European Union
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INSTITUTE OF PUBLIC ADMINISTRATION

OPERATIONAL PROGRAMME GOOD GOVERNANCE

Models for assessing digital competence

Sofia, 2021

Project BG05SFOP001-2.017-0001/28.11.2019 "Digital Transformation in Learning - Digital Competence and Learning", funded by Operational Programme "Good Governance", co-financed by the European Union through the European Social Fund.

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Analytical document

MODELS FOR ASSESSING DIGITAL COMPETENCE

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ISBN 978-619-7262-24-7

ANALYTICAL DOCUMENT: MODELS FOR ASSESSING DIGITAL COMPETENCE

Abstract: On 18 December 2006, with a Recommendation of the European Parliament and the Council of the EU on key skills, digital competence was recognised as one of the 8 key competences for lifelong learning by the European Union. In 2010, the European Commission's European Strategy 2020 recognized digital competence as a fundamental basic skill. In 2013, the European Commission published the European Digital Competence Framework for Citizens, also known as DigComp, which offers a tool to assess and improve citizens' digital competences. Currently DigComp framework is in version 2.1 and defines 21 competencies mapped to 5 competence areas.

The purpose of the Analytical report is to propose a model for digital competencies assessment for public servants, based on the best practices in European Union countries in the last 5 years.

To align with the purpose in the Analytical report are presented: the evolution of the DigComp framework throughout the years; detailed overview of five projects; research data based on face-to-face- interviews with representatives of Public Administration Institutes of Poland and Slovenia and survey among 1056 public servants in Bulgaria.

Key words: DigComp, digital competence, competence framework, competence assessment, public sector, public servants, Bulgaria

Dr. Teodora Varbanova was born in the city of Veliko Tarnovo, where she graduated from the Language School "Prof. Dr. Asen Zlatarov" with a major in English. In 2002 she obtained a Master's degree in Political Science and in 2005 a Master's degree in Business Administration from Sofia University "St. Kliment Ochridski".

Over the years, she has attended training programs at INSEAD, London Business School, Kellogg School of Management at Northwestern University in economics and political science.

Member of the educational program of the Bulgarian Association for Information Technology (BAIT) in the period 2008-2016, member of the expert group at the National Agency for Vocational Education and Training in the period 20012-2016, member of the Digital Skills Working Group @DIGITALEUROPE in the period 20018-2020.

Theodora Varbanova's professional career developed in a large international company, where she currently holds a regional position.

She speaks English and Russian.

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ANNOTATIONS

The overall objective of this analytical document is to propose the development of self-assessment models (including tools such as quizzes, practical tasks and case studies) for civil servants to self-assess their level of competence, as well as a model for objective independent external assessment by examination, based on the DigComp framework and best practices in the European Union. In order to meet the objective of the assignment, the DigComp framework is reviewed, good practices from countries in the European Union are considered, from which individual components are borrowed in the design of the self-assessment and external assessment models. A survey of 1056 civil servants was conducted to assess attitudes among this target group towards enhancing digital competences through training programmes. The proposed self-assessment and independent external evaluation models are based on both the best practices analysed and the results of the survey.

In this document, the international translation of digital is used, not the Bulgarian version.

This document uses the term competence as a set of knowledge, skills, and attitudes towards a particular activity.

As the European Digital Competence Framework DigComp does not have an official Bulgarian translation, the author has used terminology from official publications, explicitly indicating the source.

INTRODUCTION

Boosting digital skills is one of the European Commission's top priorities. In January 2018, the Commission adopted a Digital Education Action Plan, which includes 11 initiatives to support the use of technology and the development of digital skills in education. Alongside the Action Plan, a working document has been adopted which describes the details of the Commission's approach to digital education. The Action Plan has three priorities, setting out measures to help EU Member States address the challenges and opportunities of education in the digital age.

Priority 1: Better use of digital technologies for teaching and learning

This priority will be implemented through the following specific initiatives:

1. Closing the connectivity gap between EU Member States in relation to the roll-out of very high-capacity broadband to all European schools by: i) raising awareness of the benefits for schools and the funding opportunities available ii) supporting connectivity, namely through a voucher scheme targeted primarily at less favored areas and ensuring full deployment of the rural toolkit; iii) publishing data on the progress made.

2. Support the digital readiness of general and vocational schools by strengthening their digital capacities and by using the SELFIE self-assessment tool of one million teachers, trainers and learners by the end of 2019 in all EU Member States and in the Western Balkan countries; promote a mentoring scheme at national/regional level, supported by an awareness-raising platform at EU level.

3. Provide a framework for issuing digitally authenticated qualifications and for validating digitally acquired skills that are credible and that are described in different languages and can be stored in professional profiles (CVs) such as Europass. The framework will be fully aligned with the European Qualifications Framework for Lifelong Learning (EQF) and the European Classification of Skills, Competences, Qualifications, and Occupations (ESCO).

Priority 2: Developing the digital competences and skills needed for digital transformation

This priority will be developed with the following specific initiatives:

1. Creating a pan-European platform for digital higher education and enhanced cooperation. With the support of Erasmus+, the new platform will serve as a single point of contact and offer: online learning, blended mobility, virtual campuses, and exchange of best practices between higher education institutions at all levels (students, researchers, and teachers).

2. Strengthening open science and citizen science in Europe by piloting specific training, including ongoing professional development courses on open science in higher education institutions at all levels (students, researchers, and teachers).

3. Introduce coding classes in all schools across Europe, including by increasing school participation in European Coding Week.

4. Tackling the challenges posed by digital transformation via the launch of: i) a pan-European awareness-raising campaign targeting teachers, parents, and students to promote online safety, cyber hygiene, and media literacy; and ii) a cyber security training initiative based on the Citizens' Digital Competence Framework to empower people to use technology confidently and responsibly.

5. Support measures to further reduce gender gaps in the technology and entrepreneurship sectors by promoting digital and entrepreneurial competencies among girls; mobilize stakeholders (businesses, NGOs) to develop girls' digital skills and provide them with inspiring role models, building on the Citizens' Digital Competency Framework and the Entrepreneurial Competency Framework.

Priority 3: Improving education through better data analysis and forecasting

This priority will be developed through the following specific initiatives:

1. Collecting data on ICT use and digital skills in schools through the publication of a benchmark survey to assess progress on ICT inclusion in education. This survey will

address the availability and use of ICT infrastructure and digital tools, and digital skills levels. Together with the next round of the PIAAC survey, the results can be used to update the Digital Competency Framework. The Commission will also work with the OECD on the development of a new module in PISA related to the use of technology in education and will explore the appropriateness and feasibility of proposing new benchmarks to the Council on competences in digital technology and entrepreneurship.

2. Launching in 2018 projects on artificial intelligence and learning analytics in education to make better use of the vast amount of data currently available and thus contribute to tackling specific problems and improving the implementation and monitoring of education policy; develop appropriate tools and guidance for Member States.

3. Laying the foundations for a strategic foresight of the main trends arising from the digital transformation for the future of education systems, in close cooperation with experts from the Member States and using existing and future EU-wide cooperation channels in education and training (COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, 2018).

A EUROPEAN DIGITAL COMPETENCE FRAMEWORK FOR CITIZENS DIGCOMP

On 18 December 2006, the Recommendation of the European Parliament and the Council of the EU[1] on key competences recognised digital competence as one of the 8 key competences for lifelong learning by the European Union. In 2010, the European Commission's "European Strategy 2020"[2] recognised digital competence as a fundamental basic skill. In 2013, the European Digital Agenda was launched. The European Commission published the European Digital Competence Framework for Citizens[3] , also known as DigComp, which offers a tool to assess and improve citizens' digital competences. It was developed after an intensive two-year research and consultation process involving more than 120 experts and various stakeholders from the EU Member States through the European Commission's Joint Research Centre (JRC). The first version of DigComp was presented in 2013, with periodic additions and changes. The latest version is DigComp 2.1[4] was presented in 2018, and a new revision process for the framework has been initiated as of January 2021, with the new version to be released in early 2022.[5]

The reference to DigComp in European Union policy documents allows initiatives at national and local level to be formulated within the framework of broader European strategies on education and training, innovation, the digital agenda, etc., and at the same time all these initiatives can be shared and extended in other EU countries.

DigComp defines 5 competence areas and 21 competences, respectively, which outline the key components of digital competence. The domains are:

[1] RECOMMENDATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, 2006 EUR-Lex - 32006H0962 - EN - EUR-Lex (europa.eu): Last logged in date: August, 2021

[2] EUROPE 2020: A European strategy for smart, sustainable and inclusive growth EN (europa.eu) Last logged in date: August, 2021

[3]European Digital Competence Framework for Citizens JRC Publications Repository - DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe. (europa.eu) Last user login date: August, 2021

[4] DigComp 2.1: The Digital Competence Framework for Citizens https://publications.jrc.ec.europa.eu/repository/handle/JRC106281 Last User Login Date: August, 2021

[5] See Appendix 1: Updates to Digcomp version 2.0 versus DigComp version 1.0

Table 1: DigComp Competence Framework (Stephanie, Riina, & Yves, 2017)

Areas of competence	Competence
1. Information and data	1.1 Browsing, searching and filtering data, information and digital content
	1.2 Evaluating data, information and digital content
	1.3 Managing data, information and digital content
2. Communication and cooperation	2.1 Interaction through digital technologies
	2.2 Sharing through digital technologies
	2.3 Citizen participation through digital technologies
	2.4 Collaboration through digital technologies
	2.5 Netiquette
	2.6 Digital identity management
3. Content creation	3.1 Developing digital content
	3.2 Integrating and repurposing digital content
	3.3 Copyrights and licenses
	3.4 Programming
4. Safety	4.1 Protection of electronic devices
	4.2 Protection of personal data and privacy
	4.3 Protection of health and welfare
	4.4 Protection of the environment
5. Problem solving	5.1 Solving technical problems
	5.2 Identifying needs and technology responses
	5.3 Creative use of digital technology
	5.4 Identifying digital competency gaps

Competence areas 1, 2 and 3 refer to competences that can be monitored and assessed in terms of specific activities and applications. Areas 4 and 5 are 'transversal' [6], or those that apply to any kind of activity that can be carried out by digital means.

The European Digital Competences Framework helps to monitor citizens' digital skills effectively and supports the development of education and training programmes. In terms of decision-making at organisational, regional and national level, DigComp provides a clear picture of the level of digital competence of citizens in relation to their belonging to different social and economic groups, such as the level of digital competence of teachers, or of the elderly, or of underage students, etc.

[6] The term 'transversal competences' is defined as key knowledge, skills and competences from different domains and their practical application.

When it was first introduced in 2013. The DigComp framework defines 3 levels of proficiency for each competency: basic, intermediate and advanced. The updated DigComp 2.0, introduced in 2015, refined the description of the competency areas as well as the corresponding competencies, but retained the three levels of proficiency for each competency. In the current version of DigComp 2.1, presented in 2017, a fourth level of competency proficiency has been introduced: in addition to the basic, intermediate, and advanced levels, a specialist level has been introduced. Each of these levels can be divided into two additional sublevels, which help to define the proficiency level of a competency even more precisely. This model of assessment is helpful in the development of precise educational programmes and the implementation of specific strategies in relation to enhancing the digital competences of redefined groups of citizens and the specific roles they play in a digital environment.

Project BG05SFOP001-2.017-0001/28.11.2019 "Digital Transformation in Learning - Digital Competence and Learning", funded by Operational Programme "Good Governance", co-financed by the European Union through the European Social Fund.

