European Software
Skills Alliance.

# A Certification Framework for Software Professionals

MAPPING EXISTING AND NEW CREDENTIALS ON A FRAMEWORK TO INCREASE RECOGNITION

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**ESSA "A Certification Framework for Software Professionals", 2023, Final version.**

Deliverable D.8: "Recognised Certifications"

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# About ESSA

The European Software Skills Alliance (ESSA) is a four-year transnational project funded under the EU's Erasmus+ programme. It ensures the skills needs of the rapidly evolving Software sector can be met — today and tomorrow.

ESSA provides current and future software professionals, learning providers and organisations with software needs with the educational and training instruments they need to meet the demand for software skills in Europe.

ESSA will develop a European Software Skills Strategy and learning programmes for Europe. It will address skill mismatches and shortages by analysing the sector in depth and delivering future-proof curricula and mobility solutions; tailored to the European software sector's reality and needs.

# Project partners

The ESSA consortium is led by DIGITALEUROPE. It is composed of academic and non-academic partners from the education, training, and software sectors.

**View all project partners:** ESSA Partners | ESSA Associated Partners

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# List of abbreviations and acronyms

| Abbreviation | Term |
|---|---|
| **CEN** | Comité Européen de Normalisation |
| **CEN/CWA 16458-1** | CEN Workshop Agreement 16458-1 European ICT Professionals Role Profiles – Part 1: 30 ICT Profiles |
| **e-CF, EN 16234-1** | European e-Competence Framework, European Norm 16234 - Part 1: Framework |
| **ECTS** | European Credit Transfer and Accumulation System |
| **EQF** | European Qualifications Framework |
| **ESSA** | European Software Skills Alliance |
| **EU** | European Union |
| **ICT** | Information and Communication Technology |
| **LO** | Learning Outcome |
| **PLO** | Programme Learning Outcome |
| **WP** | Work Package |
| **WPL** | Work Package Leader |

# 1 Executive Summary

## 1.1 Introduction

This report "A Certification Framework for Software Professionals" is a deliverable related to Work Package 3 of the ESSA project. The certification framework is based on the ESSA educational profiles and presents different implementation approaches. This report is a part of strategic objective 4 "Validate learning processes" of the ESSA Software Skills Strategy.

## 1.2 Objective

The objective of this document is to design a certification framework considering micro-credentials and using European standards like the e-CF, EQF, and ECTS. By discussing implementation aspects and the maintenance of the framework, the objective is also to make it appealing to and easy for all kinds of organisations offering education, training, or certifications to uptake the framework and issue digital badges/certifications based on it.

## 1.3 Approach

This document reflects the process of developing the certification framework including aspects that are important for its implementation. The first step in this process was to establish the starting points including the standards and ESSA educational profiles. The next step was to determine with the partnership, in an iterative process, the structure of the certification scheme. This structure was implemented by inserting all the programme and unit learning outcomes defined in the educational profiles. The draft certification framework was discussed and fine-tuned. Then, an example of one complete role was developed. After this process, a mapping with professional certifications was made and fine-tuned by partners. The last step was to discuss the implementation aspects which was again done by developing a draft by the WPL that was reviewed and fine-tuned by partners.

## 1.4 Results

This certification framework has 4 aggregation levels, namely role level, competence level, unit level and component level. On the highest level, i.e., role level, 9 certifications were defined, corresponding to the 9 educational profiles. The competence level has 47 certifications defined and the unit level includes 190 certifications. These 190 unit-level certifications are the foundational level of the framework. By stacking these unit- and then competence-level certifications, a role-level certification can be achieved. Unit-level certifications can be divided in smaller component-level certifications if the issuer thinks this is effective.

A mapping and matching of professional certifications in the sector to the certifications in this framework resulted in an overview of 103 mapped certifications across 23 issuing organisations.

Looking at the implementation aspects, the results are that, besides describing how the framework could work for students, suppliers of certifications, and educational providers, 5 possible ways of implementation of the framework have been identified.

## 1.5 Conclusions

The certification framework will help the comparability of professional certifications and micro-credentials. It has different possible ways of being implemented.

The different aggregation levels and the possible stacking of credentials address the need for micro-credentialing.

The mapping of professional certifications is an example of how this framework can increase comparability and, together with that, stimulate mobility among software professionals.

## 1.6 Use of this document

This document can be used as the foundation for the implementation of a certification framework. It offers pointers on how to proceed with this important tool and bolsters the sustainability potential of ESSA. In the context of WP4 piloting and WP6 sustainability, the next steps will be taken to ensure the best possible implementation.

# 2 Introduction

Traditionally the ICT sector, and more specifically the software services sector, have a lot of professional certifications compared to others. Professional certifications help people to get recognition for competences they acquired, for example being able to develop an application in a certain programming language or being able to work in line with a project management method. These certifications are mostly pursued in the setting of private education and training providers and the achievement of the learning outcomes is guaranteed by independent assessment providers.

There are also educational programmes that lead to a recognised qualification like a diploma or a degree. These programmes are also offered by private providers, but mainly, by public educational providers. In general, these programmes do not focus on certifications for parts of the programme, but only on the qualification or degree learners receive after successful completion of the complete programme. In the last years the attention for credentialling smaller (parts of the) programmes in the form of micro-credentials has risen.

The ideal situation would be to bring these two worlds together and to deliver a flexible way of certifying and qualifying learners which also supports mobility across Europe. This is the reason behind designing the ESSA Certification framework.

## 2.1 Micro-credentials

Micro-credentials are used in many different ways and a lot of organisations offer them like universities, private learning providers, but also others. The focus in this case is on micro-credentials issued by learning providers including higher education. VET, and private training providers.

Professional certifications in the software services sector could also be viewed as micro-credentials since they offer validation of a part of the learning outcomes that a learner should achieve before being eligible for a complete qualification. Professional certifications are issued by independent assessment providers.

### 2.1.1 Definition of micro-credentials

The term “micro-credentials” is interpreted somewhat differently in different settings. For example, at universities, in some cases, a micro-credential covers 15 ECTS, which is equivalent to 420 hours of learning. On the other end of the spectrum, some training providers consider 2 hours of learning, or even less, worthy of credentialing.

