



**BIG DATA VALUE**  
eCOSYSTEM

## **D4.6: A Framework for the Recognition of Data Science Skills in Europe**

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Abstract:	This document proposes a framework for the recognition of data science skills in Europe after describing and comparing different existing mechanisms for skills accreditation. Particular emphasis is given to existing efforts in Europe and in industry, both in ICT and education.



## History

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### Definitions, Acronyms and Abbreviations

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Acronym	Title
AG	Activity Group
BDVA	Big Data Value Association
BDVe	Big Data Value ecosystem
EC	European Commission
EU	European Union
ICT	Information and communication technologies
KPI	Key performance indicator
PPP	Public private partnership
SME	Small medium enterprise
TF	Task force
WP	Work package

**Table 1: Definitions, Acronyms and Abbreviations**

### Executive Summary

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Currently, all stakeholders in the data science ecosystem have unmet needs when considering skills. More concretely,

Data scientists need:

- Credentials, which are widely recognized
- Credentials, which can be easily verified online
- A simple way to digitally display their skills online and in social networks
- Mechanisms to formally recognize skills acquired through informal and non-formal training<sup>1</sup>

Employers who hire data scientists need:

- Tools to verify the authenticity of credentials
- A skills recognition framework, which facilitates the comparison of candidate skills throughout the EU
- Influence in the process of designing the types of training data scientists receive
- A scheme for recognizing skills in data science, which can quickly adapt to changes in the data science ecosystem

Educators who train data scientists need:

- Publicity for their programs and the added value that an externally branded recognition of their training can provide
- Recognitions for the partial completion of their programs to assist students who are seeking employment while studying or students who abandon their studies
- Contact with employers, a mechanism to clarify the changing needs of industry and clear recommendations regarding how to adapt to those needs

The goal of this document is to propose a scheme for the recognition of data science skills, which addresses these needs while taking into consideration educational trends in Europe.

The proposal involves the use of a hybrid approach, drawing upon aspects of traditional badge and certificate recognitions. A committee of experts will define and revise both the types and requirements for the recognitions. Then vetted third

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<sup>1</sup> UNESCO's UNEVOC defines non-formal education and training as that "which takes place outside the formal system either on a regular or intermittent basis" and informal learning as that "resulting from daily life activities related to work, family or leisure. Informal learning is part of non-formal learning", see

<http://www.unevoc.unesco.org/article/Definition+of+Formal%2C+Informal%2C+and+Nonformal+learning.html> (Consulted October 2017)



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parties will responsible for both the evaluation of the requirements and issuing the recognitions. The recognitions will be given individually in the form of Open Badges.

# 1 Introduction

With the development of new technologies and the digital transformation of our economy, the labor market has also evolved. Nowadays, applicants for a job are no longer asked to submit a traditional paper resume, this information is presented digitally; recruiters and headhunters search the Internet (on an international level) for candidates who have the required skills; and some assessment of candidates can be done online. Moreover, the labor market is constantly evolving: required skills and qualifications change rapidly over time. Adequately adapting these changes is essential for the success of: employers, learning institutions, and governmental agencies related to education. In this document, we will discuss mechanisms for recognizing skills in the EU with a focus on the internationalization, digitalization, and flexibility of these credentials and their application to data science. We begin with a brief review of the main challenges we hope to address.

## 1.1 How can we standardize credentials throughout Europe?

Although political institutions in the EU have strived to coordinate and standardize diplomas and other forms of credentialing in higher education, the variety of educational systems in the EU and the lack of an adequate system to recognize learning and skills have contributed to great differences in the economic and social outcomes of the member states. The many different educational and training systems in Europe make it difficult for employers to assess the knowledge of potential employees.

There is no automatic EU-wide recognition of academic diplomas; students can only obtain a "statement of comparability" of their university degree. The statement of comparability details how the student's diploma compares to the diplomas of another EU country.<sup>2</sup> Something similar happens with the recognition of professional qualifications: the mobility of Europeans between member states of the EU often requires the full recognition of their professional qualifications (training and professional experience). This is accomplished through an established procedure in each European country.<sup>3</sup> Directives 2005/36/EC and 2013/55/UE on the recognition of professional qualifications, establish guidelines that allow professionals to work in another EU country, different from the one where they obtained their professional qualification, on the basis of a declaration.

These directives provide three systems of recognition:

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<sup>2</sup> [http://europa.eu/youreurope/citizens/education/university/recognition/index\\_en.htm](http://europa.eu/youreurope/citizens/education/university/recognition/index_en.htm) (Consulted June 2017)

<sup>3</sup> [http://europa.eu/youreurope/citizens/work/professional-qualifications/recognition-of-professional-qualifications/index\\_en.htm](http://europa.eu/youreurope/citizens/work/professional-qualifications/recognition-of-professional-qualifications/index_en.htm) (Consulted June 2017)

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- automatic recognition – for professions with harmonized minimum training conditions, i.e., nurses, midwives, doctors (general practitioners and specialists), dental practitioners, pharmacists, architects and veterinary surgeons);
- general system – for other regulated professions such as teachers, translators and real estate agents;
- recognition on the basis of professional experience – for certain professional activities such as carpenters, upholsterers, beauticians etc.;

Additionally, the European professional card (EPC) has been available since January 18, 2016 for five professions (general care nurses, physiotherapists, pharmacists, real estate agents and mountain guides). It is an electronic certificate issued via the first EU-wide fully online process for the recognition of qualifications.

Unfortunately, these existing mechanisms do not easily accommodate many professions including that of data science.

### 1.2 How can data science credentials be: digital, verifiable, granular, and quickly evolving?

Traditionally skills and credentials were conveyed via a resume on paper and other paper-based credentials. Nowadays, this information can be shared via the Internet in web pages, social media, and in many other forms. The digitalization of credentials not only allows easier access but also offers new possibilities like:

- the online verification of the validity of the credentials,
- greater granularity in the definition of the credentials,
- the expiration of credentials requiring their periodic renewal which could take into account changes in the demands for skills, and
- access to the evidence used in the awarding of credentials.

Future schemes for the recognition of skills need to adapt to and accommodate these new demands.

### 1.3 How can informal and non-formal learning in data science be recognized?

The educational landscape is rapidly changing. The great emphasis, which was previously placed on formal university training, is slowly eroding. The role of both informal and non-formal learning is increasing and skills recognition schemes need to contemplate these changes.

### 1.4 Document overview

This document begins with a summary of current trends regarding education and skills in Europe. From these trends, we extract a series of desirable properties for a future data science skills recognition scheme. Then, a survey of different mechanisms for the recognition of skills is presented. Next, a comparison and critical

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analysis of these recognitions is provided while taking into account the previously identified desirable properties. Lastly, a recommendation for a future data science skills recognition process is proposed. This proposal includes a high level description of the logistics of the recommended recognition process to help assess its viability and sustainability.

## 2 The Strategic Framework for Education and Training 2020

Even though each EU country is responsible for its own educational and training systems, a common EU policy exists to support actions at the national level and to help address common challenges, such as ageing societies, skills deficits in the workforce, technological developments and global competition.

The strategic framework for Education & Training 2020 (ET-2020) contains the current policies of the EC for cooperation on education and training. These policies were initially adopted in 2009<sup>4</sup> and contain four common objectives to address challenges in education and training systems that should be met by 2020 in the EU:

- Making lifelong learning and mobility a reality.
- Improving the quality and efficiency of education and training.
- Promoting equity, social cohesion, and active citizenship.
- Enhancing creativity and innovation, including entrepreneurship, at all levels of education and training.

