators and society		- Recognise potential regulatory and legal frameworks for blockchain operation, including consumer protection, and taxation	

Table 7. Specification of the BLISS learning outcome 6.

LO 6	**Monitor the intervention of blockchain technology in business models**		
Abstract	Introduces how the characteristics of blockchain technology can disrupt and/or innovate existing business models and business processes. Examines existing blockchain-based use cases in industries such as finance, public services, provenance, supply chains etc.		
e-CF Competence(s)	E.7 Business Change Management	e-CF/EQF levels	e-CF 3 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Blockchain as innovator of businesses and processes - Blockchain business models - Blockchain emerging trends susceptible to create value for the business - Innovative blockchain solutions and entrepreneurship - Blockchain transforming business and professionalism		- Provide detailed examples of the blockchain transforming power in specific contexts	

Table 8. Specification of the BLISS learning outcome 7.

LO 7	**Analyse blockchain SWOT (Strengths, Weaknesses, Opportunities, Threats) for specific industry scenarios**		
Abstract	Introduces how the characteristics of blockchain technology can disrupt and/or innovate existing business models and business processes. Examines existing blockchain-based use cases in industries such as finance, public services, provenance, supply chains etc.		
e-CF Competence(s)	E.7 Business Change Management	e-CF/EQF levels	e-CF 3 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Blockchain maturity and strategies - Blockchain adoption metrics, challenges and opportunities - Blockchain business strategies		- Project strengths and weaknesses of the Blockchain technology in a given scenario	

Table 9. Specification of the BLISS learning outcome 8.

LO 8	**Intelligibly present Blockchain industry business models**		
Abstract	Introduces how the characteristics of blockchain technology can disrupt and/or innovate existing business models and business processes. Examines existing blockchain-based use cases in industries such as finance, public services, provenance, supply chains etc.		
e-CF Competence(s)	E.7 Business Change Management	e-CF/EQF levels	e-CF 3 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Blockchain as business model disruption - Implications of blockchains for corporates, such as disruption by open markets, winner-takes-all, multi-sided market platforms, the role of trust in blockchain markets - How blockchain technology is disrupting existing business models and creating new ones		- Describe blockchain business processes and business logics	

Table 10. Specification of the BLISS learning outcome 9.

LO 9	**Communicate business opportunities behind the limits of the blockchain**		
Abstract	Introduces how the characteristics of blockchain technology can disrupt and/or innovate existing business models and business processes. Examines existing blockchain-based use cases in industries such as finance, public services, provenance, supply chains etc.		
e-CF Competence(s)	E.7 Business Change Management	e-CF/EQF levels	e-CF 3 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Existing applications - Main disruptive features of different practical blockchain application scenarios, such as in finance, accounting, business operations, public administration and government services		- Outline latest trends in the blockchain technology, and the directions of growth across impacted industries	

Table 11. Specification of the BLISS learning outcome 10.

LO 10	**Critically evaluate the technical options for blockchain solution suitable to varied practical scenarios**		
Abstract	Introduces process- and state-based modelling languages suitable for requirement analysis and design of blockchain applications		
e-CF Competence(s)	A6. Application Design B1. Application Development (to verify)	e-CF / EQF levels	e-CF 2 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Requirement Engineering for Blockchain Applications - Requirements modelling and need analysis techniques regarding the specific blockchain application scenarios - Modelling languages *Analysis and Design (process based approach, state based approach)* - Process based approach - State based approach		- Examine the key characteristics, potential benefits and challenges of blockchain in different types of scenarios, such as the banking and finance sector (i.e. global payments, trade finance), business operations (for instance supply chain management, traceability and internet of things for industry, logistics, insurance, digital claims management, healthcare, real state, energy), public administration and government services, like e-voting, record management, identity management, taxes, regulation compliance, authors' copyright management	

Table 12. Specification of the BLISS learning outcome 11.

LO 11	**Report on the feasibility of selected blockchain solution to the specific scenarios**		
Abstract	Identify a use case, selection of suitable platform, design a solution that delivers value, and develop a proof of concept in accordance with defined specifications		
e-CF Competence(s)	A6. Application Design B1. Application Development (to verify)	e-CF / EQF levels	e-CF 2 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Matching Use Case with Platform - Appropriate technical options for blockchain solution design adequate to specific practical scenarios		- Collect, formalise and validate functional and non-functional requirements of given scenarios	

Table 13. Specification of the BLISS learning outcome 12.