The definition used by the Council of the European Union[1] leaves both options open:

> *"'Micro-credential' means the record of the learning outcomes that a learner has acquired following a small volume of learning."*

It is also stated that:

> *"They may be stand-alone or combined into larger credentials."*

It is also explicitly stated that there is no intention to replace existing qualifications and degrees, but to strengthen opportunities for learning and employability.

The fact that micro-credentials can be stacked into larger credentials and that they would not replace full degree programmes, suggests that micro-credentials can have different sizes. This is supported by the fact that a mandatory element in the description of a micro-credential is to indicate the notional workload needed to achieve the learning outcomes.

### 2.1.2 Principles for the design of micro-credentials

The Council of the European Union (2022)[2] defined 10 European principles for the design of micro-credentials. These principles are:

1. **Quality:** Micro-credentials must be subject to systems of external quality assurance and internal quality assurance. External quality assurance is mainly focused on the assessment of providers (rather than individual courses) and the effectiveness of their internal quality assurance procedures[3]. Internal quality assurance covers the quality of the micro-credential and the course and takes into account learners' and peers' feedback
2. **Transparency:** Micro-credentials can be measured, compared and understood, offering clear information on workload (using the European Credit Transfer and Accumulation System (ECTS)), content, level, and learning offer using relevant guidance systems, registers, and platforms such as Europass.
3. **Relevance:** Micro-credentials should be designed as distinct, targeted learning achievements, relevant to the labour market, designed in a cooperative manner

[1] The Council of the European Union (2022). Council Recommendation on a European approach to micro-credentials for lifelong learning and employability. 2022/C 243/02. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(02)

[2] The Council of the European Union (2022). European principles for the design and issuance of micro-credentials – Annex II to the annex of the Council Recommendation on a European approach to micro-credentials for lifelong learning and employability. 2022/C 243/02. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(02)

[3] Where applicable, external quality assurance should be in line with: (1) Annex IV of the European qualifications framework Recommendation, (2) the Standards and Guidelines for Quality Assurance in the European Higher Education Area, (3) the European quality assurance reference framework in the field of vocational education and training (EQAVET Framework), and (4) other quality assurance instruments, including registries and labels.

with different stakeholders, and the learning opportunities leading to them should be updated as necessary

4. **Valid assessment:** The learning outcomes related to the micro-credentials are assessed against transparent criteria
5. **Learning pathways:** Micro-credentials support flexible learning pathways by applying the design principle of stackability and by the validation of non-formal and informal learning
6. **Recognition:** Micro-credentials must be recognised, where possible, by the competent authorities, for academic, training or employment purposes, using standard recognition procedures
7. **Portability:** The infrastructure used for storing data related to micro-credentials should be based on open standards and data models. They are owned by the credential-holder (the learner) and may be stored and shared easily by the credential holder, including through secure digital wallets, such as Europass
8. **Learner-centred:** Micro-credentials must meet the needs of the target group of learners and involve these learners in internal and external quality assurance processes
9. **Authentic:** Micro-credentials must contain information to check the identity of the credential-holder (learner), the legal identity of the issuer, and the date and location of its issuance
10. **Information and guidance:** The system of micro-credentials must be aimed at reaching the broadest possible learner groups and be incorporated into lifelong learning guidance services

### 2.1.3 Digital badges

Digital badges are a way of issuing micro-credentials. They allow professionals to showcase their achievements and receive recognition for them, as well as to share their success via social networks to show potential employers or other stakeholders their newly acquired skills.

Digital badges contain details about the knowledge that was acquired to gain the badge. The information on each badge includes details about the issuer(s), the validity terms, and what was actually done to gain the badge such as passing a specific exam. Digital badges can be verified easily by potential employers and, unlike traditional paper certificates, they cannot get lost or misplaced.

Digital badges support the concept of micro-credentials as they can be issued following a small volume of (assessed) learning and are stackable. Digital badges increase transparency as it is easy to verify what has been done to gain the badge.

Several countries implemented systems of issuing digital badges to students and learners. For example, in The Netherlands, this system is called “Edubadges”, in Ireland and Australia, similar systems exist. Moreover, some private learning providers and assessment providers already use digital badges.

## 2.2 The starting points

The Council of the European Union Recommendation on micro-credentials refers to a couple of standards[4] that are shared starting points in the ESSA project, namely the EQF[5] and ECTS[6]. Besides those, ESSA follows the European standard for professionals in the ICT sector and the e-Competence Framework (e-CF). It is to be noted too that the European ICT professional role profiles were the starting point for the ESSA educational profiles, which are themselves the starting point for the learning outcomes to be covered in this ESSA micro-credential framework. This section elaborates on the use of these standards in the design process of the framework.

### 2.2.1 EQF and ECTS

The European Qualifications Framework (EQF) [7] and related National Qualifications Frameworks (NQFs) are designed to make qualifications more transparent and comparable across EU countries, fostering the EU mobility of professionals. The EQF has learning outcomes as a starting point and defines eight levels of complexity of learning outcomes. Within the ESSA certification framework, the EQF is explicitly used to indicate different levels of complexity in learning outcomes. The EQF levels are also indicated in the names of the credentials in the framework:

- Foundation: EQF 4/5 level
- Advanced: EQF 6 level
- Expert: EQF 7 level

The European Credit Transfer and Accumulation System (ECTS) also increases transparency and comparability of educational programmes across Europe. It divides a full year of study into 60 ECTS credits, which results in that one ECTS credit represents 25 to 30 hours of learning. In the ESSA certification framework, ECTS is used to indicate the expected, average amount of learning needed to obtain the learning outcomes related to a certain credential.