In reviewing the progress of the ET-2020, the *2015 Joint Report of the Council and the Commission on the implementation of the strategic framework for European cooperation in education and training*<sup>5</sup> (2015-JR-SFECT) included a new set of priority areas for European cooperation in education and training:

1. Relevant and high-quality skills and competences for employability, innovation, active citizenship
2. Inclusive education, equality, non-discrimination, civic competences
3. Open and innovative education and training, including by fully embracing the digital era
4. Strong support for educators
5. Transparency and recognition of skills and qualifications
6. Sustainable investment, performance and efficiency of education and training systems

As the emphasis on promoting the “transparency and recognition of skills and qualifications” is particularly relevant to the task of recognizing data science skills we will focus further on that priority area. To explain this priority area, the report identifies these concrete needs:

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<sup>4</sup> [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009XG0528\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009XG0528(01)&from=EN)  
(Consulted June 2017)

<sup>5</sup> [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015XG1215\(02\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015XG1215(02)&from=EN)  
(Consulted June 2017)

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- Fostering transparency, quality assurance, validation and recognition of skills and/or qualifications, including those acquired through digital, online and open learning and the validation of informal and non-formal learning.
- Simplifying and rationalizing the transparency, documentation, validation and recognition tools that involve direct outreach to learners, workers and employers and further implementing the EQF [European Qualifications Framework for lifelong learning] and NQFs [National Qualifications Frameworks]<sup>6</sup>.
- Supporting the mobility of pupils, apprentices, students, teachers, members of educational staff and researchers
- Developing strategic partnerships and joint courses, in particular through increasing internationalization of higher education and vocational education and training

To further these goals, the EU has developed several instruments to support the transparency and recognition of knowledge, skills, and competences to make it easier to study and work anywhere in Europe:

- The **European Qualifications Framework for lifelong learning (EQF)** will support the process of validating qualifications by providing a common reference for qualification levels across Europe and the linking of member state validation systems with formal qualifications systems.
- **Validation of non-formal and informal learning** is a way to recognize an individual's knowledge, skills and competences, whether obtained in the formal education system or outside. If validated (identified, documented, assessed, and/or certified) these learning experiences can be made more visible and usable for further studies or work.

European countries have been asked to establish systems that allow individuals to validate all forms of learning. The necessary arrangements for validation should be implemented by 2018. To help to achieve this, the CEDEFOP (European Centre for the Development of Vocational Training) in cooperation with the EC have defined some guidelines for validating of non-formal and informal learning.<sup>7</sup> They have also proposed an up-to-date European Inventory that provides an overview for each country and good practices for the design and implementation of validation initiatives.

- The **Europass portfolio**<sup>8</sup> also interacts with validation systems since it documents learning and enables users to present their skills, qualifications and experiences in a uniform way across Europe.
- The **European Credit Transfer and Accumulation** system for higher education<sup>9</sup> and the **European Credit system for Vocational Education and**

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<sup>6</sup> [https://ec.europa.eu/ploteus/search/site?f\[0\]=im\\_field\\_entity\\_type%3A97#](https://ec.europa.eu/ploteus/search/site?f[0]=im_field_entity_type%3A97#)

<sup>7</sup> Cedefop (2015). European guidelines for validating non-formal and informal learning. Luxembourg: Publications Office. Cedefop reference series; No 104. <http://dx.doi.org/10.2801/008370>

<sup>8</sup> [europass.cedefop.europa.eu/](http://europass.cedefop.europa.eu/)

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**Training** (ECVET)<sup>10</sup> standardize the quantification of formal learning throughout Europe, making it easier for people to get validation and the recognition of skills and knowledge.

- **Quality assurance** arrangements in higher education and vocational training, to make education systems easier to understand for students and employers, by improving transparency tools.

We will now elaborate more upon the most relevant points of a number of key initiatives within this framework.

### 2.1 New Skills Agenda for Europe

The New Skills Agenda for Europe (NSAE) is one of the initiatives undertaken at the EU level towards meeting the targets of the ET-2020. On June 10, 2016, the European Commission presented this agenda<sup>11</sup>, which sets out different guidelines to guarantee that the most adequate training, skills and career guidance is accessible to all people in the EU.

The New Skills agenda emphasizes “the strategic importance of skills for sustaining jobs, growth and competitiveness”, and is centered around three key points:

- Improving the quality and relevance of skills formation
- Making skills and qualifications more visible and comparable
- Improving skills intelligence and information for better career choices

The most relevant concerns and recommendations mentioned in the New Skills Agenda regarding data science skills in Europe include:

- Future credentials should easily allow the comparison of students’ skills throughout the EU.
- Both the employed and the unemployed need adequate ways to present their skills and qualifications. Employers need ways to identify and recruit new employees with the skills that they need.
- Once skills qualifications are easily accessible, current and future demands for skills could be identified with data science analysis (skills intelligence).
- Current qualification systems focus on the learning outcomes of formal education programs, but do not validate non-formal and informal learning. Ongoing learning, including learning at the workplace, needs to be encouraged.
- Skills acquisition should not only be in formal education and training (literacy, numeracy, science, foreign languages) but also transversal skills (teamwork, creative analysis, problem solving, entrepreneurship, etc.).

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<sup>9</sup>[https://ec.europa.eu/education/resources/european-credit-transfer-accumulation-system\\_en](https://ec.europa.eu/education/resources/european-credit-transfer-accumulation-system_en) (Consulted June 2017)

<sup>10</sup> [https://ec.europa.eu/education/policy/vocational-policy/ecvet\\_en](https://ec.europa.eu/education/policy/vocational-policy/ecvet_en) (Consulted June 2017)

<sup>11</sup> <http://ec.europa.eu/social/main.jsp?catId=1223> (Consulted June 2017)

### 2.2 New Europass framework

In February 2005, the Europass was launched, following the decision of the European Parliament and the Council<sup>12</sup> to create a single framework to help people make their skills and qualifications more easily understood in Europe. This was done in the interest of facilitating the mobility of students and workers. Europass consisted of a portfolio of five documents: Europass Curriculum Vitae (CV); Europass Language Passport; Europass Mobility; Europass Certificate Supplement; Europass Diploma Supplement.

Despite the fact that the European CV has undergone significant improvements to adapt to the changes brought by the technological revolution, the current Europass still does not address the changing educational, training and labor market conditions<sup>13</sup>:

- It focuses on documents and templates that are not compatible with the use of social media, mobile devices, Big Data analysis and job matching tools;
- It does not face the growing relevance of modern learning, that needs an easy way to record the skills and qualifications acquired through non-formal or informal learning, including online learning;
- It does not take into account the use of tools such as 'open badges'.<sup>14</sup>

On October 4, 2016 the Commission adopted a proposal to revise the Europass Decision, by building a new Europass framework that will contribute to the display of people's skills and qualifications in a unified manner for all EU countries.<sup>15</sup>

It addresses challenges regarding the way that information technologies have changed the labor market and new educational possibilities:

- The publication of employment offers, job applications, candidates' evaluation and recruiting are increasingly done online through tools that use social media, Big Data and other technologies, making it easier to find information on skills and qualifications.
- Education and training is increasingly offered online using digital platforms; at the same time, skills, experiences and learning achievements (formal and non-formal) are recognized in different forms, such as open badges.

With the new framework users will be able to present their skills and qualifications in new formats (including visually), as the revised Europass will use open standards to facilitate the exchange of electronic data and will define authentication measures to ensure the validity of the digital content.

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<sup>12</sup> Decision No 2241/2004/EC of the European Parliament and of the Council of 15 December 2004 on a single Community framework for the transparency of qualifications and competences (Europass)

<sup>13</sup> Report from the Commission to the European Parliament and the Council (2013): Second evaluation of the Decision of the European Parliament and the Council on a single Community framework for the transparency of qualifications and competences (Europass)

<sup>14</sup> An open badge is a digital token used as form of digital recognition of learning which can be displayed digitally

<sup>15</sup> <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-625-EN-F1-1.PDF>



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To achieve this goal, the new infrastructure will include several new tools, which will allow users to give evidence of their skills and qualifications in all EU languages; these tools are:

- An online tool to create persona profiles, including both the traditional CV, with work experience and training/education and the skills recognition
- Applications to help to evaluate the users' skills
- Information on learning opportunities across Europe
- Assistance on how to get a user's skills recognized
- Labor market intelligence, to learn which skills are more valuable

The new Europass will be connected to other EU tools and services related to work, education and training systems, to facilitate the exchange of information and to help users in their education and career path decisions.

### 2.3 European Qualifications Framework for lifelong learning

In April 2008, the European Parliament and Council resolved to establish the European Qualifications Framework for lifelong learning (EQF).<sup>16</sup> The process was voluntary, and countries were invited to implement the framework in two stages: the first, that was to be completed by 2010, relating national qualification levels to the EQF; and the second, by 2012, ensuring that all new qualifications issued in Europe include references to the appropriate EQF level.

The aim of this framework is to provide a way to compare and interpret the levels of different qualification in the EU and thereby make those qualifications more transparent. This will also facilitate mobility, having positive effects for learners and workers, who can have their level of competence recognized using a standard description all across Europe. This proposal will also be beneficial for recruiters and education providers, who will be able to understand the applicants' qualifications. The adoption of a common reference framework will also ease the comparison and recognition of traditional qualifications awarded by national authorities and those awarded by other stakeholders (e.g., multinational companies). This will allow the comparison of formal and non-formal education by increasing the transparency of qualifications awarded outside the formal education system.