Table 2: Digital competency assessment model according to DigComp (Stephanie, Riina, & Yves, 2017)

Main levels	**Basic**		**Average**		**Advanced**		**Expert**	
Sublevels	1	2	3	4	5	6	7	8
Complexity of tasks	Easy task	Easy task	Well explained and routine tasks, clear problems	Well explained tasks and non-routine problems	Various tasks and problems	Most suitable tasks	Solving complex problems with limited solutions	Solving complex problems with multiple interacting factors
Performance autonomy	With help	Independently and with help when needed	Completely independent	Independently and as needed	Helps others	Able to adapt to others in a complex environment	Contributes to professional growth by integrating and supporting others	Proposing new ideas and processes in the field
Cognitive ability	Remembering	Remembering	Comprehension	Comprehension	Application	Evaluation	Creation	Creation

The DigComp framework defines the scope and components of citizens' digital competence in a clear and measurable way. Digital competence is defined at a generic level, without specifying hardware or software solutions and technologies to be mastered. This makes the Framework technologically neutral, but given that digital technologies are constantly changing, it should also be updated periodically.

The nature of DigComp as a reference framework does not imply that it should be applied in its entirety and off-the-shelf, e.g. in the development of a training course or a competency assessment system. On the contrary, it is designed so that **different elements can be applied depending on the objectives, target groups, working conditions, available resources, implementation time and other additional factors**. This report discusses good practices that borrow or partially cover components from DigComp.

Five are typical scenarios in which any organization can implement the DigComp framework (Carretero Stephanie, 2018):

- **Adaptation and specification:** according to the needs of the target group and the implementation context:
  - In DigComp, the description of digital competencies and the resulting learning outcomes, as well as expectations at different levels of proficiency, are described at a generic level. They are open to interpretation and are not tied to a specific technology standard, software solution or product. This characteristic enhances its sustainability given the diverse and ever-changing world of technology. This enables the Framework to be used across all sectors and organisations and for different target groups, while maintaining the reference framework established at European level.
- **Competence assessment**: assessment of the level of digital competence, strengths and weaknesses of the individual citizen or target group.
  - Objectively assessing the level of digital competency helps citizens understand where and what are the gaps they need to fill in order to realize their personal or professional goals and subsequently determine training needs and directions. The evaluation process, repeated over time, supports

both the overall assessment of the effectiveness of the learning materials developed and the training delivered and the planning and development of future activities. In this way, each citizen has the opportunity to create his or her own digital profile, which is most often needed in terms of employment and, in particular, career guidance or career development.

There are several approaches to assess digital competencies (Carretero Stephanie, 2018):

- **Self-assessment test:** each citizen assesses for themselves how well they are coping with the new technologies by being given certain tasks to complete. Also considered is a practice where certain statements are given about different situations in everyday digital life to confirm or reject this initial self-assessment. Through this assessment approach, users receive feedback on their skills, strengths, and weaknesses.
- **Situational test:** users are presented with real situations from different aspects of everyday digital life and are asked to indicate how they would act to find a solution. This approach measures factual knowledge and practical skills and gives a more accurate picture of the user's level of digital competence.
- **Scenario-based assessment**: in this case, users are presented with a scenario where different tools are supposed to be used. This approach most accurately represents the level of digital competence, but is also one of the most difficult to implement from a pedagogical, methodological, and technical point of view. This approach is usually applied in the certification of competence.

❖ **Training of trainers:** determining what digital competences the people who will be trainers should have:

- The increasing use of digital technologies in education and training and the growing trend for new technologies to play an increasingly important role in all areas of education are a new challenge for all educators. In terms of formal education, if until recently the expectations were mainly on IT teachers, today the expectation is that every teacher, through his or her

subject, can develop the digital competences of students throughout the entire educational cycle. The requirements are similar for non-formal education. Taking these irreversible trends into account, the European Framework for Digital Competences in Education (DigCompEdu)[7] was launched in 2017 to support educators in developing educational strategies.

- **End-user training:** design of the training materials and the environment in which the training of the target group will be implemented.
  - An increasing proportion of end-user training is being delivered online through a variety of platforms. DigComp reflects the global trend to virtualize learning both through self-paced learning, where learners go through specific content independently and at their convenience, and through instructor-led, real-time learning that provides the opportunity for interaction between the learner and the instructor. The majority of the projects implemented or in progress based on the Framework show that for users with no or low digital competence, fully online training does not give satisfactory results and therefore, a combined approach - both virtual and face-to-face - is more appropriate.
- **Validation & Certification:** how to validate and/or certify the competences acquired during training.
  - Certification is about the formal validation of a particular skill through a specific technology or set of specific technological solutions by an independent body in a controlled environment. The validation of the level of digital competence refers in this case, mainly to the recognition or provision of proof that can be provided when necessary. This can be various certificates or certificates of training, and recently digital badges that can be shared on social networks have become increasingly popular. Professional certification usually also has a fixed validity period, is linked to additional financial investment, and in all cases relates to enhancing career opportunities.

[7] DigCompEdu: The European Framework for the Digital Competence of Educators Digital Competence Framework for Educators (DigCompEdu) | EU Science Hub (europa.eu) Date of latest user login: August, 2021

There are three areas of socio-economic life where the DigComp framework can be applied (Stephanie, Riina, & Yves, 2017):

- **Education:** In formal education, the expectation today is that schools adapt their curricula from an early age so that digital competences are embedded in all subject areas. It is the responsibility of formal educational organisations (schools, universities, academic institutions) to prepare digitally literate citizens to succeed in the labour market.
- **Continuing Education:** refers rather to the part of the population that, for one reason or another, has not developed the knowledge and skills to be able to realise and participate fully in everyday digital life. These are e.g. the elderly, members of minorities, etc. If they are not covered by continuing education, the risk of being left isolated in today's digital society is very high.
- **Employment:** Today, digital skills are required for almost every job, with certain professions having a mandatory minimum level of proficiency.

The main users of the DigComp framework at an organisational level are three types (Stephanie, Riina, & Yves, 2017):

- **Policy-making organisations:** these are those national or international organisations that develop initiatives in different policy areas: education and training, employment, economic development, public administration, etc. These are ministries, agencies, institutes. For example, ministries of education, national and regional agencies are some of the first to adopt DigComp in the implementation of their long-term strategic goals. It can also be used in the development and implementation of a range of measures related to employment, economic development, public administration, information society development and digitalization. In terms of policy-making organisations, DigComp is used in the following aspects:

  - raising awareness and understanding of the key role of digital competence of the population and the resulting expectations of the education sector;
  - reforming the secondary (school) education sector, in particular the training of teachers and administrators to nurture digital competences in students, revising

curricula and programmes according to modern expectations and introducing new technologies in all subject areas as an integral part of the educational process;

- introducing systems to validate and assess the level of digital competence of citizens, which support long-term decision-making in relation to specific communities, target groups or sectors of the economy;
- planning lifelong learning programmes and initiatives for specific communities and target groups at risk of digital exclusion. Most often, they are related to the development of measures for the implementation of training programmes and the involvement of the appropriate organisations - educational, cultural, social - with the necessary capacity;
- implementing measures to provide employment for young people and to promote the up-skilling of employees, including the creation of new types of jobs (e.g. positions related to the management of the digital identity of organisations in social networks);
- upgrading the skills of civil servants as part of national modernisation programmes for the civil service.

❖ **Educational and training organisations:** these are organisations active in the fields of formal and non-formal education. They can use DigComp both on their own (e.g. at university level) and in national and European networks. When implementing specific projects, these organisations can receive full or partial funding for their costs through various European Union programmes, the largest of which is Erasmus+. For education and training organisations, DigComp is used in the following aspects:

- Developing strategies to increase learners' digital competence and/or implementing follow-up activities, e.g. assessment of the level of proficiency of given competences, training, validation of skills, etc.;
- Implementation of educational projects involving digital competence assessment and/or training aimed at effective labour market implementation, both at school level (vocational schools) and at horizontal level - oriented

towards young people in general and all citizens, by involving them in lifelong learning programmes;

- Development of tools for early assessment of students' digital competences and subsequent development of a long-term strategy and the necessary training tools.

❖ **NGOs and private organisations:** These are all non-profit organisations - foundations, associations, etc., which carry out activities and offer services in the field of non-formal education and training, including specialised digital competence centres. They address numerous and diverse target groups, mainly implementing activities to enhance digital competence in terms of employment. Business organisations and enterprises facing the challenges of digital transformation can also apply the framework. In terms of non-governmental and private organisations, DigComp is used in the following aspects:

- defining, assessing and developing the digital competence of its employees, or supporting the digital transformation of other SMEs;
- offering educational opportunities to young people to help them enter the labour market, including by promoting entrepreneurship;
- assessing the digital competence of users, including through professional certification;
- Motivating certain target groups who are digitally excluded (e.g. the elderly) to develop digital competences, by offering training and other accompanying activities to support their adaptation.

DIGCOMP AND OTHER REFERENCE FRAMEWORKS FOR DIGITAL SKILLS

The Digital Competence Framework for Citizens (DigComp) is fundamental to the development of sectoral reference frameworks at European Union level. Four sectoral frameworks have been developed.

DIGITAL COMPETENCE FRAMEWORK FOR CONSUMERS DIGCOMP CONSUMERS

The Digital Consumer Competency Framework (DigCompConsumers)[8] has been developed in response to the increasing use of technology in everyday activities, which inevitably has an impact on many aspects of citizens' lives, including their choices as consumers. The framework covers the key elements relating to consumer protection in e-commerce; information on businesses, goods, and services; dispute settlement mechanisms, redress, and payment protection. In addition, issues of payment security in electronic environments, privacy of personal/sensitive data, digital content, and participation in P2P (Person2Person) platforms are addressed (Mladenova, 2019).

The DigComp Consumers framework follows the same principles and modular structure as DigComp. In particular, DigComp Consumers consists of:

- 3 areas grouped according to the online shopping process,
- 14 competency areas and their descriptions,
- 210 examples of knowledge, skills, and attitudes.

DigComp Consumers is a stand-alone framework and can be used independently of other available tools, depending on the specific objectives. [9]

[8] The Digital Competence Framework for Consumers The Digital Competence Framework for Consumers | EU Science Hub (europa.eu) Date of last user login: August, 2021
[9] See Appendix 2: Compliance between DigComp and DigComp Consumers.

DIGITAL COMPETENCY FRAMEWORK FOR ORGANISATIONS DIGCOMPORG

In 2015, the European Framework for Digital Competence of Educational Organisations DigCompOrg was developed [10].

It is designed for formal educational organizations - schools, colleges, universities and other academic institutions to support self-evaluation processes in terms of the overall effective integration of technology in the educational process.

DigCompOrg can facilitate transparency and comparability between related initiatives across Europe and can play a role in addressing fragmented and uneven development across Member States.

DigCompOrg can also be used as a strategic planning tool at policy level to promote comprehensive policies for the effective uptake of digital learning technologies in educational organisations at regional, national and European level. It can also serve as a tool to promote the systematic approach needed for the effective use of digital learning technologies.