[4] Council of the European Union (2022). European standard elements to describe a micro-credential - Annex I to the annex of the Council Recommendation on a European approach to micro-credentials for lifelong learning and employability. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(02)
[5] European Commission – Education and Culture (2008). The European Qualifications Framework for Lifelong Learning (EQF). Luxembourg: Office for Official Publications of the European Communities. https://europa.eu/europass/en/europass-tools/european-qualifications-framework
[6] European Commission (2015). ECTS Users' Guide. Luxembourg: Publications Office of the European Union. Available at : https://op.europa.eu/en/publication-detail/-/publication/da7467e6-8450-11e5-b8b7-01aa75ed71a1/language-en/format-PDF/source-search and https://ec.europa.eu/education/tools/ects_en.htm
[7] European Commission – Education and Culture (2008). The European Qualifications Framework for Lifelong Learning (EQF). Luxembourg: Office for Official Publications of the European Communities. https://europa.eu/europass/en/europass-tools/european-qualifications-framework

### 2.2.2 e-CF

The European e-Competence Framework (e-CF) [8] is a European norm presenting 41 competences that are relevant for ICT professionals. It is a common language for the ICT sector in Europe to talk about competences, skills and knowledge.

The e-CF is the main input for the CEN European ICT professional role profiles[9]. The latter presents 30 general ICT roles, and for each role, the needed e-CF competences are defined and elements like the mission, deliverables, and main tasks are described. These roles are described as general roles on a "generation 2" level of granularity, according to CEN's terminology. It means they are one level higher than actual role profiles one can find in job vacancies for instance (i.e., "generation 3"). This 3rd level is not defined in the CEN classification since there are a lot of specific elements to consider, which could lead to hundreds or even thousands of role profiles, sometimes only relevant to one specific situation.

Both the e-CF and the ICT professional role profiles are used as primary references for the designing of the ESSA certification framework. This is most visible in the ESSA educational profiles that are one of the direct inputs for the certification framework.

### 2.2.3 ESSA educational profiles

The ESSA educational profiles are formulated starting from the ICT professional role profiles, but other inputs were also of significant importance, like the Software Skills Strategy and the Needs Analysis. Most important to the certification framework are the ESSA educational profiles[10]. They define programme learning outcomes and unit learning outcomes that are relevant for each profile. These learning outcomes function as direct input for the credentials on most of the aggregation levels of the certification framework.

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[8] CEN - European Committee for Standardization/ TC 428 (2019). European norm EN 16234-1:2019. e-Competence Framework (e-CF) – A common European Framework for ICT Professionals in all sectors - Part 1: Framework. Brussels: CEN-CENELEC. General information about the e-CF, available at ITPE: https://itprofessionalism.org/aboutit-professionalism/competences/the-e-competence-framework/ Formal information, available at CEN & CENELEC: https://standards.cencenelec.eu/dyn/www/f?p=205:110:0::::FSP_PROJECT:67073&cs=15E62ED24D608A5F10D6BEE8E6D50FA10

[9] CEN - European Committee for Standardization (2018). CEN Workshop Agreement - CWA 16458-1:2018 European ICT professionals role profiles - Part 1: 30 ICT profiles. Brussels: CEN-CENELEC, available at: https://itprofessionalism.org/about-it-professionalism/competences/where-to-buy-the-e-cf-standard/

[10] ESSA educational profiles, based on: CEN/TC428 (2022) Guidelines for developing ICT Professional Curricula (TS 17699), available at: https://standards.cencenelec.eu/dyn/www/f?p=CEN:110:0::::FSP_PROJECT,FSP_ORG_ID:72363,1218399&cs=169E9940F2911D404FAE0D4872E5D2630

# 3 The certification framework

This chapter describes the elements that constitute the framework. It presents the framework itself and the mapping and matching of the framework to existing certifications in the software sector.

## 3.1 Elements of the framework

The framework consists of certifications on four aggregation levels which can be stacked to obtain a larger credential.

### 3.1.1 Aggregation levels

The first important defining aspect of the framework is that it consists of 4 different aggregation levels, as follows:

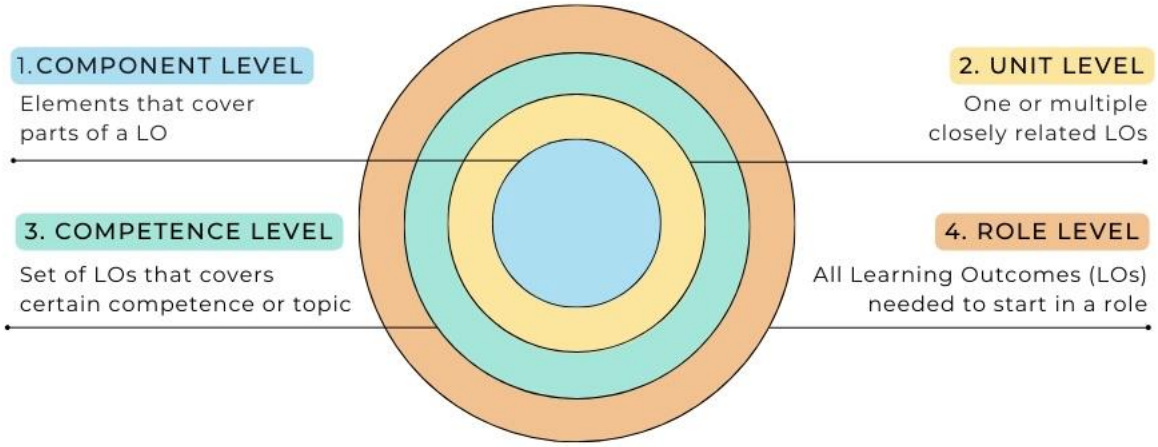


*Figure 1: The aggregation levels of the certification framework*

1. **Component level:** The lowest aggregation level covers parts of a learning outcome. In a formal learning environment these can be seen as, for example, different parts of a course that are being assessed separately. It can also be related to the concept of micro-learning in which learning activities typically take (far) less than an hour to complete. It is possible to award each micro-learning activity with a micro-credential.
2. **Unit level:** This aggregation level covers one or a combination of closely related learning outcomes. In formal learning environments, this is on the level of a traditional course of, for example, 5 ECTS. It is also the level of most vendor-related certifications.
3. **Competence level:** This is the aggregation level that covers a set of learning outcomes covering a certain competence or topic. It is comparable with a programme learning outcome which clusters a set of (unit) learning outcomes that are related to one another.

4. **Role level:** This is the highest aggregation level in which all the learning outcomes needed to start in a role as a software professional are covered. This level is comparable with a qualification or a degree.