The EQF applies to all types of education, training and qualifications, from compulsory education to academic, professional and vocational training. It consists of eight qualification levels, described in terms of learning outcomes<sup>17</sup>: knowledge, skills and competences. These levels take into consideration theoretical knowledge, practical skills, technical skills, and social competences as shown in Table 2.

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<sup>16</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:111:0001:0007:EN:PDF>

<sup>17</sup> A learning outcome is "a statement of what a learner knows, understands and is able to do on completion of a learning process."

EQF Level	Knowledge	Skills	Competence
	<b>In the context of EQF, knowledge is described as theoretical and/or factual.</b>	<b>In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking), and practical (involving manual dexterity and the use of methods, materials, tools and instruments)</b>	<b>In the context of EQF, competence is described in terms of responsibility and autonomy.</b>
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5 <sup>[1]</sup>	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 6 <sup>[2]</sup>	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 7 <sup>[3]</sup>	Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research  Critical awareness of knowledge issues in a field and at the interface between different fields	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8 <sup>[4]</sup>	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

Table 2: EQF Levels and Learning Outcomes

Each of the eight levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualification.

However, the adoption process of the EQF has proved difficult: differences have appeared when comparing general education certificates in different national systems with the EQF levels. For example, for a similar school certificate, some countries assign a level 2 or 3 (for secondary education) and others a level 4 or 5 (for higher education). This same problem has occurred with vocational education.

### 2.4 European Skills, Competences, Qualifications and Occupations

The European Skills, Competence, Qualifications and Occupations (ESCO)<sup>18</sup> framework is a multilingual classification system that aims to bridge the communications gap between the business world and the education and training field through a common reference terminology. The ESCO initiative was launched in 2010 by the EU and the first version of the ESCO framework was published in July 2017.

The ESCO benefits those in the labor market and in the education and training sector in a variety of ways:

- By providing a better matching of people to jobs by employment services or electronic tools. It will:
  - Help employers define the set of skills, competences and qualifications for a vacant job.
  - Help job seekers build professional profiles in a terminology that suits job vacancies.
  - Enable mobility through Europe.
- By supporting education and training systems in the shift to learning outcomes that better meet labor market needs. It will:
  - Support the provision of information to education and training institutions that can help them in the development of new curricula.
  - Help to provide more transparent information to students on learning outcomes and the relevance of qualifications to the labor market before they commence education or training.
- By supporting evidence-based policy making. It will:
  - Enhance the collection, comparison and dissemination of data through tools that capture skills intelligence and statistics.

The ESCO is built upon three pillars: Occupations, Skills/Competences and Qualifications. With regard to the occupations, the ESCO includes 21 Science and Engineering Professional roles. In the case of skills, the ESCO identifies some relevant to data science: analyze big data, investigate big data, test big data, all of them

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<sup>18</sup> <https://ec.europa.eu/esco>

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under the following description: “Collect and evaluate numerical data in large quantities, especially for the purpose of identifying patterns between the data.”

Regarding qualifications, the ESCO is based on the EQF framework and the national databases that most Member States developed or are developing, in which they assign an EQF level to each qualification and describe the expected outcome.

The most relevant ESCO guiding principles are:

- Useful, ESCO aims to become the de facto standard of the identification and identification of occupations, skills competence and qualifications.
- Accepted, ESCO aims to be voluntarily adopted by stakeholders.
- Updated, ESCO will be continuously updated and adapted.
- Flexible, ESCO does not aim to standardize the scope of occupations but to provide standard terminology.
- High-quality, different stakeholders carefully ensured the quality of the ESCO.
- Transparent and open development, results were shared with interested parties and it was open to all stakeholders.
- Machine readable and compatible with existing IT systems and standards.

### 2.5 Highlights and common threads in these initiatives

After reviewing these political trends in Europe, we can now extract some of the key properties that a future data science skills recognition program should contain in order to be in agreement with these existing efforts.

A future data science skills recognition system should:

- P1 (2015-JR-SFECT, NSAE, Europass, EQF, ESCO) be transparent, accessible and allow the easy comparison of students’ skills throughout the EU
- P2 (2015-JR-SFECT, ESCO) include an assurance of quality
- P3 (2015-JR-SFECT) provide tools for their verification and validation
- P4 (2015-JR-SFECT, NSAE, Europass, EQF) include skills acquired through traditional, digital, online, and open learning, as well as the validation of informal and non-formal learning
- P5 (2015-JR-SFECT, EQF, ESCO) be compatible with the EQF
- P6 (NSAE) influence the relevance of the skills being acquired
- P7 (NSAE, Europass, ESCO) allow the digital analysis of both the demand for and the availability of skills
- P8 (Europass) allow their use online: in platforms like the Europass, social media and on mobile devices
- P9 (EQF, ESCO) focus on learning outcomes and not on traditional measures such as hours of study

With these goals in mind, we will now look at the most common and popular methods of recognizing skills.

## 3 A Survey of Recognitions

### 3.1 Accreditations

"Accreditation is the formal recognition by an independent body, generally known as an accreditation body, that a certification body operates according to international standards." [ISO, 2017]

In the context of higher education in Europe, accreditation is the process by which an educational program acquires the right to grant degrees. In Europe, most accreditation agencies are endorsed by national governments and accredit all degrees in the country. Sometimes these agencies recognize European or international accreditations and simplify the national accreditation process for programs already accredited at the European or International Level.

Requirements for accreditation vary depending on the accreditation agency. Some examples of Accreditation Agencies are: the Agencia Nacional de Evaluación de la Calidad y Acreditación [ANECA, 2017] in Spain, the UK Accreditation Service [UKAS, 2017] in United Kingdom, the Accreditation Board for Engineering and Technology [ABET, 2017] or the World Association of Conformity Assessment Accreditation Bodies [IAF, 2017].

### 3.2 University/Academic degrees

Within the collection of recognitions we will review, this is most certainly the one with the longest history. For example, the notion of a doctorate was established in medieval Europe and was considered to be a license to teach at the university level [Academic Degree, 2017]. Nowadays, the European system of university degrees (bachelor degree, master degree, and the doctorate) are used worldwide.

Accredited College and University programs have the right to award academic degrees. It should be noted that in some parts of the world, unaccredited programs (sometimes referred to as degree mills) can legally confer degrees but these degrees are often considered to be of little worth.<sup>19</sup>

A great variety of requirements exist but typically four years of university study must be completed to be awarded a bachelor degree, two additional years of study for a master degree, and a significant research contribution is required for the awarding of a doctorate.

In many private and public sector jobs, both pay scales and position prerequisites are directly related to the degrees held by a candidate. In some parts of the world,

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<sup>19</sup> [https://en.wikipedia.org/wiki/List\\_of\\_unaccredited\\_institutions\\_of\\_higher\\_education](https://en.wikipedia.org/wiki/List_of_unaccredited_institutions_of_higher_education). Consulted June 2017

holding a degree results in a change of title (Doctor for example) and in others it results in the right to use post-nominal letters (BA for example).

Noteworthy examples in Big Data/Data Science include: M.Sc. Big Data and Business Analytics, University of Amsterdam, M.Sc. Applied Informatics, Vytautas Magnus University, M.Sc. Data Science, Sapienza Università di Roma or M.Sc. Computer Science, National University of Ireland.

### 3.3 Certificates

A certificate is simply a document that attests to the fact that a certain person has received a specific training and/or has passed a test or series of tests. Though in reality they are very varied in use, in the context of the computing industry certificates are most commonly used to recognize knowledge regarding a specific set of skills.

There are both academic and professional certificates with the former being awarded by higher education providers while the latter are awarded by professional organizations or individual companies related to their own products.

Certificates typically require less effort to obtain than an academic degree. The examples given below have an average duration of between 6 and 18 months. Many certificate programs are specifically designed for 'continuing education' students who are already employed full-time but are trying to advance their career. Many academic certificates are associated with traditional coursework and are basically equivalent to having passed with a certain grade a set of courses. Most professional certificates require passing a test, some also require a certain amount of professional experience to be eligible for certification. Many professional certificates expire after a certain period of time and require renewal by completing continuing education courses and/or exams.

Corporations often require that service providers have staff with certain certifications before they can provide specific services. Often job advertisements specifically require certain certifications. For example, many Network Engineer positions require that applicants have a Cisco Certified Network Associate (CCNA)<sup>20</sup> certificate.