The DigCompOrg framework has seven key elements and fifteen sub-elements that are common to all education sectors. Additional sector-specific elements and sub-elements can be added. For each of the DigCompOrg elements and sub-elements, 74 scenarios have been developed (Competencies and Frameworks of Reference, 2019).[11]

[10] European Framework for Digitally Competent Educational Organisations European Framework for Digitally Competent Educational Organisations | EU Science Hub (europa.eu) Last user login date: August, 2021

[11] See Appendix 3: DigCompOrg Overview

DIGITAL COMPETENCE FRAMEWORK FOR DIGCOMPEDU

DigCompEdu (2017) has been developed in response to the growing recognition by EU Member States that teachers and educators need additional and specific digital skills to integrate innovation into all areas of the education process.

DigCompEdu follows the DigComp model by describing the specific needs for digital competence enhancement in 6 areas, grouped according to the requirements, taking into account 22 competence areas and their descriptions.

- **Area 1. "Professional engagement"** is aimed at the wider professional environment, i.e. the use of digital technologies in interacting with colleagues, students, parents and other stakeholders, for individual professional development and for the development of the institution.
- **Area 2. "Digital Resources"** focuses on the competences necessary for effective and responsible use, creation and sharing of digital learning resources.
- **Area 3. "Teaching and Learning"** is dedicated to the management and organisation when using digital technologies in teaching and learning.
- **Area 4. "Evaluation"** focuses on the use of digital strategies to improve the student assessment process.
- **Area 5. "Empowering learners"** focuses on the potential of digital technologies for teaching and building learning strategies.
- **Area 6. "Supporting students' digital competences“** describes the specific pedagogical competences needed to support students' acquisition of digital competences (Competences and Reference Frameworks, 2019)[12].

[12] See Annex 4: DigCompEdu Overview

E-COMPETENCE FRAMEWORK (E-CF) VERSION 3.0

In 2014, the Commission presented the European e-Competence Framework (e-CF) version 3.0, which defines 40 competences that are required and applied in companies and organisations operating in the information and communication technologies (ICT) sector. The e-CF is structured in four dimensions. They reflect different levels of business process and human resource planning requirements, in addition to job proficiency guidelines, and are defined as follows:

- **Dimension 1:** Contains five areas of e-competence derived from ICT business processes:

PLANNING- CONSTRUCTING - TAKING ACTION - OPPORTUNITIES - MANAGEMENT

- **Dimension 2:** A set of reference e-competencies for each domain, with a generic description for each competency. The common competences identified provide the European common reference definitions of e-CF 3.0.
- **Dimension 3:** Reference levels of e-competence from e-1 to e-5, which are related to levels 3 to 8 of the European Qualifications Framework (EQF).
- **Dimension 4:** Examples of knowledge and skills that relate to the e-competences in dimension 2, without being exhaustive. While competency definitions are embedded in Dimensions 2 and 3, examples of knowledge and skills are provided in Dimension 4 of the framework and are embedded in all three dimensions.

In 2016, e-CF was officially recognized as a European standard (EN 16234-1, 2016) (Mladenova, 2019) [13].

[13] See Annex 5: Overview of the European e-Competence Framework

BEST PRACTICE ANALYSIS OF EUROPEAN UNION COUNTRIES WHICH HAVE IMPLEMENTED DIGCOMP BASED PROJECTS

This section analyses a total of 5 projects implemented by countries in the European Union that have either also been implemented in the public sector or offer elements that would be useful for the development of self-assessment models (including tools such as tests, practical tasks and case studies) for civil servants to self-assess their level of competence, as well as a model for objective, independent external assessment by examination, the analyser being based on the DigComp framework.

ITALY: BREAD AND INTERNET (Pane e Internet)

This is one of the first digital literacy and inclusion projects in Europe, implemented and funded since 2009 by the Regional Government of Emilia Romagna in Northern Italy. For the first few years, numerous training sessions have been organised and delivered in collaboration with local authorities and municipal administrations.

In the second phase of the project, between 2014 and 2017, the government promoted the creation of so-called "Bread and Internet" centres throughout the region. These are local clubs that are established by municipalities in partnership with libraries, schools, associations, and other stakeholders involved in the development of digital competence and inclusion of citizens. The regional government partially finances their establishment and subsequently continues its support by presenting a range of free educational services. The decentralised approach through the involvement of local communities aims to ensure the sustainability of the project in the long term in terms of the main activities: training citizens in digital literacy, helping citizens to use various e-services, organising various local initiatives related to raising the digital awareness of the population. At the same time, in order to minimize the risks of decentralization - working at different speeds, deterioration in the quality of services offered, or dropping some of the set priorities, the regional government is introducing DigComp 1.0. as a unified framework that ensures a common understanding of the direction of development of activities in terms of increasing the digital competence of citizens. The common European framework has been used to achieve 4 main objectives:

- Map existing training courses under DigComp and revise content where necessary;
- - create training materials that cover all competency areas with proficiency level: basic (1 and 2);

- introduce a common understanding on the nature of citizens' digital competence;
- to identify relevant topics that relate to the digital culture of the population and to develop local initiatives.

Initially, the training offered are aimed at citizens with no or very limited ICT skills or experience with computers and the Internet. A 20-hour course on basic computer literacy has been developed, focusing on basic concepts: keyboard and mouse operation; creating directories, folders, and files; typing; setting up and using an email account; web search and navigation; some basic examples of social media and online public services. Over time, additional modules or stand-alone courses have been developed based on this introductory course with the assistance of employer organizations or communities. With the introduction of the DigComp 1.0 framework, two new courses have been developed to cover Level 1 and Level 2 of the Basic Level, respectively, as a build-up to the introductory computer literacy course and a deepening of what has been learned.

In the process of adapting the existing course and learning materials for basic computer literacy, experts found that the DigComp framework did not address the most basic knowledge and skills needed by citizens who are entirely new to new technologies. For this, **a new competency area is defined, competence zero, which is called First Access**. Another argument for the introduction of a zero level is that the majority of users of the project's education services are older people between 55 and 74 without any digital skills.

Gradually over the years, the Regional Government has expanded the project by adding online courses, training and supporting citizens on how to use electronic platforms and services, etc. (Carretero Stephanie, 2018)

This project is presented in terms of the possibility of introducing a "zero" level for civil servants who do not have any digital skills.

FRANCE: PROJECT PIX: ONLINE PLATFORM FOR DIGITAL SKILLS ASSESSMENT AND CERTIFICATION

The project was launched as an initiative of the French Ministry of Higher Education, Research and Innovation, in partnership with public and private stakeholders. The project has no specific target group and is freely accessible to all citizens who want to assess their level of digital competence. This is done by freely registering on the platform and completing an interactive test. Once the test is completed, a digital profile is generated, which can be further certified by an authorised organisation.

The European DigComp framework has been adopted in the creation of the test platform, especially in terms of the possibility of dissemination to other countries that have adopted DigComp as a universal framework for measuring and validating citizens' digital competence. This allows integration with other similar tools, as well as the adaptation and adoption of the PIX professional certification in EU countries.

The PIX platform[14] tests 16 skills from the five competency areas with 8 levels of proficiency set out in DigComp. The system currently covers the first 6 levels, with tasks for the Expert level to be developed. The platform supports users by displaying the current score after answering every five questions and offering a set of learning materials designed to fill identified gaps and improve knowledge and skills. The PIX test is not time-limited - the user can start it but not complete it. On a subsequent visit to the platform, he or she can continue with the test from where he or she left off. In addition, each user can take the test an unlimited number of times to raise their score.

The PIX professional certification is carried out in specially designated certification centers, which also provide additional training to successfully complete the certification. In order to sit for the professional certification, the user must have passed the online testing system successfully through all levels. The time required to complete the professional certification is 2 hours, and the certificate is intended to be valid for five years.

[14] PIX Online testing platform https://pix.fr/ Last user login date: August, 2021

The PIX certification is recognised by French institutions as an official document that certifies certain knowledge and skills in the field of digital competences, according to the Digcomp framework. The certificate has no application in industry. There are over 250 PIX certification centres in France, mostly universities. Over the years, it has been adopted that universities provide as an option for students, upon graduation, to also obtain a Certificate in Digital Skills. The online platform is available in French and partially in English (PIX, n.d.).

This project is presented as a best practice in **the introduction of a certification exam whose certificate is recognized by French public sector institutions**.

CROATIA: "E-SCHOOLS: COMPREHENSIVE INFORMATISATION OF OPERATIONAL AND LEARNING PROCESSES IN SCHOOLS ORIENTED TOWARDS CREATING DIGITALLY PREPARED SCHOOLS OF THE 21ST CENTURY"

One of the first projects implemented in a European Union country and aimed at public officials is the project in Croatia (e-Schools: "A comprehensive informatisation of school operation processes and teaching processes aimed at the creation of digitally mature schools for the 21st century"). The project was launched in 2015 and is being implemented in several phases, with the aim of covering all schools in the country by 2022. It is funded through EU structural funds, with the Croatian Academic Network as the coordinator. In the first phase of the project, the target group has been defined according to school roles. Three types of roles were identified:

- Teachers
- Principals
- Administration

A digital competency framework has been developed that defines the specific competencies for individual roles that are required for their daily tasks in the course of the educational process and that require the application of digital technologies.
The framework introduces three distinct lines of digital competences:

- Core digital competences which apply to the whole target group.
- Competences focused on the use of digital technologies by teachers in the educational process.
- Digital competences for the management of the learning process aimed at principals and administrative staff.

In the second phase of the project, a self-assessment system was developed. By answering the questions, users receive feedback on their level of digital competence, at three levels: beginner, intermediate and advanced (according to Digcomp 1.0) and recommendations on which area they need to make additional efforts to improve it.

A curriculum has been developed that sets the benchmark outcomes for the 34 digital competences learned up to level 6. Based on this curriculum, three methods of delivering the training have been developed:

- Attendance training
- Online seminars
- MOOCs (Massive Open Online Courses)[15].

Users receive a digital badge for successfully completing the training, with each subsequent training building on the previous one and accumulating digital badges accordingly (Carretero Stephanie, 2018).

This project concerns the education sector, which is part of the public sector and concerns all employees. It is also the first DigComp-based project to offer digital badges as a way of recognising demonstrated performance.

SPAIN: IKANOS INITIATIVE (IKANOS)

The IKANOS project was initiated by the Government of the Basque Autonomous Community in Spain in 2012. The initiative was launched with the main objective of providing professional support to the individual citizen, as well as to public, educational and private organisations, through the introduction of the European digital competences framework DigComp (version 1.0 at the time of launch). In the initial phase of IKANOS implementation, the focus was on comparing the DigComp framework in relation to the set levels of digital competences, and the results achieved in terms of multi-year training and qualification programmes for computer skills implemented in the territory of the Basque Autonomous Community in Spain.

The main lines of work in this **initial phase** rest on the following redefined components:

- **Introduction of the DigComp-based digital competency assessment methodology and the corresponding adaptation of local proficiency standards to the European framework.** The successful implementation of this first component will ensure that all subsequent training, qualifications and retraining

[15] Online courses open to the general public

in both the public and private sectors will be fully aligned with European digital competence standards.