#### 3.1.1.1 EQF levels

It is important to highlight that these aggregation levels do not indicate the complexity level of the possible learning experience leading to the certificate. In other words, it does not say anything about the EQF level related to a certain credential. There are credentials of EQF 4 complexity and others of EQF 7 complexity, although both are on the same aggregation level.

### 3.1.2 Stacking

The Council Recommendation on micro-credentials defines "stackability" as[11]:

> *"The possibility, where relevant to combine different micro-credentials and build logically upon each other"*

The Council Recommendation also states that stacking does not necessarily lead to a qualification or degree, however, if the regional or national authorities decide that the stacked micro-credentials add up to the learning outcomes needed, it can award a qualification or degree.

Stackability assumes that a set of micro-credentials leads to a higher-level credential. There are no extra (parts of) learning outcomes that need to be assessed on the higher level, because all (parts of) learning outcomes should be already assessed on the lower level.

This implies that there is only one level that really needs to have validated assessments of learning outcomes and that higher levels are automatically awarded if the predefined set of the lower level credentials is obtained.

## 3.2 The framework

The actual ESSA micro-credentials framework starts from the nine ESSA educational profiles and the learning outcomes that are part of those profiles.

### 3.2.1 Three of the four levels defined

The ESSA certification framework consists of four levels, but only three of those levels are defined in detail in the framework. The lowest aggregation level, i.e., the component level, will not be defined in detail. The reasoning behind this is that on the aggregation level 1, all

[11] The Council of the European Union (2022). Council Recommendation on a European approach to micro-credentials for lifelong learning and employability. 2022/C 243/02. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(02)

depend very much on the chosen learning approach and methods on how (parts of) learning outcomes are achieved and therefore assessed. It would limit the flexibility of learning providers using their own methods to achieve learning outcomes, but also it would lead to an enormous amount of (micro-)credentials that would have to be monitored and updated.

### 3.2.2 190 aggregation-2, unit-level credentials

There are 190 unit-level credentials defined as relevant to the ESSA project. Among these, there are 69 foundational (EQF 4/5) credentials, 89 advanced (EQF 6) credentials, and 32 expert (EQF 7) credentials. These are based on the unit learning outcomes of the ESSA educational profiles.

This may sound a lot, but for example for the complete profile of “ESSA Junior Developer”, there are only 39 level 2 (i.e., unit level) credentials, while in a standard fulltime initial VET-programme this would take 4 years to complete.

The unit level is the level on which the assessment of achieved learning outcomes takes place. This can be done in two ways. On the one hand, an accredited learning provider can establish that the learning outcomes are achieved by either an assessment covering the complete level 2 credential or by stacking the level 1 (i.e., component level) credentials that they defined to cover the level 2 credential. On the other hand, there can be an assessment by an independent assessment provider.

### 3.2.3 47 aggregation-3, competence-level credentials

There are 47 competence-level credentials defined among which 17 foundational (EQF 4/5) credentials, 18 advanced (EQF 6) credentials and 12 expert (EQF 7) credentials. The starting point is the programme learning outcomes of the ESSA educational profiles. A programme learning outcome groups a set of unit learning outcomes, in most cases based on the fact that they belong to the same (e-CF) competence.

Although the basic level of assessing whether learning outcomes are achieved is on aggregation level 2, it is possible to have an assessment covering a complete level 3 credential at once. An assessment that for example covers three out of the five level 2 credentials that are part of the level 3 credential is also possible.

### 3.2.4 9 aggregation-4, role-level credentials

There are 9 role-level credentials. These are the roles defined in the nine educational profiles. All the learning outcomes related to all the competences needed to become a professional in a certain role are assessed at the lower aggregation level(s). This set of credentials leads to an aggregation 4, role-level credential. A level 4 credential usually will contain about ten level 3 credentials.

This level is comparable with a complete programme of initial education, leading to a role as starting professional. It can therefore be compared with qualifications and degrees. The

aim is to start with mapping existing qualifications and degrees, but also to get to the point where an ESSA role-level credential leads to an official qualification or degree issued by an accredited learning provider.

### 3.2.5 Example of how stackability functions

The basic principle of stackability can be best exemplified by showing how an aggregation 4 role is composed of aggregation 3 (i.e., competence level) credentials, which are themselves made of level 2 (i.e., unit level) credentials. The example given is the "ESSA Junior Developer" role and a visualisation of this example can be found in Annex 2.

The aggregation level 4 role "ESSA Junior Developer" credential can be achieved by obtaining all related aggregation level 3 competence credentials related to this role, i.e., ten level 3 credentials. These vary from soft skills foundation to component integration foundation and eight other level 3 credentials. Together they cover all the programme learning outcomes from the ESSA Junior Developer educational profile. Each of those level 3 credentials consists of one or more level 2 credentials. For example, the level 3 soft skills foundation is composed of five level 2 credentials including teamwork skills, communication skills, problem-solving skills, and self-management skills foundation, as well as, English language skills B2.

These aggregation level 2 credentials can consist of one or more level 1 credential(s), but as explained, those will be specified and assessed on the level of an individual learning provider. A learning provider can, for example, decide to divide teamwork skills foundation into three aggregation 1 credentials. These could be one credential on the theory of teamwork which is assessed with an exam, one credential on practical teamwork assessed based on a report and one credential on reflection on the teamwork assessed based on a self reflection. But again, if and how these aggregation level 1 credentials are used is up to the individual learning providers. The only demand is that those level 1 credentials together cover the learning outcome(s) of the level 2 credential.

## 3.3 Mapping with existing certifications

The framework can function as a foundation for a new certification scheme in the future, but it functions already as a mapping tool for existing professional certifications. An initial mapping has been performed by identifying internationally used professional certifications provided by vendors and assessment providers. This mapping is available as an excel sheet, which can be easily updated.

# 4 Implementation aspects

A framework is nice to have and offers the possibility of mapping, but without real implementation where credentials are actually issued, it misses the biggest potential impact. Therefore, this chapter is dedicated to possible implementation aspects that need to be considered when planning an actual implementation of the framework as a spin-off of the ESSA project.