Relevant examples of academic certificates in Big Data/Data Science include:

- Harvard Data Science Certificate<sup>21</sup>: Cost: 10,200 USD, Duration: 1.5 years, all courses can be completed online
- University of California, Irvine Data Science Certificate Program<sup>22</sup> [Irvine, 2017]: Cost: free for UCI graduate students, Duration: 32 hours of courses/workshops

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<sup>20</sup> <https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html>

<sup>21</sup> <https://www.extension.harvard.edu/academics/professional-graduate-certificates/data-science-certificate>. Consulted June 2017

<sup>22</sup> <http://datascience.uci.edu/data-science-certificate-program/> Consulted June 2017

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- Georgetown University Professional Certificate Program in Data Science <sup>23</sup>: Cost: 6,760.00 USD, Duration: 5 months, courses held on Friday evenings and Saturdays
- UC Berkeley Certificate Program in Data Science <sup>24</sup>: Cost: 5,100 USD (+ materials + registration), Duration 150 hours of class

Given the importance and success of professional certifications, we will give some detailed information regarding two noteworthy examples.

### 3.3.1 Cisco Career Certifications

Training for Cisco's certifications is available through traditional skills-based training, with instructor led courses, as e-learning; or in the form of product and solutions training.

CISCO has four levels of certification<sup>25</sup>:

- Entry (CCENT: Cisco Certified Entry Level Technician),
- Associate (Cisco Certified Design and Architecture or CCNA: Cisco Certified Network Associate),
- Professional (CCDP: Cisco Certified Design Professional or CCNP: Cisco Certified Network Professional),
- Expert (CCDE: Cisco Certified Design Expert or CCIE: Cisco Certified Internetwork Expert).

Training courses for entry, associate and professional levels usually last 5 days. Cisco provides learning resources that can be purchased. For all levels, training is provided by Cisco Learning Partners and also by Certified Cisco Instructors. There are thousands of course providers throughout the world.

Certifications for entry, associate and professional levels are valid for three years; for the expert level the certification is valid for two years. To recertify at these levels, an exam must be passed before the certification expiration date. In general, Cisco offers two types of exams: monitored exams in an authorized test center or self-administered online exams. Exam prices vary by level and by currency, ranging from 65 USD to 1600 USD.

The Cisco Architect certificate is valid for 5 years. Re-certification is a different process for this level and involves contributions to the Cisco architect program.

### 3.3.2 Microsoft Certification

Training for Microsoft Certification is provided through Microsoft Learning Partners worldwide, either online or on-site. Also, in the Microsoft Virtual Academy, there is free Microsoft training delivered by experts. You can also train on your own, with the

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<sup>23</sup> <https://scs.georgetown.edu/programs/375/data-sceince>. Consulted 2017

<sup>24</sup> <http://extension.berkeley.edu/public/category/courseCategoryCertificateProfile.do?method=load&certificateId=28652248>. Consulted June 2017

<sup>25</sup> <https://learningnetwork.cisco.com/community/certifications>

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possibility of purchasing Microsoft Press Books and Official Practice Tests. Experience with the technology is required. There are various levels<sup>26</sup>:

- MTA Microsoft Technology Associate
- MCSA Microsoft Certified Solutions Associate
- MCSE Microsoft Certified Solutions Expert
- MCSA Microsoft Certified Solutions Developer

Upon passing the first qualifying Microsoft Certified Professional exam, the title Microsoft Certified Professional (MCP) can be used. MCP-qualifying exams include all exams required in the MCSA, MCSE and MCSA programs.

MCP exams are provided by third-party partners (e.g., Certiport or Pearson Vue). Exams can be taken in a classroom or online. For many of the certifications you can choose between a number of different exams.

Microsoft Certified Trainers (MCTs) are classroom and e-learning instructors, training and certification consultants.

Prices vary depending on the country and exam/certification.

### 3.4 Labels

Labels are a distinction awarded to an existing degree program. The use of the term label appears to be almost exclusively European. Like accreditations, but unlike the other recognitions mentioned here, it is applied to the program itself and is not normally through of as being applied to the program's participants (except through association). A label publicly recognizes that the program in question meets the requirement of the label issuer.

There is no clear consensus regarding who can confer a label, but at the moment the most noteworthy labels are conferred by programs funded by the European Commission. Each organization is free to design any requirements, which it sees fit.

Noteworthy examples are Erasmus Mundus Master of Excellence [Erasmus Mundus, 2017], Erasmus+ [Erasmus+, 2017], EIT Digital [EIT Digital, 2017], Eur-ace [Eur-ace, 2017], Euro-Inf [Euro-Inf, 2017], and The European Language Label (ELL) [ELL, 2017].

### 3.5 Badges

Badges are a very recent arrival in the skills recognition landscape. A badge is a graphical representation of any kind of achievement, goal or milestone based on a digital file that integrates the criteria and evidences used to obtain the badge [Buckingham, 2014]. In an industrial setting, badges seem to be a lesser and more accessible form of recognition when compared with certificates. One of the principal motivations behind the "Badge Movement" was to provide a new mechanism for the recognition of skills which is better adapted to recent changes in learning:

- Nowadays, learning happens in many different contexts and while using various kinds of media. Instead of only recognizing credentials from students

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<sup>26</sup> <https://www.microsoft.com/en-us/learning/browse-all-certifications.aspx>



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enrolled in established learning institutions, employers should have a mechanism for recognizing skills (and experiences) acquired by anyone through: professional training programs, participating in competitions, volunteer programs, MOOC's etc.

- Learning is not something which should only be 'recognized' during the 'student' phase of one's career but should rather be an ongoing process.
- Traditional skills recognitions do not capture elements, which cannot be easily evaluated by test scores and short-term projects.
- Academic diplomas are for the most part monolithic documents. Recognitions of lesser granularity and much more flexibility are needed. Also, these recognitions should contain both the criteria used to evaluate the skills and evidence of the acquisition.
- Recognitions need to be digital, and capable of being displayed online

By design, badges can be awarded by any organization. Each organization is free to design any set of requirements, which it sees fit.

Noteworthy examples are Big Data University Badges (IBM community initiative)<sup>27</sup>, Purdue University<sup>28</sup> or Stackoverflow<sup>29</sup>. To further illustrate the use of badges in industry, we will now provide some concrete examples.

### 3.5.1 IBM and badges

IBM currently offers more than one thousand different badges<sup>30</sup>. IBM's badges are issued in accordance with the open badges standard (as defined by Mozilla). IBM uses Acclaim as its badge hosting platform. (Acclaim is an initiative set up by Pearson VUE.)

Most IBM badges are issued automatically once training and/or an exam is completed and more than 70% of badge earners say an IBM Open Badge improves their career opportunities.

The different types of badges offered by IBM include:

- IBM Knowledge Badge: associated with content in a broad range of topics, with learning assessment to validate the acquired knowledge.
- Skills Badge: associated with the application of knowledge, with learning assessment.
- Proficiency Badge: includes the evaluation of knowledge and skills to evaluate the candidate's capacity to perform job functions.

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<sup>27</sup> <https://datascience.uci.edu/data-science-certificate-program/> Consulted 2017

<sup>28</sup> <https://www.itap.purdue.edu/studio/passport/> Consulted June 2017

<sup>29</sup> <http://stackoverflow.com/help/badges/> Consulted June 2017

<sup>30</sup> <https://www-03.ibm.com/services/learning/ites.wss/zz-en?pageType=page&c=M425350C34234U21>

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- Professional Certifications Badges: with the following business units: IBM Analytics, IBM Cloud, IBM Security, IBM Systems, IBM Watson and IBM - Watson Internet of Things.
- Other Badges are also offered related to contests, memberships, certain types of employees etc.

IBM's Big Data University is not an accredited institution. It offers online free training through several sites:

- BigDataUniversity.com: Most of the courses are in English, but there are also some courses in Japanese, Spanish and Russian.
- BigDataUniversity.com.br: launched in July 2015 for students in Brazil. It offers courses in Portuguese.
- BigDataUniversity.com.cn: launched in August 2015 for students in China. It offers courses in Mandarin. The site and all course materials are hosted in China.

IBM's Big Data University issues badge at three different levels:

- Level 1 (1 star): It proves basic knowledge in the selected area. Badges are awarded by passing the first course in the selected learning path.
- Level 2 (2 stars): It proves complete knowledge in the selected area. Badges are awarded after **all the courses** in a learning path are passed.
- Level 3 (3 stars) (*Not offered yet*): This badge will indicate a complete knowledge in several related areas. This badge will be awarded upon passing the requirements of two or more learning paths.