LO 12	**Account for optimization of application development, maintenance and performance by employing design patterns and by reusing proved solutions**		
Abstract	Identify a use case, selection of suitable platform, design a solution that delivers value, and develop a proof of concept in accordance with defined specifications		
e-CF Competence(s)	A6. Application Design B1. Application Development (to verify)	e-CF / EQF levels	e-CF 2 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Capstone Project - Existing blockchain-based POC (Proof Of Concept) - Metrics, track-recording and monitoring related to application development, debug and testing		- Explain and communicate the design/development of use case/POC, at their different phases, to potential users and stakeholders - Perform tests and evaluate test results against POC specifications	

Table 14. Specification of the BLISS learning outcome 13.

LO 13	**Autonomously report on de advancement of the application development**		
Abstract	Identify a use case, selection of suitable platform, design a solution that delivers value, and develop a proof of concept in accordance with defined specifications		
e-CF Competence(s)	A6. Application Design B1. Application Development (to verify)	e-CF / EQF levels	e-CF 2 / EQF 5-6
Knowledge (Knows / Aware of):		**Skills** (Able to):	
Capstone Project - Appropriate blockchain software programs/modules and their inner workings		- Develop and apply appropriate software architectures	

7 Guidelines on how to prepare corresponding learning units

The BLISS learning outcomes lay the ground for the formulation of BLISS learning units. The learning units should be specified in Intellectual Output 2, according to the project Application Form. As so, this section intends to provide guidelines on how to prepare the BLISS Learning Units. Table 15 presents a template and example of specification of a Learning Unit and guidelines for learning materials. A Learning Unit (LU) should include the following items: a title, the module of which the LU is part of, the list of topics of the LU content, prerequisites, learning materials and assessment material, planned duration of the LU and references.

Training materials will be created and if suitable reused to support learning on the technical components and practical applications, such as lecture notes, slide presentations, case studies, FAQs, and audio-visual aids.

Assessment of learning outcomes means methods and processes used to establish the extent to which a learner has in fact attained particular knowledge and skills. In order to determine whether the learner has acquired the proposed knowledge and skills and to provide learners with the opportunity to evaluate the extent to which they have attained the desirable knowledge and skills, assessment materials for each learning unit will be developed.

Table 15. Template and example of specification of a Learning Unit.

Learning unit title: Smart contracts as a decentralised application
Part of Learning Unit 2 - Blockchain platforms, programs and protocols
Learning unit objectives
- Give a global vision of a smart contract as a decentralised application - Provide knowledge on the different phases of a smart contract design, implementation and deployment

Topics / Content
This learning unit is comprised of the following parts: - Part 1: Basic theoretical knowledge of smart contract blockchain technology, general usage and background - Part 2: Vision and architecture of smart contracts, legal dimensions of smart contracts - Part 3: Writing smart contracts and ERC20 Tokens contract, encoding business logic by smart contracts - Part 4: Smart contract interaction, managing smart contracts - Part 5: Available smart contract development platforms, infrastructures and offers - Part 6: Smart contract implementation and deployment - Part 7: Running the deployed smart contract, interaction with the smart contract - Part 8: Ethereum and the inner workings of the Ethereum Virtual Machine (EVM) - Part 9: Ethereum smart contracts development, Ether & Gas - Part 10: Production pipeline of a decentralised application in Ethereum - Part 11: Setting up a private Ethereum network: mining configuration, data replication - Part 12: Complete practical examples of programming a smart contract with language Solidity, test the smart contract with Truffle, implement the smart contract and interact with the it through a Javascript web interface using Web3
Prerequisites
- Have followed module 1 of the BLISS curricula, if no previous knowledge on the blockchain fundamentals - Knowledge of Javascript programming language and of a Javascript framework such as Angular, React or Vue.js
Learning materials
Presentation slides and lecture notes: 40-60

Exercises: 2-4

FAQs: 10-20

Case studies: 2-3

For this learning unit, situation case studies can be useful. The situation case requires an analysis of the information embodied in the case and asks students to delineate the significant relationships existing among the various items of information. The forum discussion is designed to develop an understanding of why things went wrong and how that could have been avoided.

Assessment material:

Multiple choice questions and quizzes, case studies and application scenarios analysis will comprise the bulk of assessment material.

Multiple choice questions: 20-30

Short response questions: 5-10

case studies and application scenarios analysis: 1-2

All learning materials will be available in English and in the partnership languages (FR, NL, IT, EL, EE, BG).

Planned duration of the learning unit

- Average duration for reading the lecture notes and slide presentations: 4h
- Learner personal work: 10h

References

1. Build Your First Smart Contract, A Tutorial for Beginners, Gerald Nash, 2017, https://medium.com/crypto-currently/build-your-first-smart-contract-fc36a8ff50ca
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