## 4.1 How does it work for students?

The framework serves as a guide for students to understand the certifications that can assist them in future-proofing themselves and achieving outcomes to help them secure work as a software professional. They can see which certifications are relevant to be grouped together and which certifications can in the end lead to an equivalent of a qualification.

This is of course very relevant for reskillers and upskillers, since they can see which certifications are relevant for a certain software role and therefore also know what education or training to choose to obtain the corresponding learning outcomes. Also, initial students that are not willing and/or able to get a qualification, like e.g., a bachelors degree, can use it to see what relevant certifications they could pursue to help them get started as a software professional.

## 4.2 How does it work for certification suppliers?

For certification suppliers, the framework supports the development of a coherent set of certifications, in which each individual certification is linked to the other certifications, in a transparent and logical manner. An accredited certification supplier can use the ESSA name to emphasise the fact that these certifications have a Europe-wide recognisability.

Certification suppliers can also use the framework to map the certifications they already offer. If they can prove that their existing certification is covering one or more ESSA certifications, they can be added to the mapping. That makes it easy to communicate and explain the relevance of their certifications.

When adhering to the framework, which has been developed in a European context, the supplier has a firm underpinning of the certifications offered in line with the framework, whether these are already existing certifications and/or new certifications based on the ESSA specifications.

### 4.2.1 Quality aspects

It is important that the certifications included in the mapping with the ESSA certification framework are of high quality, whether these are professional certifications or (micro)credentials which form part of an educational programme. This means that the suppliers of certifications need to adhere to certain quality and integrity requirements to be included in the framework.

The ISO/IEC 17024 standard for bodies operating schemes for the certification of persons[12] is a useful starting point for defining these aspects. The standard contains principles and

[12] ISO/IEC 17024:2012 Conformity assessment — General requirements for bodies operating certification of persons. Available at: https://www.iso.org/standard/52993.html

requirements for a body certifying persons against specific requirements and includes the development and maintenance of a certification scheme for persons.

The purpose of certification of persons, as defined in the standard, is to measure the competence of individuals. Competence is defined as the ability to apply knowledge and skills to achieve the intended results.

To assess suitability for inclusion in the ESSA certification framework, certifications will be measured against the criteria below.

A certification scheme contains:

1. Scope of certification: The scope of the certification scheme is a description of the range and boundaries that apply. A scope description can be:
    - a job title
    - a certification title (e.g., Agile Scrum Product Owner)
    - a list of certification topics
    - a more detailed description of the certification
2. Job and/or task description (target group)
3. Required competence (e.g., Bloom level, e-CF mapping, a statement of capability such as 'the candidate can …')
4. Prerequisites (when applicable), i.e., accredited training or another certification
5. Reference to an accessible and accepted Body of Knowledge upon which the certification content is based

A certification scheme shall include the following certification process requirements:

- Criteria for initial certification and recertification (where applicable)
- Assessment methods for initial certification and recertification (where applicable). Assessment methods can include written, oral, practical and observational examinations.
- The depth, length and content of the examination. By depth it is meant the degree of detail of knowledge and skills. By length, it is meant the length of the examination in terms of number of questions and/ or the time allowed to take the examination. By content it is meant the percentage of an examination devoted to each subject area (weighting).
- Surveillance methods and criteria (i.e., supervised exam sessions or online proctoring)
- Criteria for suspending and withdrawing certification

The certification body can demonstrate when requested:

- The involvement of appropriate experts
- The use of an appropriate structure that fairly represents the interests of all parties significantly concerned, without any interest predominating (i.e., the certification body is not the same as the training body)

- The identification and alignment of prerequisites, if applicable, with the competence requirements
- The identification and alignment of the assessment mechanisms with the competence requirements
- Review and validation of the certification scheme on an ongoing, systematic basis[13]

## 4.3 How does it work for learning providers?

Learning providers can design programmes that educate or train for micro-credentials inline with the ESSA certification framework. They can do that by directly following the framework and couple their learning one-on-one to the learning outcomes of an ESSA certification or they can choose to issue micro-credentials to (parts of) a programme in a way that they think it has added value in the specific situation and then map the micro-credential to the certification framework in the same way as it is done for professional certifications.

It helps learning providers to identify the mode of delivery for each micro-credential which is becoming more varied with the growth of online learning. The framework can form the basis for industry and learning providers to work together to design micro-credentialed learning that meets market needs.

The process of developing micro-credentials is faster than creating a traditional course. The same level of regulations around a formal degree or master's programme is not required and with micro-credentials, the related course or training can be developed in stages.. This has the desired effect of allowing the educator to be more agile in response to both students' and businesses' changing and evolving learning and skills needs.

Offering micro-credentials for parts of programmes or (short) courses may impact the profile and number of students for educational providers. They offer a unique learning model for individuals to enrol in education without overly impacting their work or personal life. Students can enrol in single courses they find the most relevant to their needs and choose to consume additional courses as time and circumstances allow.

### 4.3.1 Working with aggregation-1, component-level credentials

Learning providers can issue their own aggregation level 1 credentials. A set of credentials should prepare or lead to a level 2 credential.

## 4.4 Possible ways of implementation

There are a couple of ways to implement the ESSA certification framework, including:

[13] CASCO International Standards Organisation March 2016. Considerations and guidance on Clause 8 of ISO/IEC 17024 for scheme development for certification of persons. Available at : https://www.iso.org/publication/PUB100384.html

- Using the framework as a mapping tool
- Issuing ESSA badges based on mapped existing certifications/qualifications
- Issuing ESSA badges/certifications issued by accredited learning providers
- Issuing ESSA badges/certifications issued by assessment providers
- Using a combination of implementation options

### 4.4.1 Use as a mapping tool

The most basic implementation of the certification framework is to use it to have an overview and map existing professional certifications and micro-credentials offered by learning providers. This is not a real implementation of the certification framework itself, but it will provide insights into what professionals certifications and micro-credentials match the ESSA educational profiles and the defined learning outcomes.

The advantage of this kind of implementation is that it does not require the issuing of credentials and can be implemented without resources from outside the consortium. The disadvantage is that the added value is little in comparison to full-scale implementation and that it is likely that the tool will be difficult to maintain and update after the project ends.