### 3.5.2 Microsoft and badges

Microsoft's Badge program<sup>31</sup> was launched in October 2016. Not all Microsoft certifications have a corresponding badge; and additional badges are being evaluated. Currently, there are badges for the following certifications:

- MTA: Microsoft Technology Associate certifications do not qualify as a MCP, so we are not considering them here
- MCSA: Microsoft Certified Solutions Associate
- MCSE: Microsoft Certified Solutions Expert
- MCSD: Microsoft Certified Solutions Developer

The next section compares these recognition strategies according to the main characteristics identified from the EU political trends discussed in Chapter 1.

## 3.6 A Comparison of Recognitions with a Recommendation

We began by reviewing current political trends in Europe regarding skills recognition and then we gave a brief overview of different popular skills recognition tools. The

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<sup>31</sup> <https://www.microsoft.com/en-ie/learning/badges.aspx>

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goal of this section is to evaluate the suitability of the recognition tools based upon the previously identified European political trends along with a short list of properties specific to data science. Lastly, based upon the evaluation we will recommend a scheme for the recognition of data science skills in Europe.

### 3.6.1 Properties specific to data science

Before proceeding to the comparison, we would like to include a few additional properties not previously mentioned in Section 2.5 and which are specific to the rapidly evolving area of data science. Additionally, skills recognition in data science should:

- P10 require renewal after a set period of time
- P11 provide a framework which can quickly adapt to changes in skill requirement
- P12 measure skills on a highly granular and an individual by individual basis

### 3.6.2 The comparison

It should be noted that many of the recognition tools are very flexible, thus in certain cases they could or could not satisfy a certain property depending upon the implementation of the tool. When this occurs we will mark that fact with a “ ✓ ? ” in Table 3.

## 3.7 Discussion

In the previous comparison the two tools, which showed the worst scores were accreditations and labels. Simply put, accreditation is a tool used to ensure that an educational program meets some minimum requirements for it to issue degrees. As such, it is not suited for the recognition of data science skills. Labels have more promise but again are a tool used to recognize traditional educational programs as a whole and not an individual’s learning outcomes. University degrees have many strong points but fall short in that they:

- are neither very transparent nor individual,
- do not traditionally recognize informal and non-formal learning,
- are not very granular,
- are not traditionally digital, and lastly
- are not well suited to recognizing quickly changing skills.

Badges and certificates both contain all of the desired properties and thus our recommendation will be a mix of both of these tools.

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Desired Property	Accreditation	University degree	Certificate	Label	Badge
P1 - transparent, accessible and allow the easy comparison of students' skills throughout the EU			✓	✓?	✓
P2- include an assurance of quality	✓	✓	✓	✓	✓?
P3 - provide tools for their verification and validation	✓?	✓?	✓?	✓?	✓
P4 - include skills acquired through traditional, digital, online, and open learning, as well as the validation of informal and non-formal learning		✓?	✓	✓?	✓
P5 - compatible with the EQF		✓?	✓	✓	✓
P6 - influence the relevance of the skills being acquired		✓?	✓	✓	✓
P7 - allow the digital analysis of both the demand for and the availability of skills			✓?		✓
P8 - allow their use online: in platforms like the Europass, social media and on mobile devices		✓?	✓?	✓?	✓
P9 - focus on learning outcomes and not on traditional measures such as hours of study		✓?	✓	✓	✓
P10 - require renewal after a set period of time			✓		✓
P11 - provide a framework which can quickly adapt to changes in skill requirement			✓	✓?	✓
P12 - measure skills on a highly granular and an individual by individual basis			✓		✓

**Table 3: Comparison of different skills recognitions**

## 4 Recommendations Regarding Data Science

### Skills Recognition

Given that both certificates and badges manifest all the properties which we found desirable in a skills recognition tool, we propose a hybrid approach drawing from the strengths of both badges and certifications.

We begin with a summary of the needs of all stakeholders in the data science ecosystem.

Data scientists need:

- (DS-N1) Credentials, which are widely recognized
- (DS-N2) Credentials, which can be easily verified online
- (DS-N3) A simple way to digitally display their skills online and in social networks
- (DS-N4) Mechanisms to formally recognize skills acquired through informal and non-formal training

Employers who hire data scientists need:

- (EM-N1) Tools to verify the authenticity of credentials
- (EM-N2) A skills recognition framework, which facilitates the comparison of candidate skills throughout the EU
- (EM-N3) Influence in the process of designing the types of training data scientists receive
- (EM-N4) A scheme for recognizing skills in data science, which can quickly adapt to changes in the data science ecosystem

Educators who train data scientists need:

- (ED-N1) Publicity for their programs and the added value that an externally branded recognition of their training can provide
- (ED-N2) Recognitions for the partial completion of their programs to assist students who are seeking employment while studying or students who abandon their studies
- (ED-N3) Contact with employers, a mechanism to clarify the changing needs of industry and clear recommendations regarding how to adapt to those needs

The BDVA needs:

- (BA-N1) To establish sources of revenue to ensure its continuity (by increasing its self-sufficiency)
- (BA-N2) To firmly establish its brand

Accordingly, our recognition approach will be based on the following elements:

- The use of Open Badges. (DS-N2, DS-N3, EM-N1, EM-N4, ED-N2)

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- Experts from industry and academia will contribute to both defining and maintaining the badge scheme. (DS-N1, EM-N2, EM-N3, EM-N4, ED-N1, ED-N3)
  - An initial proposal regarding both the types and the requirements of the badges will be based upon the work of the EDISON<sup>32</sup> and EDSA<sup>33</sup> projects. These projects have focused a great deal of time and effort in establishing a consensus regarding frameworks for data science education in both industry and academia.
- Badges will only be issued by trusted third parties. By carefully vetting badge issuers and their practices the reputation of the credentials will increase. (DS-N1, ED-N1)
- Supposing that the badges become popular, their requirements will influence the training of data scientists, give prestige to those who issue the badges and give publicity to their branding. (EM-N3, ED-N1, BA-N2)
- Include the recognition of skills acquired through informal and non-formal training. (DS-N4)
- A small application fee will be charged to badge issuers which will be used to finance the review of their applications. If the BDVA chooses to participate in the process, these fees could also be used to help defray the BDVA's operational expenses. (BA-N1)

Table 4 shows that our proposal covers all previously identified needs.

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<sup>32</sup> <http://edison-project.eu/>

<sup>33</sup> <http://edsa-project.eu/>

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	DS-N1	DS-N2	DS-N3	DS-N4	EM-N1	EM-N2	EM-N3	EM-N4	ED-N1	ED-N2	ED-N3	BA-N1	BA-N2
Open Badges	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Industry/Academic Involvement	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Trusted Third Parties	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Impact on Training and Prestige	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Informal/Non-formal Training	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Small Fee	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪

Table 4: Needs vs. Proposal

#### D4.6: A Framework for the Recognition of Data Science Skills in Europe

Though what we are recommending is really a hybrid approach inspired by aspects of certificates and badges, given the novelty and interest by large corporations such as IBM and Microsoft in use badges, we believe that the term “badge” should be used for the new data science skills recognition system.

The only disadvantage to the use of the term “badge” that we see is their currently strong association with informal and non-formal learning. But in light of the growing interest both in academia and in industry to use badges we believe that in the medium-term that association will decrease.



## 5 EC funded projects with a prominent use of badges

Once we have reached the conclusion that a hybrid approach, which we will call “badges”, is our recommendation for the recognition of data science skills, in this section we will establish the fact that a number of other important projects funded by the EU have also recommended the use of badges.

### 5.1 Open Badge Network (2014-1-DE01-KA200-000675)

The aims and objectives of Badge Europe<sup>34</sup>, BEU (pronounced “Be You”) were to exploit the benefits of Open Badges to provide a European contribution to the leadership of the worldwide Open Badge movement. It facilitated systematic access to the recognition of non-formal and informal learning, placing formal and informal recognition of learning on the same level. It also helped to create the conditions for a Europe-wide and worldwide recognition of learning achievements as well as new employment and learning opportunities.

BEU developed a network of organizations and practitioners to promote the use of Open Badges for the recognition of learning. It made recommendations and implement improvements to the Open Badge Infrastructure, technologies, and services. In fact, it intended to develop a trustworthy infrastructure to increase job market fluidity and a seamless environment for the recognition of individual skills to full qualification. Those activities were carried out directly, with the support of Open Workshops and a MOOC.