- **Development and testing of a system for self-assessment of the level of digital competences.** The logic of this component is that every citizen should have the opportunity to self-assess the level of his/her knowledge and skills in the field of new technologies and, consequently, to consolidate and build on these skills during further training. At the same time, feedback is given to the organisations that prepare training materials and courses on how to structure their activities to ensure that they maximise the benefits of training services that support the upgrading of knowledge and skills. The system is also oriented towards providing managers in public and private organisations with an up-to-date snapshot of the level of digital competencies of their employees' skills and, accordingly, the steps they can take to enhance these skills in specific areas where a need is seen. Last but not least, the self-assessment system provides feedback to decision-makers at government level - in terms of designing and implementing national and sectoral policies for further qualification or retraining of citizens and public sector employees.
- **Presenting the concept of the initiative and attracting key representatives of various public, educational and private organizations to its implementation.** This component is critically important, especially from a multi-year perspective for the successful implementation of the initiative, by obtaining approval and at the same time declaring a willingness to actively assist and involve these organizations in the various stages of implementation. For example, with regard to training organisations, it is key that they revise and adapt their programmes to the European DigComp framework, or that public and business organisations adopt a certain level of acquired digital competence, based on the European DigComp framework, as universal for each profession.
- **Review, analyse and adapt existing digital skills assessment and certification practices to a universal system based on the European DigComp framework.** Thus, the initiative aims to develop a universal system that applies a unified model for assessing digital competences that are certified at different levels.
- **Launch of the IKANOS initiative at national level and its presentation to various organisations in the European Union.** The initiative is intended to be piloted on the territory of the Autonomous Community of the Basque Country in

Spain and the good practices, experience and knowledge gained will serve as an example for the implementation of similar initiatives throughout the European Union (IKANOSTEST, n.d.).

The main lines of action in the implementation of the second phase of the IKANOS initiative are aimed at identifying the most important components related to improving the digital skills of citizens and employees and engaging institutions in their recognition and formalisation.

The European DigComp digital framework as a foundation for acquiring and enhancing digital competences has been gradually introduced **as mandatory in formal training** - in schools and universities, as well as in continuing training for the qualification or retraining of employees and citizens. For example, one of the first tools developed was to define and assess the digital profile of teachers in public and private schools, as well as trainees in vocational fields. It is no coincidence that the efforts have been directed precisely in the field of school and vocational education, where the role of digital technologies, the certification of the acquired teachings, the creation, maintenance and continuous upgrading of the digital profile are most crucial for the successful transformation of the economy to the new requirements of the global digital society.

Logically, the IKANOS initiative has evolved over the years to develop additional components to define and evaluate which are the digital profiles that will dominate the Fourth Industrial Revolution - Industry 4.0[16].

[16] Industry 4.0 refers to the transformation of industry through the intelligent networking of machines and processes using information and communication technologies (ICT). The term is used interchangeably with 'the fourth industrial revolution'. The adoption of common technology standards is one measure to ensure that European industries are at the forefront of the development and use of new technologies. They ensure interoperability between systems and guarantee their reliable operation as well as compliance with confidentiality, security and availability requirements. The digitalisation of manufacturing can lead to a large extent to intelligent automation of industry, which will allow the free movement of industrial production in Europe. Digital manufacturing could reach EUR 3.2 trillion in G20 countries and already contributes up to 2.8% of GDP, leading to growth and creating new jobs. It is important to note that more than 75% of the added value created by Internet technologies is in traditional industries and is due to an increase in their productivity (Chamber, n.d.).

Based on the European DigComp framework, both standard digital profiles for citizens and specific ones based on the requirements of different sectors and industries have been developed.

Within the IKANOS initiative, the following tools have been developed:

Personal digital profile

An online test system for self-assessment of digital competences has been developed. It enables the self-diagnosis of digital skills of any user or organization. It is based on the following basic principles:

- **Perception/Application:** the questions measure users' knowledge and skills and their confidence in applying them, and in the process ask them to evaluate different statements or suggest solutions to certain situations related to different levels of digital competence.
- **Comprehensiveness:** the questions relate descriptively to each of the competences set out in the European DigComp framework, and are tailored to and reflect real examples of the application of the three core competence elements: knowledge, skills and attitudes.
- **Motivation:** users are encouraged to improve their skills by providing information and resources to do so.
- **Simplicity:** the test is easy for users to understand and requires no further explanation. All items are tied into familiar actions from everyday digital life.
- **Neutrality:** the questions relate only to self-assessment and are not tied to knowledge of specific software or software products.
- **Visualization:** The digital profile graphically shows the achievements and areas for improvement in terms of different levels of digital competence. It can be downloaded electronically and used for future decision-making on skills upgrading.
- **Awareness:** By completing the test, users are introduced to all aspects of the competences covered by the European DigComp framework. The questionnaire

takes relatively little time - about 20 minutes - and has been completed by over 70 000 citizens, employees, teachers and students. [17]

Professional Digital Profile

It identifies the knowledge, skills and attitudes needed to perform the tasks that require the use of information and communication technologies in a profession.

In order to generate the professional digital profile, the digital aspects in the performance of tasks in a profession are identified and the specific content of digital activities is described according to the technological solutions that are commonly used.

If a competency requires knowledge or skills specific to a particular occupation, it is further enriched by including additional descriptions of tasks specific to that occupation. For such specific situations, the concept of 'sub-competence' is introduced to emphasise their importance and is reflected in the occupational profile.

The features of the Professional Digital Profile relate to:

- **Competency level:** defines the level and describes the competencies required in a profession, following the DigComp framework.
- **Professional development:** career and professional development planning should include the acquisition of new digital sub-skills that allow progression within the profession itself.
- **Dynamic model**: the professional digital profile should evolve with the development of technology and new digital demands on professions.
- Governance: the organisation must manage and update the profiles of its employees as they develop their competences or the technology used in the professions changes, and they must be seen as a key resource for assessing performance.
- **Specificity:** the profile is specific to each profession within each organisation, depending on the activity carried out and the digital tools used to implement it.

In 2019, the online self-assessment test system is also open to private and public organisations. The digital profile of an organisation brings together the individual profiles

[17] According to the latest data from the initiative's website: https://ikanos.eus/modelo-ikanos/auditar/diagnostico/ Last user login date: August, 2021

of its employees at department, unit or overall structure level. It helps organisations to plan and implement employee-focused programmes and strategies that will help the organisation achieve digital transformation, such as setting certain minimum digital competence level requirements for a job. In addition, the system enables organisations to benchmark professional profiles with other similar organisations (IKANOSTEST, n.d.).

BAIT Certification System (Basic Competences in Information Technologies)

BAIT is an online digital skills certification system based on knowledge, skills and attitude towards technology. It builds on the IT Txartela system that has been in place for more than 10 years. The main difference is that while IT Txartela is product-oriented (operating systems, application and programming software), BAIT is a technology-neutral certification system following the European DigComp digital framework.

The competency areas to be certified are structured in 5 core areas, based on which 21 competencies are defined, distributed in 3 levels (beginner, intermediate and advanced).

The BAIT certification system[18] was developed within the IKANOS initiative, but the certification exam itself is conducted by an independent certification organisation - Tecnalia[19]. This is the largest applied research centre in Spain, focusing on the scientific and technological development of small and medium-sized enterprises. Tecnalia is also the fifth largest certification organisation in Europe. The certification exam itself is conducted on site in authorised centres, mainly part of the Basque Network of Telecentres (277 in total in the Basque Autonomous Community in Spain). The exam takes the form of a test and is conducted online, with the results automatically generated after the exam is completed.

Appearance for the certification exam occurs after pre-registration at least 4 days before the exam. It is recommended that the candidate prepares himself/herself in advance to

[18] Evaluation and certification system of digital competences in the Basque Country BAIT: Web de usuario Last user login date: August, 2021
[19] Inicio | Tecnalia Last user login date: August, 2021

work with the platform and the format of the questions, and a demo version of the certification exam environment has been created for this purpose.

The exams for the Basic and Intermediate levels consist of 20 questions with a 30-minute answer time. To pass the Basic level exam, 14 questions, or 70%, must be answered correctly. For the Intermediate level, the test is divided into two blocks of 10 questions each. A minimum of 7 questions in each block must be answered correctly in order to pass the certification exam (or again, 70% of the entire test). It is possible to take certification exams for both levels on the same day. If a user fails to pass the exam, they may retake the same test a minimum of one month after their last test (BAIT, n.d.).

In order to ensure maximum support for users as well as the smooth functioning of the certification process, the IKANOS initiative has developed an Orientation Guide [20] to train e-facilitators from local telecentres. Their role, in addition to being on-site to support the certification exam, is to provide day-to-day support to all those wishing to enhance their digital competencies by offering professional support regarding the necessary training and qualification activities.

The IKANOS project is the first in the European Union to be fully implemented following the DigComp framework and all its components, including the certification of the level of digital competence. Much of its success is due to the fact that it is implemented by a governmental organisation that has the mechanisms to enforce policies regarding training, qualification, recognition of public, private and non-governmental organisations.

DCDS (Digital Competence Development System)

One of the first multinational projects implemented in terms of assessing digital competences, formulating specific learning policies and fully based on the European DigComp framework is the DCDS project (Digital Competence Development System)[21]. 5 countries are participating: Italy, Greece, Spain, Latvia and Romania.

[20] IKANOS Orientation Guide: Orientation guide - Ikanos
[21] DCDS – Digital Competences Development System (dcds-project.eu) Last user login date: August, 2021

The DCDC is co-funded by the Erasmus+ programme of the European Union under Action KA3 "Support for Policy Reform, Future Cooperation Projects" (FLCPs). The project started on 1 January 2018 and its duration is 2 years. The aim is to create a framework to provide European Union citizens who have no or very low digital literacy with opportunities to acquire the basic digital skills needed to secure employment, personal development, social inclusion and active citizenship.

To achieve this goal, the project is developing a multilingual, integrated, modular "Digital Competency Development System" to be used to provide informal training to low-skilled adult citizens in digital technologies.

The specific objectives of the DCDS are:

- Improving the basic digital and transversal competences of citizens aged 25+ through an integrated system that combines online and face-to-face learning.
- Support non-formal learning providers in planning and delivering flexible and modular learning offerings aimed at improving adults' core digital competences that are mapped against the DigComp 2.1 framework.
- Empowering policy makers and key stakeholders from different fields to formulate integrated policies to assess and recognise adult basic digital skills.
- Collect and analyse evidence to inform the rationale for innovative policies and practices by testing DCDS in the five countries involved in the project (Valentini, 2018).

The project is implemented in several stages. **The first stage** is to carry out a thorough review and analysis in all partner countries on:

- The extent to which the DigComp framework has been implemented in non-formal adult education;
- existing digital inclusion policies and their coherence with the DigComp framework and other EU flagship initiatives in adult education.

The main objective of this analysis is to outline the current picture in the context of e-inclusion policy in the partner countries, focusing on how national and local authorities are implementing EU flagship initiatives. A number of policy documents and recommendations are reviewed and analysed, both related to adult non-formal education and to other specific economic and societal areas, thus identifying cross-sectoral links e.g. with health, education, economic development, labour market, culture, etc.

Desk research in all partner countries shows that a National Digital Inclusion Plan is in place and aligns with the 2014-2020 European programming period. However, only two countries (Latvia and Italy) have updated their plans since 2016 in line with the new European Commission guidelines and recommendations.

On the other hand, different initiatives are planned in all partner countries, targeting as a priority low-skilled citizens, people living in remote areas, young people at risk of marginalisation and senior citizens (over 60) in terms of:

- Promote and improve access to ICT.
- Promote social participation and civic engagement.
- Promote labour market participation.

During the first phase, 5 focus groups with 10 representatives from public organisations and educational institutions in each of the partner countries were held to define the main components of the project:

- **The target group: what is the profile of people with a lower level of digital competences?**

The comparative analysis of the results obtained in the five partner countries shows that the three most important factors determining the level of digital competence are:

Education: a lower level of education and qualification usually involves lower digital competence and a higher risk of social exclusion.

Employment: Unemployment very often depends on a lack of digital skills and the right training to improve these skills.