### 4.4.2 Issuing based on mapped certifications/qualifications

The issuing of ESSA certifications/digital badges based on mapping is another way to implement the framework. This will increase the visibility of ESSA and the comparability of credentials in the software sector in Europe. The amount of effort in issuing own certifications/digital badges is more than only mapping but less than implementing a system in which assessments are used to establish whether a credential can be issued.

The long-term sustainability will depend on (associated) partner(s) willing to issue the digital badges and maintain the framework. The mapping itself will be the responsibility of issuers of professionals certifications and of micro-credentials that want to be mapped in ESSA's certification framework. They will have to provide proof that they match the learning outcomes related to the credential(s). The issuer of the ESSA credentials only needs to verify the latter.

### 4.4.3 Issuing by accredited learning providers

Another option is for accredited learning providers to issue the credentials. This would entail that an organisation would need to accredit learning providers to ensure they adhere to the ESSA principles and issue credentials based on an assessment that covers the learning outcomes related to a credential.

### 4.4.4 Issuing by assessment providers

The option that guarantees independent assessment and issuing best, is for assessment providers to issue the credentials. This would mean that the provider will be responsible for

the assessment and issuing, but also, for example, for detailing the assessment specifications based on the learning outcomes.

### 4.4.5 Using a combination of implementation options

Although independent assessment providers ensure comparability of the issued certifications best, there are learning providers that prefer to do their own assessments. This can have multiple reasons, but the fact is that to increase the uptake of ESSA certifications, combining both possibilities can be an option. Also, assessing again, what already has been assessed and awarded with a certification, is not logical.

The most comprehensive option is therefore to combine mapping and issuing by accredited learning providers and by assessment providers. Accredited learning providers issue their micro-credentials and the related ESSA badge(s). Assessment providers issue professional certifications and the related ESSA badge(s).

There are a couple of models that can be used. The accreditation and coordination of the issuing can be done within the alliance which is mainly based on trust, or by an independent professional body. It is examined at the moment what is the most feasible and sustainable option.

# 5 Maintenance and update of the framework

This first version of the framework is a starting point, but it will need to be maintained and updated to stay relevant. Moreover, the mapping and matching with professional certifications and micro-credentials, will need continuous attention and updating. Both are explicitly related to the framework itself and not to the actual implementation of the framework in the form of issued certifications, which is not part of the ESSA scope.

## 5.1 Iterations within the project

The framework and mapping will be updated on (at least) a yearly basis, at the end of 2023 and the end of the project in 2024. The inputs that will be used are:

- Evaluation of WP4 material development, train-the-trainer programme, and pilots.
- New or updated professional certifications and qualifications/degrees.
- Feedback from partners, especially (associated) partners with expertise in certification/digital badges.

The update will be coordinated by WP6 Long-term Sustainability and performed preferably by the former WP3 leaders or another partner(s) with expertise in certification.

## 5.2 Maintenance and update after the project ends

The long-term sustainability of the ESSA project results is a very important point of attention within the project. The best way to guarantee the long-term sustainability of the certification framework would be for the framework to be implemented. This would mean that the certifications resulting from this implementation would have to be issued by an organisation that can continue doing it after the end of the ESSA project. This organisation(s) would then also become responsible for the maintenance and updating of the framework and mapping. This can be arranged within the alliance or by an independent professional body.

# 6 Methodology

The methodology for developing this certification framework was defined as part of the work package's overall methodology and approach.

In this chapter, we will briefly describe the methodology behind the input, process, and output of the design and development of the ESSA certification framework.

## 6.1 Input for framework

This ESSA certification framework is mainly based on the e-CF, EQF, Council recommendation on a European approach to micro-credentials, ESSA Software Skills Strategy, ESSA educational profiles, and inputs from existing professional certifications, (national) qualifications, and degrees.

The main starting point was the educational profiles and more precisely the learning outcomes defined within. All programme learning outcomes and unit learning outcomes defined in the ESSA educational profiles must be covered in the ESSA certification framework.

## 6.2 Design process

The design and development of the framework and mapping was an iterative process. The following steps were undertaken:

1. **Defining starting points**: The first phase was to define the starting points. The WPL drafted a first proposal based on the available input. This proposal was discussed with the partners that participated in task 3.3 (certification framework). These were all the substantial contributors of WP3, other interested partners, and associated partners. The result served as input for the design of the framework.
2. **Translating learning outcomes in certifications**: The second step was to translate the programme and unit learning outcomes defined in the ESSA educational profiles into a certification framework. The first draft was made by the WPL and discussed with the partners of task 3.3. The revised draft was agreed on as starting point for further development and mapping.
3. **Mapping existing certifications:** The next step was to map existing professional certifications with the draft certification framework. A list of internationally established issuers of professional certifications and their certifications relevant for ESSA was created. Partners were asked to review the list and add nationally important professional certifications. Based on the revised list a first mapping and matching between the ESSA certification framework and those certifications was made. This mapping was reviewed by the task 3.3 partners.
4. **Fine-tuning:** The last step in designing the certification framework was to fine-tune. Firstly, associated partners who issue certifications fine-tuned the match for their own portfolio. Secondly, there was an exchange with partners of task 3.1 in which the educational profiles and curricula were developed. In that task, fine-tuning of the learning outcomes was done based on findings defining curricula and discussions

about the certification framework. In return, the certification framework was fine-tuned based on the work done in task 3.1.

## 6.3 Production of the output

All the elements of this deliverable were discussed and produced during the process of designing and developing the framework. The starting points, content of the framework, possible implementation, and maintenance were all discussed and the outcomes are transferred to the deliverable.