### 5.2 The Digital Workplace: skills for a changing work environment (2015-1-IT01-KA202-004831)

The purpose of this project was to promote an innovative organizational approach for working and meet the needs of a market and labor world that is more than ever globalized, digitally embedded and ever changing<sup>35</sup>. The project addressed these needs by defining a methodology for providing key staff and companies with a set of critical skills. This skill-set was mostly digital but also encompasses communication, organization and stress management.

The project therefore aimed to identify and define best practices and to define the profile for the “ideal” digital worker and employer, and thereby to define an appropriate skill-set and competence-based training and certification. It also aimed to design and test the certification scheme for workers and employers, with clear

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<sup>34</sup> [www.openbadgenetwork.com/](http://www.openbadgenetwork.com/)

<sup>35</sup> <http://digitalworkplace.education/>

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evaluation rubrics, audit and awarding mechanisms. It was based on the innovative use of Open Badges.

### 5.3 Recognition of Valid and Open Learning (2016-1-LT01-KA202-023131)

Recognition of Valid and Open Learning<sup>36</sup> (ReOPEN) directly addressed the recommendations published in the study of the European Commission "Validation of Non-formal MOOC-based Learning" [Witthaus,2016] implemented in 2014-2015.

More specifically, it focused on designing a platform for non-formal open learning curriculum development, training teachers and trainers (T&T) at C-VET organizations, companies, higher education (HE) institutions and adult learning organizations. One of its goals was to design a validated non-formal open learning curriculum using digital badges as a new form of digital credential. It also facilitated the tracking one's learning path in non-formal open learning and to recognize non-formal open learning results in formal curricular.

### 5.4 European Badge Alliance (2015-1-IT03-KA205-005757)

The European Badge Alliance<sup>37</sup> was a project aimed at innovating the recognition, validation and communication processes of key competences acquired by young people in non-formal and informal learning contexts. Emphasis was placed on learning mobility, in order to increase personal and professional development, the participation in learning and employability.

This project aimed to increase the use of badges as an innovative tool for the recognition of key competences from non-formal and informal learning among young people in Europe. It also hoped to raise awareness regarding the importance of improving the recognition of key competences learned through mobility among decision makers and to increase the integration and interaction among non-formal, informal and formal learning, including vocational educational training.

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<sup>36</sup> [reopen.eu/about-project/](http://reopen.eu/about-project/)

<sup>37</sup> [ebawebsite.net/](http://ebawebsite.net/)

## 6 Workflows for Awarding Badges for Skills in Big Data

The purpose of this section is to describe in detail the different workflows proposed for the awarding of badges for skills in big data. The initial implementation of these workflows will be the responsibility of members of the BDVe project. But, it is important that they all be sustainable (in terms of cost and effort) and designed so that before the end of the BDVe project (December of 2020) they could be completely implemented by the BDVA Skills Work Group.

Please note: Approval by the Board of Directors of the BDVA for the BDVA's participation in these workflows is still pending. However, in the interest of simplifying the following explanations, we will *assume* that this proposal will be accepted. If not, the participation of another association will be explored.

In the following sections, we will describe the five main processes:

- Process 1: Program Applies to be a Badge Issuer
- Process 2: Student Requests Badge
- Process 3: Approval of a New Badge or Changes to Existing Badge
- Process 4: Registering of Badge Application Reviewers
- Process 5: Renewal of Badge Issuer Status

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These processes include the following actors and roles:

Actor	Role
BDVA Skills Group	Define and revise badge requirements
BDVA Skills Group	Manage the review of applications to issue badges
Reviewers	Review applications to issue badges
Educators and/or Programs	Evaluate skills and issue badges branded by the BDVA
Badge hosting platform	Validate issued badges

**Table 5: Actors and roles in badge workflow**

### 6.1 Process 1: Program Applies to be a Badge Issuer

Assuming that a collection of approved badges already exists, this process describes the workflow involved in recognizing a new badge issuer. Here the basic underlying idea is that badges will not be directly issued by the BDVA (or BDVe) but rather by individual educators or programs. (It should be noted that the same badge can be issued by different educators or programs.) In this sense, this workflow is somewhat like an accreditation process, but due to legal implications of the notation of accreditation, we will not use that terminology. The heart of the process involves the external review of documentation presented by an educator or a program to insure that the training in question meets the existing requirements for the badge.

#### 6.1.1 Application

The core of this process begins with an educator or a program interested in issuing badges submitting an application during an open call for badge issuers. In order to apply, the educator or program must complete an online application form, submit supporting documentation, and pay an application fee. (The exact nature of this form and documentation as well as the amount of the fee is determined in Process 3 on a badge-by-badge basis.)

#### 6.1.2 Review

As part of the preparation for a call for badge issuers, a Chief Evaluator is selected by the BDVA Skills Work Group for the call. Upon receiving an application, the Chief Evaluator selects three reviewers. Two of these reviewers prepare a report (an online form) to assess whether the program meets the requirements of the badge. This report is submitted to the Chief Evaluator. The Chief Evaluator determines

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whether the two reviews are both positive, if so the review process ends. If only one was positive, a third review is requested.

In both cases (two or three reviewers), if two positive reviews are received the application is accepted. If only one of the reviews was positive the applicant is given the chance to revise their application or to appeal. Appeals and revisions are resent to all application reviewers. Appeals are accepted if two reviewers agree with the allegations. If only one agrees, one last opportunity is given to revise or appeal. Revisions are accepted if two positive reviews are received.

In all cases, if no positive reviews are received the application is denied.

Upon the completion of the review process, the Chief Reviewer and all application reviewers are compensated for their work. The Chief Reviewer also reports on the performance of each reviewer. These performance reports are then used to assist future reviewer selections.

Lastly, in the interest of quality assurance and the improvement of the entire process, some additional steps are included in the workflow. At the start of a review period a meeting is held with all reviewers to establish common criteria for the evaluations. At the end of the evaluation period a debriefing meeting is held with all the reviewers to collect feedback and suggestions for improvement. Also, during the review process the BDVA will consider all the reviews as a whole to ensure consistency, and when significant variations are detected applications are sent to be re-reviewed.

### 6.1.3 Approval

If an application is accepted, the badge management platform is notified and adds the appropriate permissions for the educator or the program to issue the badge in question. Lastly the program is notified of the success of its application.