Age: although younger generations need to be trained in specific basic digital skills, a significant proportion lack even a basic level of digital competence.

- **Motivation: what are the main motivational factors that may encourage people in the target group to engage in DCDS or similar skills development pathways?**

The leading factor that motivates users to participate in DCDS and similar initiatives is the possibility of getting a job or a better career.

- **Resources: what is the best strategy to ensure local interoperability of the DCDS and to promote its scalability at national and European level?**

Standardising the certification of core digital competences within DigComp may help its use beyond partner countries, but on the other hand, a potential risk is the integration of the DCDS certification system with other existing systems and practices for validating digital competences within the EU.

- **Certification: how important and what is the purpose of certifying and validating core digital competencies?**

For the wider acceptance of a certification system and especially for its sustainability, it is important on the one hand that it is integrated with existing systems and practices and recognised by the public and private sector in terms of career development, i.e. that the certificates issued are recognised institutionally and/or industrially.

In the **second phase** of the project, each partner country formed focus groups, but this time with representatives of the target group - adult citizens with very low digital competence. Starting from the findings of the first phase, participants whose socio-economic profile is close to the EU average were selected: average age 39.65 years, a slight preponderance of women compared to men (57%), a high percentage of unemployed (50%), a high level of education (86% with a degree, of which 52% have a university degree). The discussions in the focus groups are again oriented towards motivation, resources, and certification. The aggregated results show the following trends:

- In terms of **motivation to improve their digital** skills, the vast majority consider this a 'must' in terms of career progression. At the same time, mistrust and fear of new technologies dominate, with negative ones - e.g. data theft and potential abuse - being raised against any positive aspect - e.g. easier access to many services through electronic systems. Rather, there is passivity and waiting, despite a clear understanding that 'something must be done'.
- The proposal for a system of **attestation through digital badges** is not recognized as an incentive for participation in DCDS, but **certification is one of the most critical factors in motivating adult learners**. The certification process needs to be clear and focused, its meaning understood and accepted by users, but also have a validating body - public administration, business organisations, accredited organisations.

According to the project target group, the most important components of the future Digital Competence Development System are:

- to provide certificates;
- reflect their professional and personal interests;
- allow interaction with other participants;
- be easy to use;
- Provide a variety of forms, methods, and approaches to learning - multimedia, webinars, online mentors, group assignments, quizzes, etc.

It is very important for the target group that the System is in the local language, and that face-to-face training sessions on how to use it are held prior to implementation. The majority of target group participants prefer to attend face-to-face training. In their opinion, any training in a fully online environment would be of low quality. The blended format is only adopted if alternating face-to-face with online sessions.

Table 3. Success factors and main barriers to implementation and sustainability of DCDS

The most likely success factors for the DCDS	Main obstacles to the implementation and sustainability of the DCDS
Certification to ensure employability	Identification of target groups and priorities - lack of interest
To have a measurable impact on social and digital inclusion	Lack of motivation to participate
Accredited certification/internationally recognised certificates	Activities to be carried out exclusively online
Blended learning (face-to-face and online)	Too theoretical/too complex
Well-structured modules on each topic	Language barrier (if not translated into the local language, and in terms of specific terminology, which is mostly in English)
Useful for employers to assess the level of digital competence of their employees	Availability of many other certification programs - which one is of value?
Certification may have value in the public sector as specific vertical skills are sought in the private sector	
Free access	

The third stage of the project foresees the creation of a **platform for self-assessment of digital competence by users.** Since the project targets adults with no or very limited knowledge and skills in digital technologies, the online self-assessment platform itself assesses only the first two levels of proficiency in each competency: a "basic" level and an "intermediate" level. The purpose of the self-assessment test is to identify users' skills gaps, which can then be filled with appropriate training. On the basis of the results shown, training is offered, and after passing it, the user takes the test again in the form of an online test and receives a certificate and a digital profile following the Europass model.

The self-assessment test consists of two types of questions relating to each of the 21 competences from the five domains of digital competence:

Self-Assessment Questions. They have a standard format: the introduction is always phrased as " Please evaluate how you will perform/find..." (a reference to a skill topic). The user is asked to rate his/her skills in relation to this task on the following scale:

1 = I have no skills
2 = My skills are very weak
3 = I have some skills but not enough to complete the task independently
4 = I have enough skills to complete the task independently

Example: competence 2.4 Interaction through digital technologies

Self-assessment question: we want you to assess how you interact with other users through digital technology. Below are some examples of online interactions, and you are asked to indicate how proficient you are at these activities using the following scale*:*

1 = I have no skills
2 = My skills are very weak
3 = I have some skills but not enough to complete the task independently
4 = I have enough skills to complete the task independently

- I can send and receive emails from multiple users, as well as reply "to all" from group communication.
- I can join a video conversation or add a participant to a video conversation that I have created.
- I can create a WhatsUp group and add a member.

Depending on the answers given, the test continues in two directions.

1. If the answers given fall on a scale of 1 to 3, then the user needs further training in this competency to improve their skills. His score is reported, and he moves on to the next self-assessment question.

2. If the user indicates the fourth option ("I have enough skills to complete the task independently"), then the test continues with the other type of knowledge and skills questions.

Knowledge and Ability Questions. Their purpose is to show the extent to which the user actually has mastery of a skill for which he or she has indicated that he or she can perform a task independently. In order to accurately ask these questions, the experts develop to each of the 21 DigComp competencies corresponding reference expected outcomes or what the user should be able to perform independently. These reference outcomes total 95. Separately, for each of the five competency areas, the most significant reference expected outcomes (39 in total) are specified to consider the user proficient in that competency.

In developing the methodology for answering the Knowledge and Skills Questions, the experts were guided by the following rules:

- There is only one correct statement.
- There is one completely wrong statement.
- There is one confusing statement, i.e. it is false but plausible and if selected by the user, is an indicator of the inaccuracy of their knowledge.
- Answers should not contain any logical clue as to which is correct.
- Some questions may require the user to perform a series of actions via an electronic device to arrive at the correct answer.

There are a total of 41 knowledge and skills questions, one for each of the 39 significant benchmark outcomes and two additional.

After the validation of the questions from the focus groups, it is assumed that a fourth answer needs to be added: **I do not know how to perform this task**. In the initial structuring of the questionnaire, the idea is to identify specific skills, and if the user cannot answer a specific question, to simply skip it. When validating the questions, it turns out that skipping a question is something that users think is not good, and even if they don't know the correct answer, some answer is given just so the question is not skipped.

Example: key learning outcome: 2.4.1. I can send and receive emails from multiple users, as well as reply "to all" from group communication.

You have received a party invitation which was sent to three of your friends in addition to yourself. Unfortunately, you will not be able to attend the party and want to let everyone know. Which of the following commands in your e-mail client will you use to notify everyone?

- Reply
- Forward
- Reply to all
- I don't know how to complete this task

After the user completes the Self-Assessment Test, different learning options are offered according to their results. Users are encouraged to discuss these learning opportunities in a team of educational experts (Stefano Kluzer, 2018).

In the **fourth stage** of the project, a tool was developed to support the adult learning process and target training organisations. Starting from the fact that the target group of DCDS are people with no or low digital competence, the proposed model includes both face-to-face trainings and trainings implemented remotely. Distance learning is provided with pre-made materials and tools that the learner can go through at his/her convenience. The ratio of face-to-face/online training depends largely on the learner's performance and capabilities. All this is described in the Trainer's Guide and the Training Guide, which have been published within the project (Stefano Kluzer, DCDM: Digital competence development methodology, v.2, 2019).

In the **fifth and final stage** of the project implementation, a system for validation and recognition of skills has been developed. This system is in the form of a test with open and closed questions, performance tasks, and case studies. Each answer carries a specific number of points, and when the points after the finalisation of the test are more than 60% of the total number of points, the test is considered to have been passed, and a digital badge is issued.

Digital badges are upgradeable - i.e. from specific content - a module badge, through to covering a set of modules - an educational pathway badge, and successful completion of several educational pathways leads to the highest level - a digital competency badge.

After the successful approbation of the project among 160 representatives of the target group, its independent implementation in the partner countries started. During this phase, the project partners will seek assistance and support from policy makers and all stakeholders to support its implementation at sectoral, regional and/or national level.

The DCDS project has been analysed from the point of view that it is one of the first projects that is focused in developing a very detailed methodological framework for each of the activities. It has been approbated and can be used in the implementation of other similar initiatives.

Following the detailed review and analysis of the projects reviewed, they are compared against criteria corresponding to the five typical DigComp implementation scenarios.

Table 4: Comparison of considered projects by criteria

Criteria	Pal	PIX	E-Schools	IKANOS	DCDS
Is there a competency description?	Yes	Yes	Yes	Yes	Yes
To which level of proficiency has the competency toolkit been developed?	Up to level 2	Up to level 6	Up to level 6	Up to level 8	Up to level 4
Is there a tool that determines the level of competency proficiency prior to a training program?	No	Yes	Yes	Yes	Yes
What is this tool?		Self-assessment test		Self-assessment test	Self-assessment test
Is there a tool for recommendations for upgrading competency levels?	No	Yes	No	Yes	Yes
What type of questions are used in creating digital profiles?	No	To complete tasks	No	Closed questions and performance tasks	For self-assessment and validation
What is the training format (online, face-to-face, blended)?	Face-to-face	Online - self-study	Blended	Blended	Blended
Is an exit exam required, including a certification exam?	Yes	Yes	Yes	Yes	Yes
How are the results proven?		Certificate	Digital badge	Certificate	Digital badge
Is the validation document issued recognised at institutional level	No	Yes	No	Yes	No

This comparison table based on the analysis clearly shows the most complete implementation of the DigComp framework has been done in the DCDS and IKANOS projects. In relation to the target group, civil servants, the IKANOS project is the only one that also covers them.

In terms of the tools developed and the level of proficiency for each competency, only the IKANOS project has tools that reference all 8 levels, and for the PIX project, tools are under development for levels 7 and 8.

In terms of tools for the initial validation of the level of proficiency of the competences, the most accurate one is the one developed by the DCDS project, because in addition to the self-assessment questions, there are also validation questions on whether the user has correctly self-assessed.

In terms of the digital profile, the IKANOS project is the best developed, and here the reason should be sought in the fact that the project aims not only to create one for the user, but also to use it for the organizations digital profile needs.

If the sustainability of the project is to be evaluated, IKANOS and PIX are the most comprehensive, mainly due to the fact that they provide for a certification exam at an independent centre and a certificate recognised at a certain institutional level respectively.

The e-Schools project is the only one whose target group is a specific professional field. All other projects target either the whole society (IKANOS, PIX) or groups at risk of digital exclusion (Pane e Internet, DCDS). So the toolkit introduced to validate the acquired skill, the digital badge, is recognised at institutional level, in this case the Ministry of Education.

INTRODUCING THE EUROPEAN DIGCOMP FRAMEWORK FOR THE TRAINING OF CIVIL SERVANTS

For the purpose of this analysis, an interview-type survey was conducted with representatives of organisations from European Union countries responsible for providing training services to public sector employees. The questions were sent out in advance for the interviewees to familiarise themselves with and the interview itself lasted approximately 40 minutes. During the interview, the interviewer's aim is to gather as much detail as possible on the questions asked in advance. Two interviews were conducted.