The steps in the production of this deliverable were:

1. **Discussing and establishing the structure:** The structure of the deliverable was discussed with the ESSA partners involved in WP3 task 3.3. The first version was drafted by the WP3 leader and partners provided feedback on this. This was discussed during a meeting, and it was confirmed that the structure covered all the relevant topics.
2. **Interactive iterative writing:** Within a month, the first draft of the deliverable was written by the WPL and with contributions from partners. The draft was placed online so it was possible to work collaboratively on this. Partners involved in WP3 task 3.3 were asked a couple of times to provide input and reminded to have a regular look at the document to provide feedback and input.
3. **Feedback on draft and rewriting:** All ESSA partners and associated partners were asked to provide feedback on the draft. This feedback was processed which resulted in a final draft on a content level.
4. **Finalising:** The last phase is preparing the final document. This includes layout, checking of references, including annexes, and other activities to finalise the deliverable. This was done by the WP3 leader together with the WP5 leader who is responsible for communication and dissemination. The final version was presented to all partners for final feedback and approval.

# 7 References and resources

CASCO International Standards Organisation March 2016. Considerations and guidance on Clause 8 of ISO/IEC 17024 for scheme development for certification of persons.

CEN - European Committee for Standardization (2018). European ICT professionals role profiles - Part 1: 30 ICT profiles. Brussels: CEN-CENELEC. CEN Workshop Agreement - CWA 16458-1:2018 (E).

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CEN - European Committee for Standardization (2022). Guidelines for developing ICT Professional Curricula as scoped by EN16234-1 (e-CF). Brussels: CEN-CENELEC. CEN/TS 17699:2022.

European Commission – Education and Culture (2008). The European Qualifications Framework for Lifelong Learning (EQF). Luxembourg: Office for Official Publications of the European Communities.

European Commission (2015). ECTS Users' Guide. Luxembourg: Publications Office of the European Union.

ISO/IEC 17024:2012 Conformity assessment — General requirements for bodies operating certification of persons.

The Council of the European Union (2022). Council Recommendation on a European approach to micro-credentials for lifelong learning and employability. 2022/C 243/02.

# 8 Annexes

## 8.1 Annex 1: Glossary

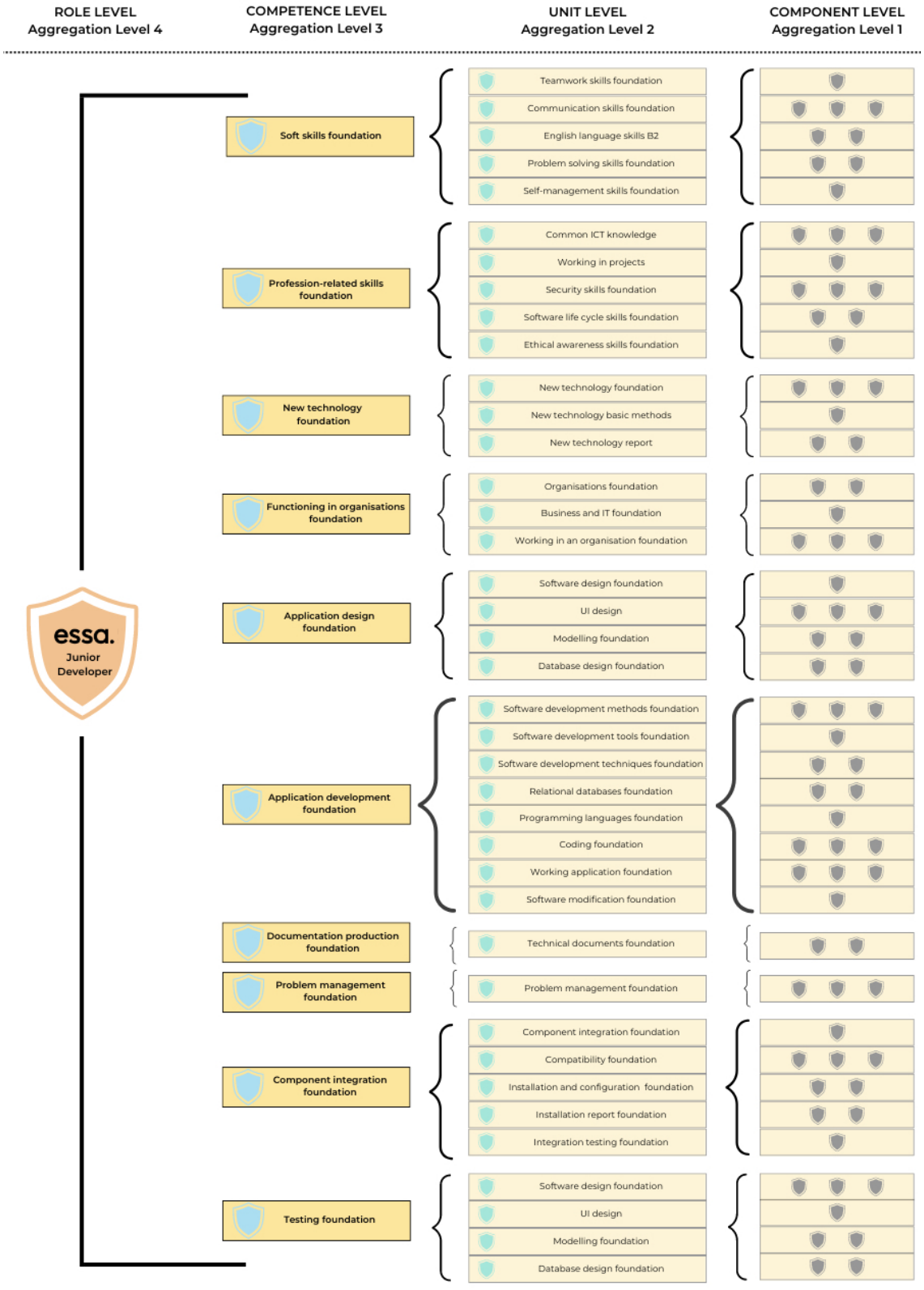
This glossary provides a list of key terms that are used hereinafter and their definitions. It is not meant to provide an exhaustive list of all the terms related to the subject of this study.