6.1.4 Work Flow Diagrams

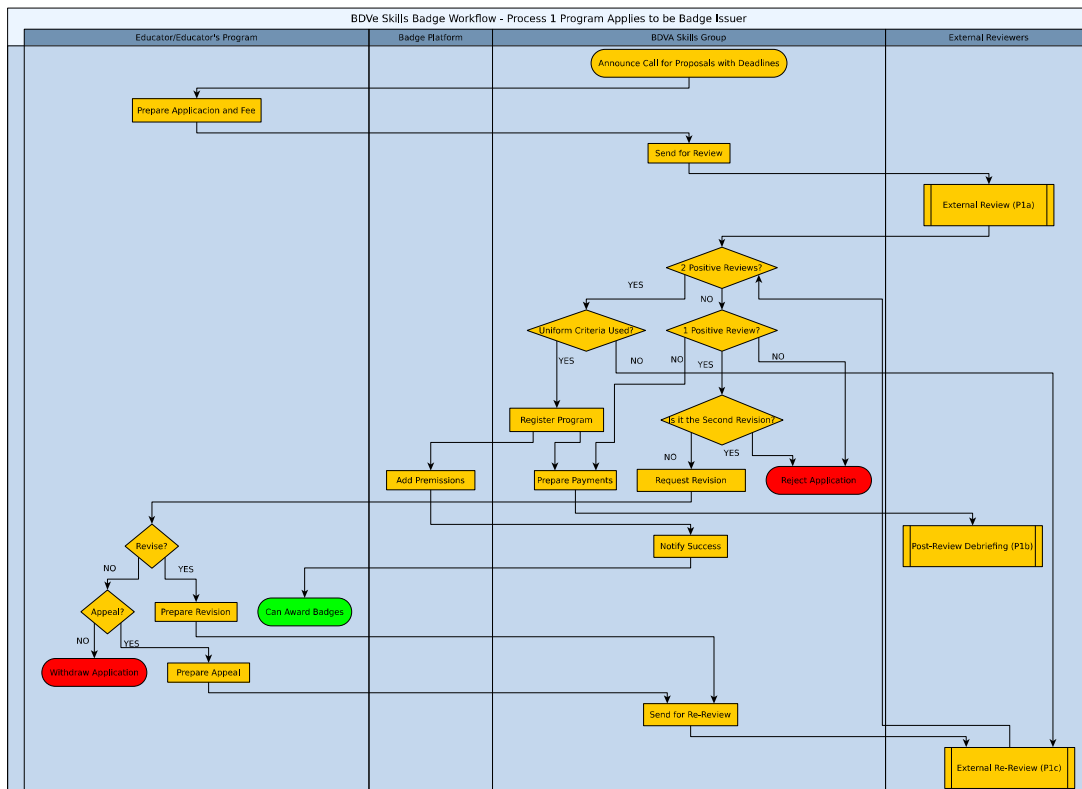


Figure 1: Process 1 Program Applies to be Badge Issuer

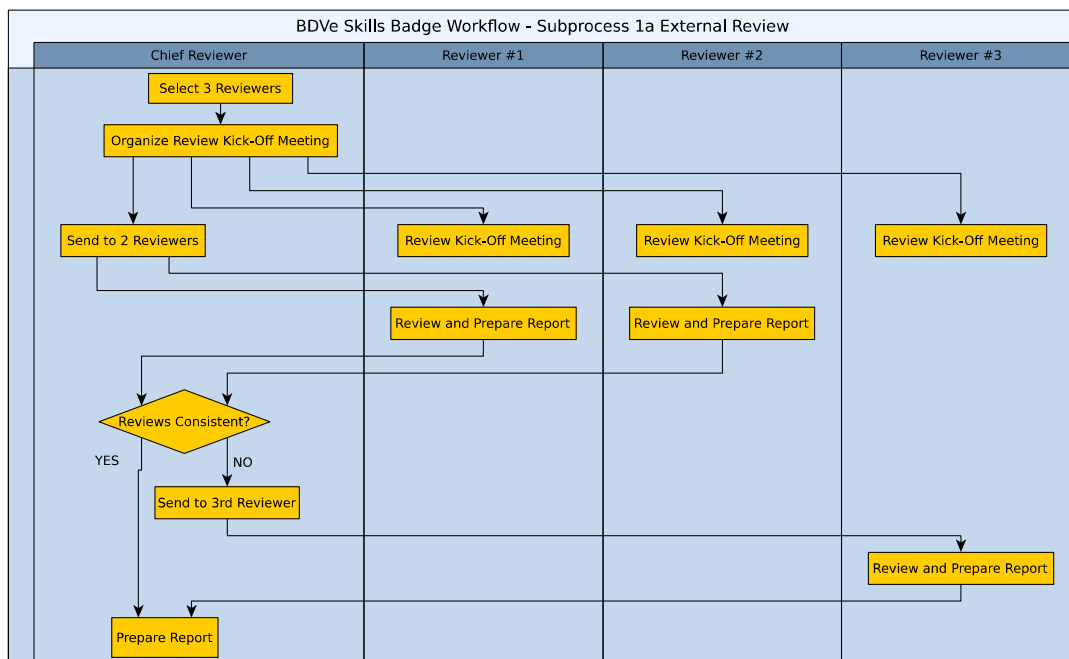


Figure 2: Subprocess 1a External Review

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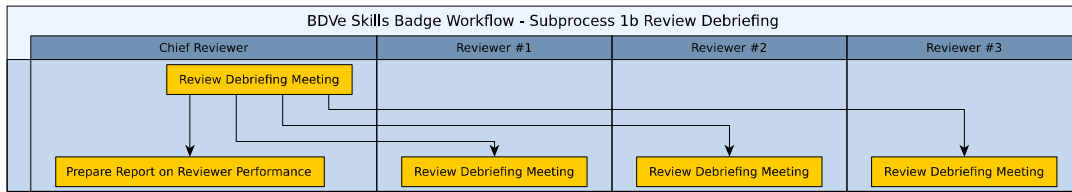


Figure 3: Subprocess 1b Review Debriefing

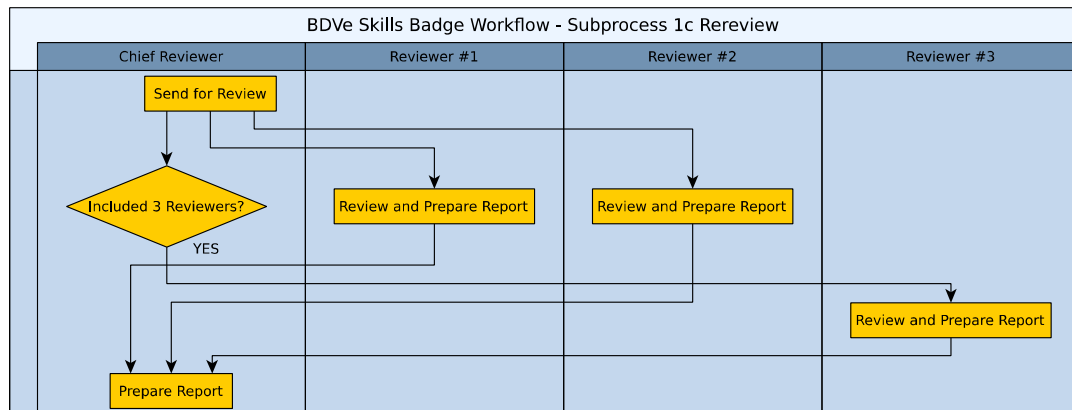


Figure 4: Subprocess 1c Rereview

## 6.2 Process 2: Student Requests Badge

Assuming that the student has attended a skills related activity sponsored by an existing badge issuer, this process describes the steps involved in awarding a badge to that student.

### 6.2.1 Badge Application

Educators or programs can issue badges upon request or automatically upon the completion of an activity. In the case of automatically issuing badges, the student's application for a badge can be omitted.

The slightly more complicated case begins with a student requesting a badge. The request is received by a skills related educator or program. In both cases (upon request or automatically), the educator or program first determines whether the student has met the badge's requirements. If the requirements have been met, the necessary meta-data for the badge are prepared (dates, evidence, etc.) and submitted to the badge platform. The platform verifies that the educator or program has permission to issue the type of badge in question. If permission exists the badge is sent directly to the student. If not, the assumption is made that there has been an error in the data sent and the educator or program is requested to resubmit the request.

It should be noted that neither the BDVA Skills group nor the BDVe participates in this process.

### 6.2.2 Work Flow Diagram

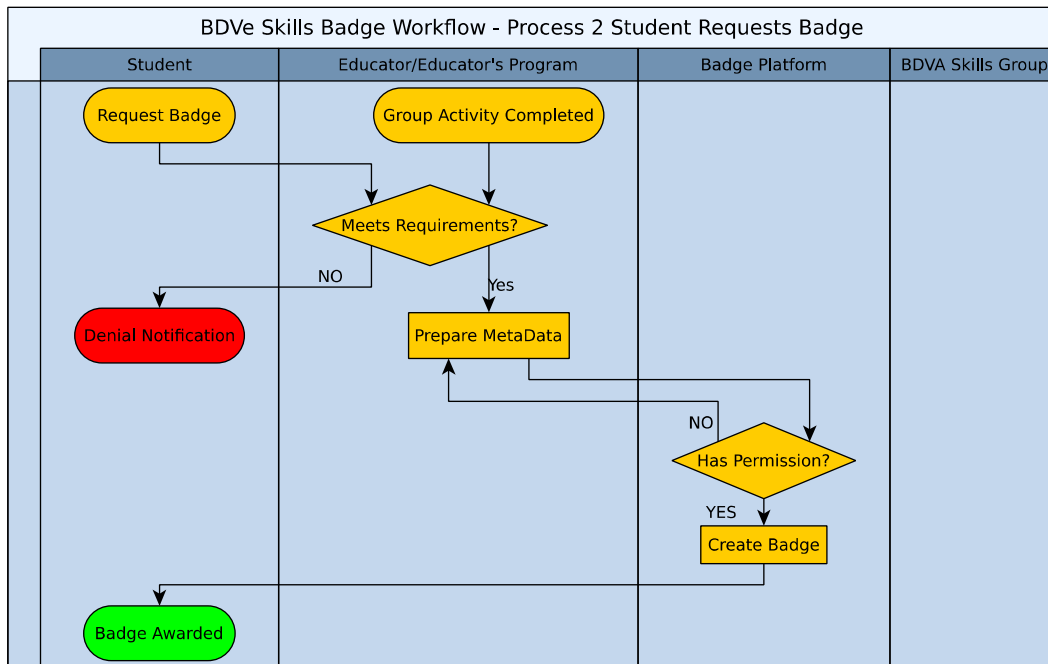


Figure 5: Process 2 Student Requests Badge

### 6.3 Process 3: Approve a New Badge or Change an Existing Badge

This process begins with a member of the BDVA Skills Group proposing a new badge or the modification of an existing badge.