POLAND: NATIONAL SCHOOL OF PUBLIC ADMINISTRATION

Interviewee: Anna Yaron, Advisor to the Chairman

The National School of Public Administration of Poland is responsible for the training and further qualification of all civil servants in the country. Three models are offered:

- **An open catalogue of training curriculums:** the catalogue is public and accessible. Any civil servant can choose a course to attend in line with their professional interests - for example, foreign language training**.**
- **On-demand and as-needed training:** a specific request is made to the organisation to organise training on a topic specific to a particular public administration. The National Schools then conduct research and hire experts and trainers to develop the learning materials and deliver the training. Training curriculums related to digital competence are developed in this area**.**
- **Training for future civil servants:** an 18 months curriculum has been developed. It is open to all students who have a Master's degree. Once they have completed the programme, they are appointed to the civil service. Within this training, there are courses related to digital competences as well.

Although a discussion on professional certification of digital competences has been initiated with one of the foundations in Poland working on DigComp oriented projects, this discussion is still in its initial phase, as there is no consensus at the state level on how and whether DigComp will be used as a reference framework for educational initiatives in the country. For this reason, the training offered on digital competences are not in line with DigComp.

A Certificate of Completion is issued upon completion of the training course. This certificate is recognised within the structure of the public administration and is relevant to the career development of the employee. Only language training is subject to a testing and certification procedure. The system has been developed by the National School, and the examination itself takes place in two parts: written and oral. The language certification examination follows established world standards for proficiency levels.

Most of the training courses are delivered in person, and in the last two years, as a result of the pandemic situation around the world, there has been a shift to online training - ready-made courses or lecturer-led.

According to interviewee Anna Yaron, today there are all the prerequisites for the topic of digital competence to return in terms of creating a single framework that measures the knowledge levels and capabilities of learners, following the example of assessment in language learning, where each level is clearly defined. The last two years, in particular, have greatly boosted the application of digital technologies in all socio-economic areas, and the time is now ripe for digital skills to be adequately measured.

SLOVENIA: ADMINISTRATIVE ACADEMY
Interviewee: Breda Gruden, Director

The Administrative Academy of Slovenia is part of the Ministry of Public Administration. The Academy is responsible for the training of all civil servants in Slovenia as well as their professional certification. It is staffed by 15 employees and offers over 100 different courses in its training catalogue. On an annual basis, 30,000 - 50,000 employees are trained, in over 600 training courses organised. More than 200 external lecturers are used to deliver the training courses. At the beginning of the pandemic in the spring of 2020, they initially stopped their activities entirely and started with the development of an online system, and later redesigned all training courses into an online version. More than 40,000 employees have been trained since fall 2020.

The Academy is implementing a project funded by the European Union to develop a comprehensive training programme based on DigComp 2.1, with the target group being government employees - around 30,000 employees out of a total of 160,000 civil servants in Slovenia.

A digital competency self-assessment questionnaire has been developed, covering the "basic" and "intermediate" levels. The training cover these levels again, with additional funding to be sought for the 'advanced' and 'expert' levels under the Slovenian Recovery Plan. At this stage, the aim of the Academy is to ensure that all civil servants included in the project cover the 'intermediate' level in all competency areas of the DigComp framework.

There is no system to independently measure the level of digital competence - the level is determined as a user's self-assessment. Accordingly, training is offered on how to fill the identified gaps. A training certificate is issued upon completion of the training, and no other type of professional certification is envisaged to be introduced at this stage.

In the coming years, it is foreseen to develop educational pathways related to digital competences for other public sector groups - managers and IT professionals, as there are no educational opportunities for them so far..

ONLINE SURVEY OF CIVIL SERVANTS' ATTITUDES TOWARDS DIGITAL COMPETENCE TRAINING

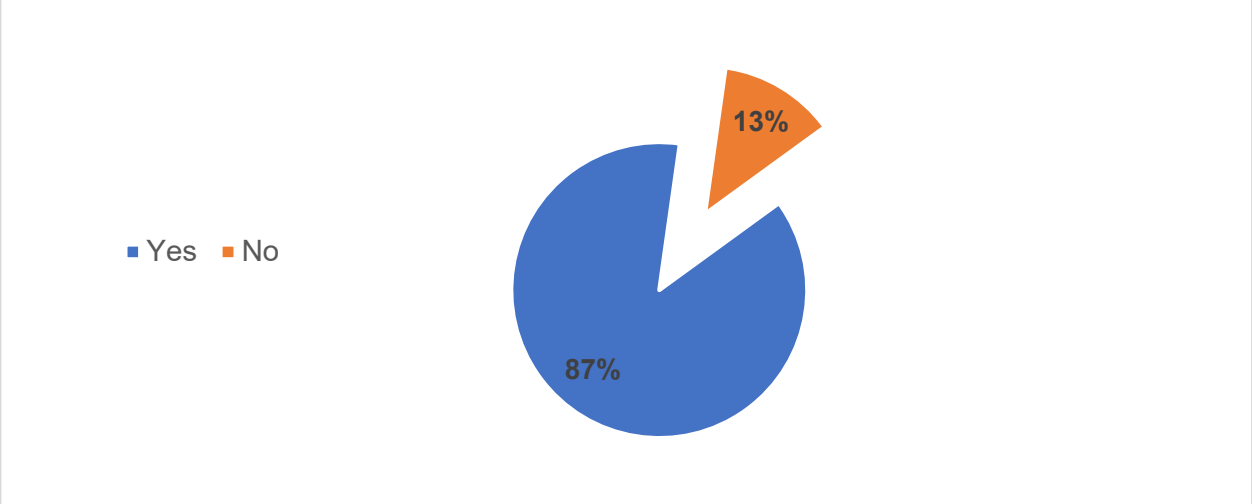
As part of the analytical report, an online survey was conducted on the attitudes of civil servants towards the training offered by the Institute of Public Administration related to digital competences. The survey involved 1,056 respondents, making it representative of the audience. The responses are presented below, as well as the interrelationships between the different questions in terms of the situation analysis.

1. Which organisation do you represent? (e.g. National Revenue Agency)

Open question

Respondents represent a wide range of state institutions: at national level, regional structures of state administration, municipal administrations. They work in organizations, both primary budget administrators as well as secondary. On the basis of the information submitted on the place of work, it can be concluded that the survey covers all types of organisations operating as part of the public administration.

2. Are training and further qualifications in digital technologies available??



The percentage of positive responses submitted was very high: 87% or 915 respondents. This shows that, on the one hand, employees are not only aware of the educational opportunities available to them, but also that these opportunities are very well communicated at the organizational level.

13% of respondents answered negatively to this question. Of the 134 negative responses when intercepted with a follow-up question, 60 respondents answered that they did not participate in any digital competency training at all, 43 participated once, and 30 participated in more than one in a calendar year. One respondent did not answer this question. It can be inferred from the responses submitted that slightly more than half of the respondents have participated in some type of technology training in the past, but not recently. Of those who had participated in "more than one training within a calendar year," all rated the importance of training programs related to increasing digital competencies as "very important" and "extremely important." These are also the predominant ratings for those respondents who have attended training related to enhancing digital competencies "once": of the 43 respondents, 9 indicated a medium rating of important, and 2 indicated a rating of neither important nor not important. In the group of respondents who answered that they had never attended training related to improving digital competences, again the prevailing ratings for the importance of training programs were in the "very important" and "extremely important" scale - 47 responses out of 60.

As the survey does not aim to profile respondents in detail (e.g. by position held, since when they have held a position in the civil service, etc.) some more general conclusions can be drawn based on the additional responses submitted by respondents falling into this group:

- that they have been employees of the administrations for a relatively short period of time and, consequently, no information on training offered has reached them;
- that they consider their level of proficiency in digital technologies to be sufficiently high and that the training offers do not meet their expectations;
- that they hold specific jobs which require specific IT skills in specific technologies and the training offered is not of interest to them.

The remaining respondents, 21 in total, answered that they had not been offered training and further qualifications in digital technologies and at the same time rated the importance of training programmes related to improving digital competences as "important" (7), "neither important nor not important" (1) and "not important" (2). Three respondents did not answer this question.

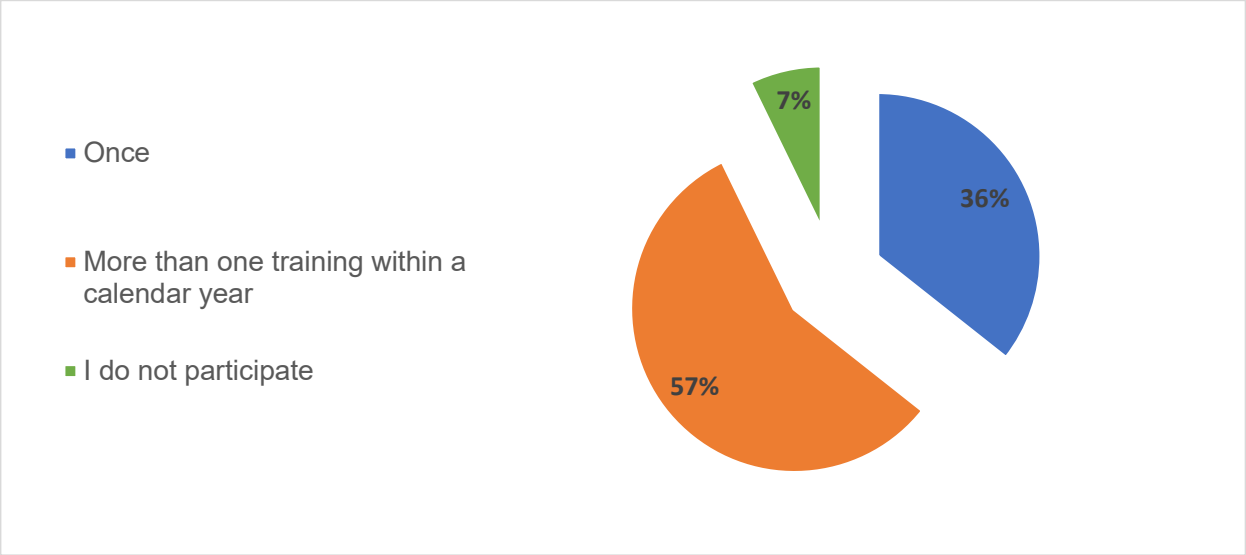
The general conclusions that can be drawn overlap with the above scenarios, with one additional conclusion that can be drawn, and related to the answers about the importance of training programs related to enhancing digital competences obtained in the negative scale:

- these are civil servants where the nature of the work is reduced to minimal technological interactions (certainly working with an e-mail client because the survey was sent electronically) and
- they do not associate improving their digital competence with future career opportunities (they are probably at the end of their working career or their chosen professional field does not imply the need for such competence).

The focus on the analysis of the negative responses is essential for the further interpretation of the survey results, since on the one hand the percentage (13%) is relatively high, given the numerous digitisation projects of the public administration, and especially the situation of the last year and a half related to the "Sars-CoV-2" epidemic situation and the measures taken to work remotely through new technologies. But on the other hand, a comparison with the assessment of the importance of training programmes related to the improvement of digital competences shows that even if they have not participated in training, the vast majority of respondents are aware of their importance.

3. How often can you participate in training related to digital competences within a calendar year?

- Once
- More than one training in a calendar year
- I do not participate



The answers to this question will be analysed in terms of the positive answers given to question 2: yes, training and further qualifications in digital technologies are offered, as the negative answer to question 2 has been analysed above.