| Term | Definition |
|---|---|
| **Assessment** (of learning outcomes) | Process of appraising knowledge, know-how, skills and/or competences of an individual against predefined criteria (learning expectations, measurement of learning outcomes). Assessment is typically followed by certification. (Cedefop, 2014) |
| **Certification** (of learning outcomes) | Process of issuing a certificate, diploma or title formally of learning outcomes attesting that a set of learning outcomes (knowledge, know-how, skills and/or competences) acquired by an individual have been assessed by a competent body against a predefined standard. (Cedefop, 2014) |
| **Curriculum** | Inventory of activities related to the design, organisation and planning of an education or training action, including definition of learning objectives, content, methods (including assessment) and material, as well as arrangements for training teachers and trainers. (Cedefop, 2014) |
| **Competence** | Demonstrated ability to apply knowledge, skills, and attitudes for achieving observable results. (CEN/TC 428, EN 16234-1 (2019) |
| **Digital badge** | Validated indicator of accomplishment, skill or competences, that can be displayed, accessed, and verified online, which describes a specific performance that the recipient has done to earn it. They often represent the completion of a microcredential. (Carey, 2012) |
| **e-Competence Framework (e-CF)** | Standard established as a tool to support mutual understanding and provide transparency of language through the articulation of competences required and deployed by Information and Communication Technology (ICT) professionals. (CEN/TC 428, EN 16234, 2019) |
| **Educational credential** | Documented statement that acknowledges a person's learning outcomes. (European Micro-Credential Terminology, 2022) |
| **Educational profile** | Structure that enables a competence-oriented learning programme design and development, thus providing a link between competences needed in a professional environment and learning outcomes of education and training. It assists planning education and professional accomplishment at individual and institutional levels. (CEN/TC 428, TS 17699, 2021) |
| **European Qualification Framework (EQF)** | Overarching framework that makes transparent the relationship between European national (higher) education frameworks of qualifications and the qualifications they contain. It is an articulation mechanism between national frameworks. (Bologna Working Group on Qualifications Frameworks, 2005) |

| | |
|---|---|
| **European Skills, Competences, Qualifications and Occupations (ESCO)** | The multilingual ESCO classification identifies and categorises skills, competences, qualifications, and occupations relevant for the EU labour market and education and training. It systematically shows the relationships between the different concepts. (ESCO, 2022) |
| **Formal recognition** (of learning outcomes) | Process of granting official status to learning outcomes knowledge, skills and competences either through: validation of non-formal and informal learning; grant of equivalence, credit units or waivers; award of qualifications (certificates, diploma or titles). (Cedefop, 2014) |
| **ICT Professional Role Profiles** | These profiles reflect a collection of typical tasks, competences and responsibilities that are to be fulfilled and each profile is given a common use title for ease of identification. They provide a broad picture of the activities performed by individuals engaged in the multitude of positions that make up the ICT profession. ICT Professional Role Profiles are key components of ICT jobs. (CEN Workshop Agreement 16458, 2018) |
| **International Standard Classification of Education (ISCED)** | Global reference classification for education systems and it provides a comprehensive framework for organising education programmes and qualification by applying uniform and internationally agreed definitions to facilitate comparisons of education systems across countries. (ISCED, 2022) |
| **Knowledge** | Theoretical or practical understanding and awareness of phenomena such as facts, terminology, concepts, models, or theories that are related to a field of work or study. Knowledge is the outcome of the assimilation of information through learning and is theoretical and/or factual. (CEN/TC 428 EN 17748-1, 2022; Council of the European Union, 2017) |
| **Learning** | Process by which an individual assimilates information, ideas and values and thus acquires knowledge, know-how, skills and/or competences. Learning occurs through personal reflection, reconstruction and social interaction. It may take place in formal, non-formal or informal settings. (Cedefop, 2014) |
| **Learning environment** | Any environment that allows a person to learn in providing certain conditions or procedures to do so; this can be an educational institute, a training facility or a workplace, as well as a face-to-face, hybrid or virtual environment. (CEN/TC 428, TS 17699, 2022) |
| **Learning outcome** | Statements of what a learner knows, understands and is able to do on completion of learning process, which are defined in terms of knowledge, skills and competence. (Cedefop, 2014) |
| **Learning programme** | Inventory of activities, content and/or methods implemented to education or training achieve education or training objectives (acquiring knowledge, skills and/or competences), organised in a logical sequence over a specified period of time. (Cedefop, 2014) |

| | |
|---|---|
| **Learning path** | Specific route that reflects a person's subsequent learning activities undertaken in a specific learning environment throughout his/her life, career or study. (CEN/TC 428, TS 17699, 2022) |
| **Micro-credential** | Sub-unit of a credential that could accumulate into a larger credential or degree or be part of a portfolio. Microcredentials are frequently portrayed and promoted as a new way for individuals to build their own skills profile (portfolio) by collecting and "stacking" learning in flexible ways, at their own pace and according to their own priorities. Micro-credentials certify the learning outcomes of short-term learning experiences, for example, a short course or training. They offer a flexible, targeted way to help people develop the knowledge, skills and competences they need for their personal and professional development. (European Micro-Credential Terminology, 2022; Cedefop, 2021 & European Approach to Micro-Credentials, 2022) |
| **Modular programmes** | Programmes that are composed of small discrete modules or learning units that are virtually self-contained, independent, nonsequential, and typically short in duration. Modular programmes allow students to compose the content of their education in a flexible way by combining different courses or modules. (French, 2015; UNESCO, 2011) |
| **Qualification** | An official record (certificate, diploma) of achievement which recognises successful completion of education or training, or satisfactory performance in a test or examination;<br><br>and/or the requirements for an individual to enter, or progress within an occupation. (UNESCO, 1984) |
| **Qualification system** | All activities related to the recognition of learning outcomes and other mechanisms that link education and training to the labour market and civil society. These activities include:<br><br>· definition of qualification policy, training design and implementation, institutional arrangements, funding, and quality assurance;<br><br>· assessment and certification of learning outcomes.<br><br>Comment: a national qualifications system may be composed of several subsystems and may include a national qualifications framework. (Cedefop, 2014) |
| **Validation**<br>(of learning outcomes) | Confirmation by a competent body that learning outcomes (knowledge, skills and/or competences) acquired by an individual in a formal, non-formal or informal setting have been assessed against predefined criteria and are compliant with the requirements of a validation standard. Validation typically leads to certification. (Cedefop, 2014). |

## 8.2 Annex 2: Example of certification scheme



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