This proposal is sent to the group's secretary who then passes it along to all members of the BDVA Skills Group at least 14 days prior to a meeting of the group.

In order to discuss new badges or changes to existing badges a quorum of at least 1/3 of the group's members must be present at a meeting. In order to approve proposals, a simple majority of the members present at the meeting must agree with the proposal.

Upon the approval of changes in existing badge requirements, current badge issuers can continue to issue badges using the previous requirements for a maximum of 12 months. During this 12 months period issuers must reapply to issue the new badge based upon the new requirements.



### 6.3.1 Work Flow Diagram

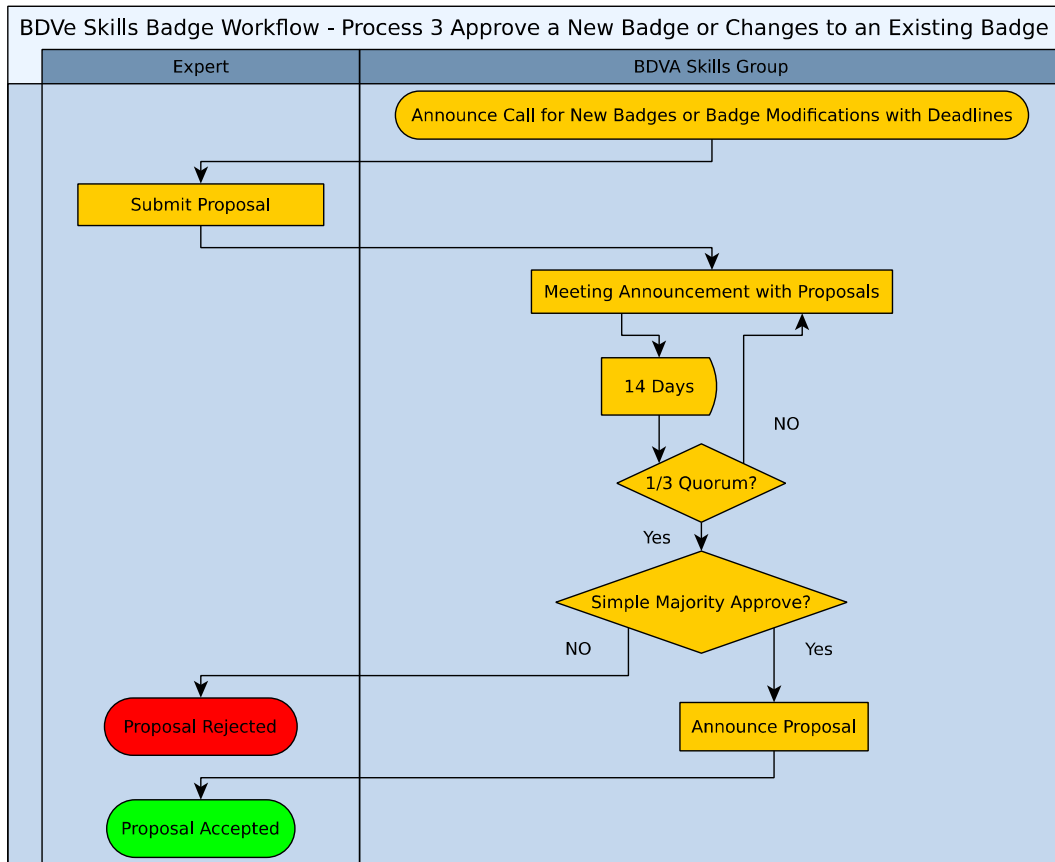


Figure 6: Process 3 Approve a new Badge or Changes to an Existing Badge

## 6.4 Process 4: Registering of Badge Application Reviewers

When determined necessary by the BDVA Skills Group, a call for badge reviewers can be opened. Any expert employed full-time by full members of the BDVA association can apply to be a badge reviewer. Applicants are required to submit an online form along with a CV. All applicants who meet the membership requirement are registered, however this does not guarantee that they will be selected to review. (Reviewer selection is made in Process 1 and 5 and is decided by the Chief Reviewer.)

### 6.4.1 Work Flow Diagram

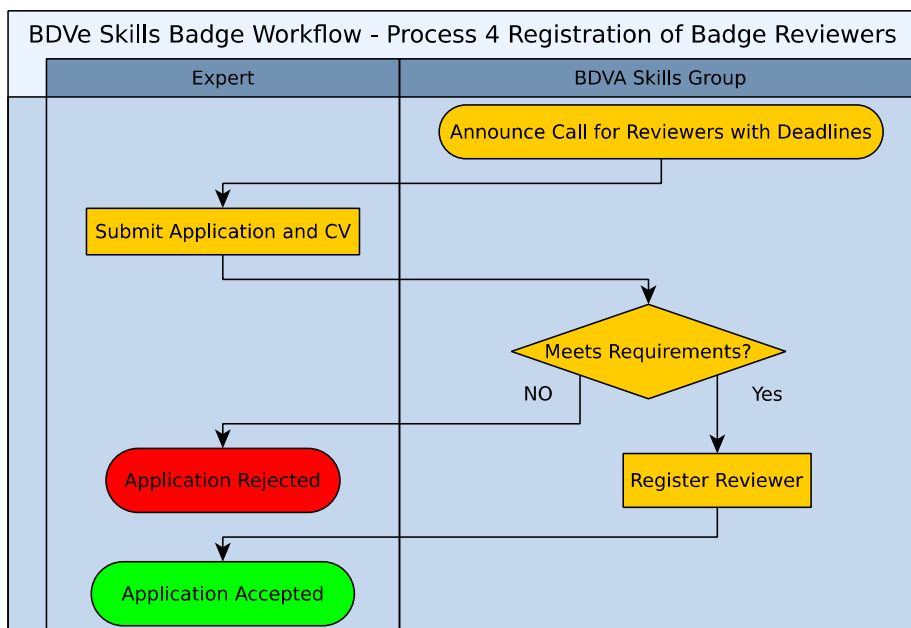


Figure 7: Process 4 Registration of Badge Reviewers

### 6.5 Process 5: Renewal of Badge Issuer Status

Badge Issuer status is granted for a period of four years. At the completion of that time issuers need to apply to renew their status. The workflow here is identical to that of Process 1, with the exception being the content of the application. While the application in Process 1 is focused on meeting the badge's requirements, here the focus of the application is on quality assurance and program improvement.

## 7 Timeline

Activity Description		Start Date	End Date
<b>Propose a BDVe skills recognition system</b>		<b>01/2017-</b>	<b>06/2018</b>
	Propose type and logistics of the recognition system	01/2017-	06/2017
	Propose the categories and levels of recognition	06/2017-	01/2018
	Propose criteria for recognitions	01/2018	06/2018
	Establish community consensus regarding the recognition system and criteria	06/2017-	06/2018
<b>Rollout Phase 1: Pilot of 2-3 badges with focus on traditional programs</b>		<b>06/2018</b>	<b>06/2019</b>
	Setup badge hosting platform and web for submitting/reviewing badge issue requests	06/2018	01/2019
	Publicize badge program	06/2018	01/2019
	First call for badge issuers	01/2019	03/2019
	First badges issued	03/2019	06/2019
<b>Rollout Phase 2: All badges with focus on traditional programs</b>		<b>06/2019</b>	<b>01/2020</b>
<b>Rollout Phase 3: Badges for informal and non-formal learning</b>		<b>1/2020</b>	<b>12/2020</b>

Table 6: Proposed timeline

## 8 Future Work

Once this document has been reviewed and accepted by the BDVA, the next steps are:

- Propose the types of badges to be offered, their contents and requirements. In this process we expect to include work from both the EDISON and EDSA projects discussed in chapter 5.
- Agree upon a schedule for the progressive implementation of the badges. Rather than attempting to implement the entire set of badges in one step, we plan to begin modestly with a limited number of badges and then use the experiences with those badges to improve the roll-out of the remaining badges.
- Propose a business plan for the badge workflows.
- Start to accept applications to issue badges.

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