The majority of respondents (57%) had participated in more than one training course in a calendar year. As we made clear in the previous section**, this includes respondents who gave a negative answer to question 2.** When we subtract these from the total, we are left with 569 respondents. It is noteworthy that when we look at the responses to question 7 about the importance of training programs related to increasing digital competencies, the responses are distributed in the high scale of "very important" (133) and "extremely important" (394). No respondent in this category gave a negative assessment of the importance of such training.

328 respondents whose organisations had offered them the opportunity for training and further training and they had attended such training once in a calendar year. Here again, the tendency of rating the importance of such programmes is in the high scale of 'very important' (90) and 'extremely important' (193). 36 of the respondents gave ratings in the lower scale.

Conclusions that can be drawn from the positive responses received to this question (participated once, or more than once) are:

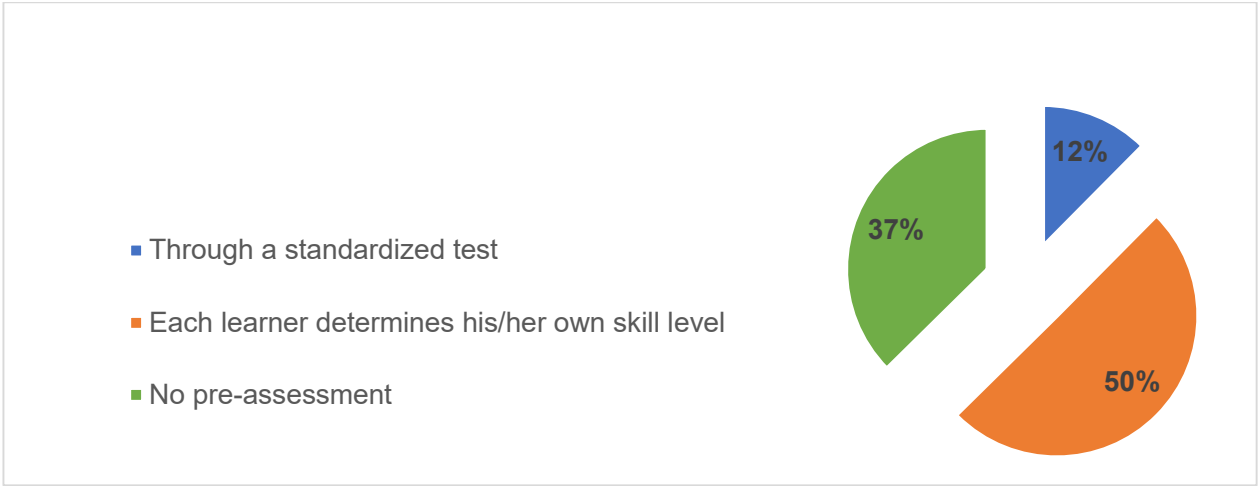
- The majority of respondents have a positive attitude towards enhancing digital competences and realise the importance of being involved in such programmes.
- Respondents almost definitely place a high value on the importance of training programs related to enhancing digital competencies.

- ❖ In terms of evaluation, it is important to note that those users who participated in more than one training rated the importance more highly than those who participated in only one. One possible reason is that the only training that respondents participated in did not meet their expectations (such as career opportunities, effective application in daily work, etc.). As a recommendation, a regular mechanism could be implemented, within a calendar year, for civil servants to receive training related to improving their digital competence.

Of the 76 respondents who indicated that they had never participated in a training, only 7 indicated that their organisations offered such an opportunity. Again, the importance of this type of training is highly rated. For the whole sample, this represents an insignificant percentage (0.7% of all respondents) and analysis of this particular sub-group would be too hypothetical (e.g. one possible scenario is that the respondent signed up for training but did not attend due to illness).

4. How is your level of digital skills and competencies determined before starting a training program?

- Through a standardized test
- Each learner determines his/her own skill level
- No pre-assessment



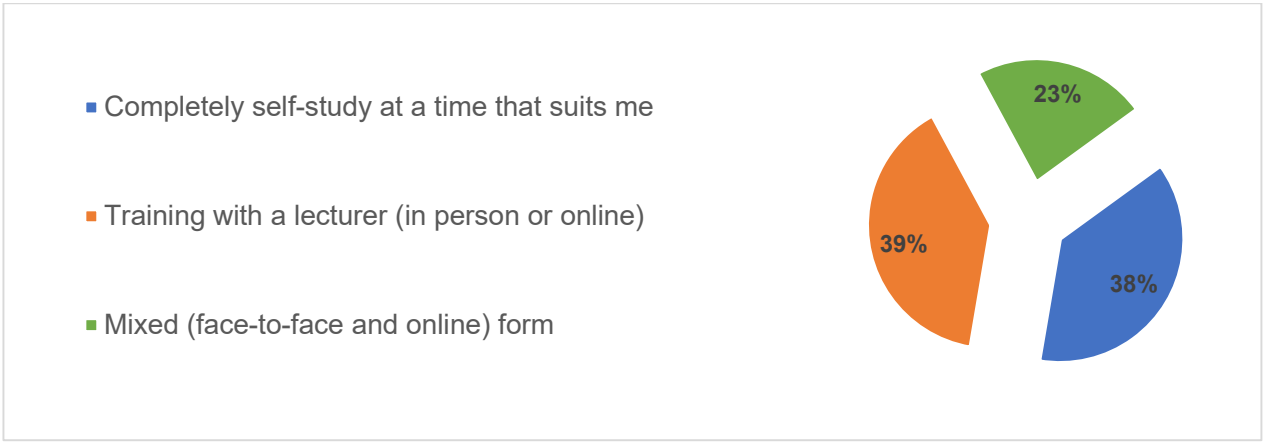
The answers given to this question are very important in terms of the final recommendations of this report. First of all, the fact that more than half of the respondents (50.2%) define their own skill level clearly stands out - i.e. this is a subjective judgment. On the other hand, for 37% of the respondents, no pre-assessment is applied. Or for the

majority of respondents - 88% the training that is offered and that they undergo is not targeted to a formal assessment of their skills.

In order to unify the different levels of digital competency and therefore deliver training that meets the needs of learners (and in line with what the European DigComp digital skills framework is aiming for), it is crucial to introduce a standardised mechanism to verify digital competency levels and therefore ensure the effectiveness of the training offered. The introduction of such a mechanism is also relevant to the long-term strategic planning of all activities aimed at enhancing the digital competence of employees in the Bulgarian public administration.

5. How training programmes in digital competences are implemented?

- Completely self-study at a time that suits me
- Training with a lecturer (in person or online)
- Mixed (face-to-face and online) form



This is the only question where there is a relative balance in the answers. In terms of the analyses of European projects presented in the previous part of the report, it is not surprising that the largest group of respondents preferred a fully face-to-face form of training (39%). This preference is typical for users with lower digital competence and for older users. In terms of future planning, it is key to offer training programmes and opportunities that are aligned with both the current in-person constraints associated with the Sars-CoV-2 outbreak and their future impact on the overall functioning of the public administration in terms of digitisation.

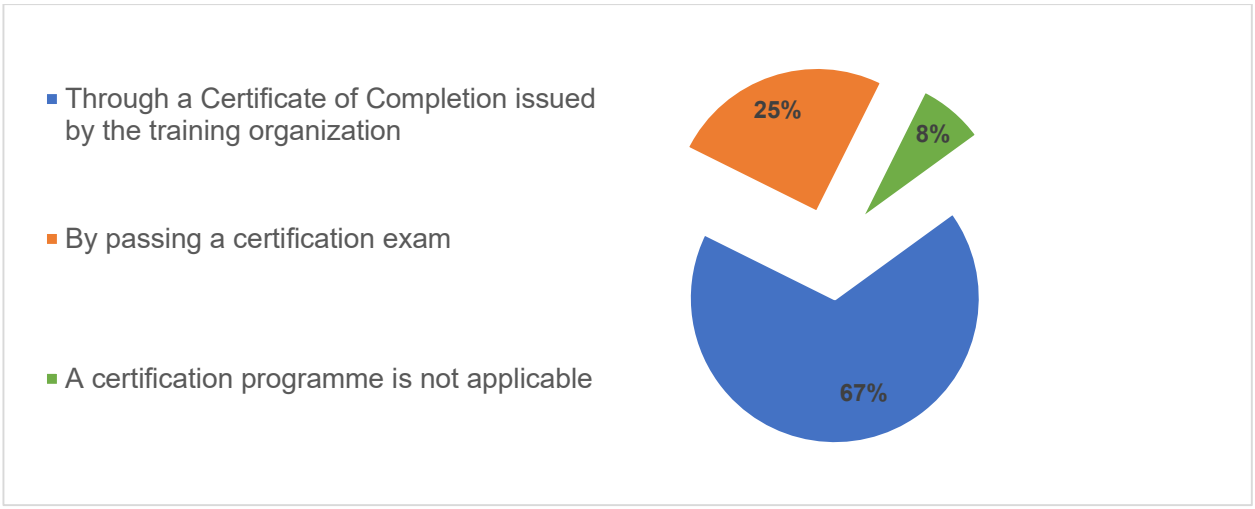
As a positive trend, it can also be reported that there is a similar number of respondents (38%) who have participated exclusively in online trainings. Out of 384 respondents, 332 rate the importance of such programs in the high scale of "very important" (96) and "extremely important" (236).

Given the short timeframe in which distance learning in an electronic environment was introduced, this part of the survey can be taken as a testimonial that a mechanism has been found to offer a satisfactory alternative approach to training while relatively maintaining quality.

Blended learning is a traditional approach that has been used for years around the world, where the learner prepares independently through provided e-learning resources, and at the same time has some time for face-to-face learning. It is also one of the most preferred approaches for training working adults.

6. How the acquired skills, knowledge, and competences are validated?

- Through a Certificate of Completion issued by the training organization,
- By passing a certification exam,
- A certification programme is not applicable.

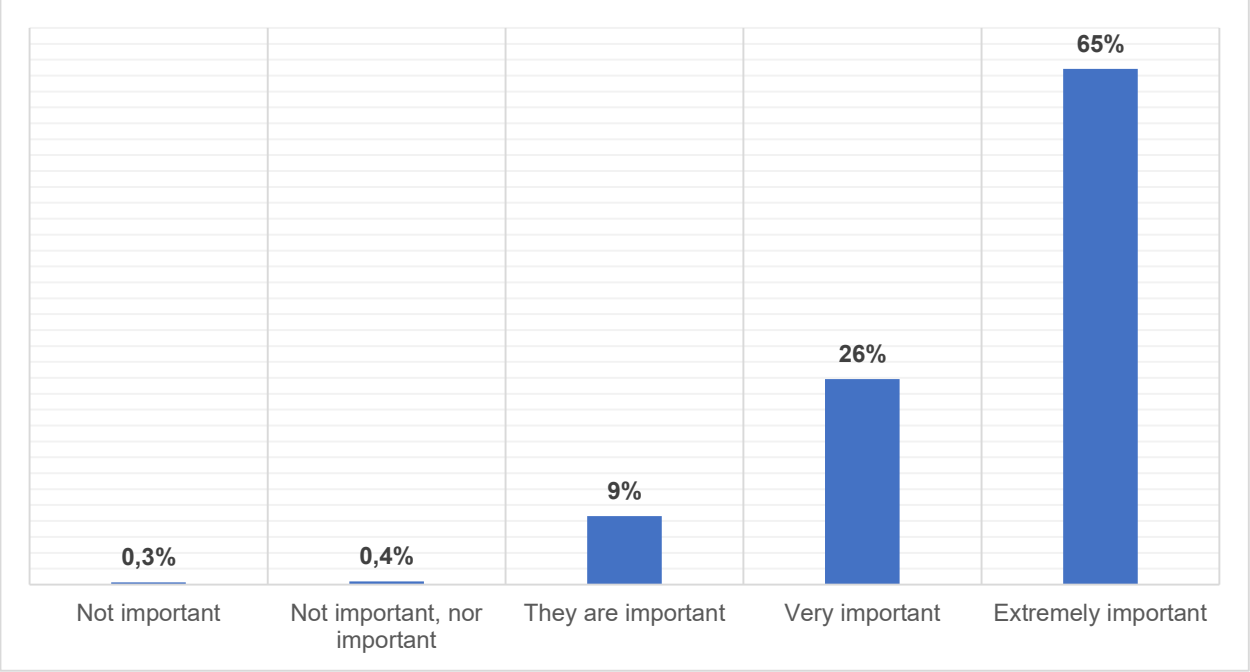


The overall results of this question are not mutually exclusive, and the question itself is designed to measure respondents' attitudes towards post-training skills verification. For the public administration in Bulgaria, as well as for the administrations in Poland and Slovenia, every employee who has undergone training receives a so-called Certificate of Completed Training (67% of respondents), which is relevant to their career development

within the public administration. In some of the training offered by the Institute of Public Administration in the field of digital competences, exit tests are made, on the basis of which the Training Certificate is issued. This also explains the response of 25% of the respondents about taking the certification exam. The Bulgarian state administration has not adopted a universal certification of digital competences, and accordingly, such certification is not applied.

More than half of the respondents (47) who answered "No certification program is applied" have not participated in training, and accordingly could not give an answer based on their experience. For the remaining 32 respondents, the reason for giving this answer is that, for them, a certification programme refers to having an independent institution that validates skills through a test and therefore issues an internationally recognised certificate.

7. On a scale of 1 to 5, how would you rate the importance of training programs related to enhancing digital competencies? (1 - not important; 5 - extremely important)



The responses of all 1,033 respondents to this question were analysed in detail in terms of its relationship to other questions in the survey. The assessment of civil servants is very clear regarding the importance of training programmes in the field of digital competence. The sector has the understanding that it is necessary to increase their competences,

which creates a very suitable environment for introducing new methods, programmes, environments, etc. In view of the fact that there is a single European framework for digital competences for citizens, it is logical to take steps to adapt the training and validation process to it.

A MODEL FOR ASSESSING THE DIGITAL COMPETENCES OF CIVIL SERVANTS IN BULGARIA

This section proposes a model for assessing the digital competencies of civil servants in the Republic of Bulgaria, which borrows best practices from the projects analyzed in the report, as well as takes into account the results of the survey conducted among civil servants.

First of all, before starting to implement the Assessment Model, which adopts the European reference framework for digital competences DigComp, it should have an official translation into Bulgarian. Also, a preliminary analysis of the Classification of Administrative Positions and the requirements for a particular position according to the job description should be carried out to determine whether there are any positions that do not require digital skills (e.g. levels 11 to 14, which require secondary education or not). This analysis should also answer the question: is it necessary to introduce a 'zero' level of digital competency in order to cover those employees who do not require any digital skills in relation to their day-to-day job, and is it necessary to have such skills.

In development, the Model should reflect the five typical DigComp implementation scenarios. The DCDS project implementation approach is the most complex and detailed in this respect. Both specialists in different fields (decision-makers, pedagogical, methodological, human resources, information technology) - an **expert group** - and a sample of the target group - a **validation group** - should be involved.

Adaptation and specification: according to the needs of the target group

The role of the expert group is to:

- Defines the learning outcomes for each competency.
- Analyse and decide which level of competency is the minimum required for each job in public administration. All projects are considered set as a minimum level 2, which is also a starting point for upgrading.
- To define which job levels according to the Classifier correspond to the different levels of digital competence as mandatory for the employee to be effective in his/her job.

- ❖ To propose a technical and methodological framework for the initial assessment of the level of digital competence: according to the projects analysed, good practice is a test of self-assessment.
- ❖ To propose a pedagogical and methodological framework for a system of recommendations for upgrading digital competences through educational services and what is the model by which these educational services will be implemented in practice.
- ❖ To propose a technological framework for the implementation of the Method (in terms of a technical solution, platform).
- ❖ The role of decision-makers and HR professionals is mainly related to the validation and recognition of acquired skills - how and through what document.

Assessment of the level of digital competence

The model should offer a system for self-assessment by the target group, which should have the following characteristics:

Table 5: Model Requirements

Area of competence	All five, according to DigComp
Level of proficiency for testing and profiling purposes	Minimum 4, basic
Developed learning outcomes for 21 competencies	Minimum three for each
Method of implementation	Online test
Type of questions	Closed-ended questions with one possible correct answer and performance check questions
Recommendations for upgrading	Online training materials.
Option to retake the test	Yes, after reviewing the recommended online training materials.
Digital profile	Provides an initial such after completing the self-assessment test that can be built upon.

The majority of positions under the Classification require a minimum Bachelor's degree. This suggests that employees have a satisfactory level of digital competence, which is confirmed by the survey that the majority have participated in digital competence training in the last calendar year and have a strong positive attitude towards the training programmes.

The model should implement a good practice from the PIX project - the self-assessment test should be per competence area, with the result visualised after testing each area and recommended learning resources given for each competence for which the level was not achieved. From a management perspective, this will give a more accurate picture of the strengths and weaknesses of civil servants' level of proficiency in the digital competencies across the 5 domains and therefore where emphasis needs to be placed to secure further training.

The system through which the self-assessment test is administered should allow for multiple administrations, as it is assumed that the user performs certain activities to increase their digital competence, e.g. completes the suggested online gap-filling trainings. When taking the same test again, the questions must be different. This requires the creation of a database of appropriate self-assessment and control questions, as well as the technical capability of the system to recognize at the user level what questions were given the first time the test was taken, so that there is no matching when taking it again.

After retaking the self-assessment test, the user's original digital profile is 'locked' and the results are transmitted to the expert group for analysis and follow-up.

Training of trainers

Once the expert group has analysed the data from the initial digital profiles, those entities that will implement the training of civil servants should be involved. Their role is to develop the methodological framework, pedagogical tools and delivery method for subsequent training.

End-user training

All the projects reviewed clearly demonstrate that the preferred learning mode for users is blended learning: both face-to-face and online. The survey data confirms this, but also clearly shows that civil servants adopt both face-to-face and fully online training.

For this, the model provides for different methods of training delivery according to the levels of proficiency of the different competences.
For **levels 1 and 2**, where the complexity of the tasks is lowest, and the cognitive level relates to recall, the most appropriate training method is fully online with many practical exercises to stimulate recall of actions. Given the educational profile for the majority of government jobs according to the Classifier, the group of people who fall into this group will be the smallest. All training should culminate in a test that validates proficiency at the appropriate level.
For **levels 3 and 4**, which require understanding in performing routine tasks and non-routine problems, the training should be of a mixed type: online and with a lecturer/facilitator. This type of training can be delivered entirely in a virtual environment, with the lecturer giving introductory lectures to learners and also providing additional materials and resources in an online environment. The validation of the level of competency, in this case, will be done through an online situational test: users are presented with real situations from different aspects of their digital working life, and they have to indicate how they would act to find a solution. At this stage, this would be the largest group of public sector users in Bulgaria - at the official "expert" level.

For **Levels 5 and 6**, where application and evaluation are required to perform different tasks and problems, the most appropriate training is of a mixed type: face-to-face with a speaker/facilitator and online self-study with resources provided. If face-to-face training is not feasible, it may be replaced by similar training conducted in a virtual environment. The validation of the level of proficiency is done through a combined situational and scenario-based test model. Achievement of these levels of digital competence is primarily targeted for the job level - "managerial".

For levels 7 and 8, there is a model developed only by the IKANOS project. The most appropriate form of training is one that combines all forms of training: face-to-face with a

lecturer/facilitator, virtual with a lecturer/facilitator and online self-study with resources provided. Validation of the level of competency is done through and scenario-based test. The provision of pedagogical and methodological tools at these levels of digital competence requires long-term planning, continuous interaction with other organisations in Europe working in this direction. This area of DigComp has hardly been implemented and organisations are still working on its adaptation and application.

Validation and certification

In the case of end-user training, the method by which proficiency at the different levels of competence will be validated is also described. More important is the final document of successful validation. The model borrows good practice from the e-Schools project through digital badges and good practice from the DCDS project for these to be incremental - i.e. from specific content - a module badge, through to covering a set of modules - a learning pathway badge, and successful completion of several learning pathways leads to the highest level - a digital competency badge.

In terms of digital competence certification, the projects analysed show that this has been developed for the first four levels at national level and has institutional recognition. The model refers to a specific target group from a specific public sphere: civil servants and its aim is to increase the digital competence of the individual employee, and therefore of the whole organisation - in this case, the recognised certification model is the one that is most appropriate for the organisation. The digital badges applied in each competency validation are applicable to a specific organisation.

On the other hand, national projects related to increasing the digital competence of the population are yet to be implemented. There are still few good practices in the EU, but successful ones are characterised by the development of a stand-alone or adaptation of an existing certification system that also benefits civil servants. It is important that these certificates are institutionally recognised.

Before the full implementation of the Model, all its stages need to be tested by the validation group in order to make necessary changes.

Thus, the proposed Model covers all five scenarios for the implementation of DigComp by the Institute of Public Administration in Bulgaria. Detailing it and putting it into practice requires, above all a managerial will, securing funding and a long-term perspective.

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APPENDICES

APPENDIX 1: UPDATES TO DIGCOMP VERSION 2.0 WITH DIGCOMP VERSION 1.0 (Mladenova, 2019)

Competencies version 1.0	Competences Version 2.0
1.1. View, search and filter information To access and search online information, to formulate information needs, to find relevant information, to select resources effectively, to navigate between online sources, to create personal information strategies	**1.1. View, search and filter data, information, and digital content** Articulate information needs, search for, access, and navigate data, information and content in a digital environment. Create and update personal search strategies.
1.2. Evaluating information Gather, process, understand, and critically evaluate information.	**1.2. Evaluate data, information and digital content** Analyse, compare and critically evaluate the reliability and credibility of data sources, information and digital content. Analyse, interpret and critically evaluate data, information and digital content.
1.3. Store and retrieve information Manipulate and store information and content to facilitate retrieval, organisation of information and data	**1.3. Data, information, and digital content management** Organize, store and retrieve data, information, and content in a digital environment. Organise and process them in a structured environment.
2.1. Interaction through technology Interact through a variety of digital devices and applications to understand how digital communication is distributed, displayed, and managed, understand appropriate ways to communicate through digital means, address different communication formats, adapt communication modes and strategies to specific audiences.	**2.1. Interaction through digital technologies** Interact through a variety of digital technologies and choose appropriate digital means of communication in a given context.

2.2. Information and content sharing Share with others the location and content of information found, be willing and able to share knowledge, content, and resources, act as an intermediary, be proactive in disseminating news, content, and resources, be knowledgeable about citation practices and integrate new information into existing knowledge	**2.2. Sharing through digital technologies** Share data, information, and digital content with others using appropriate digital technologies. Act as a mediator, be aware of citation and attribution practices.
2.3. Online Citizenship Participate in society through online engagement, seek opportunities for self-development in the use of technology and digital environments, be aware of the potential of technology for civic engagement.	**2.3. Citizen participation through digital technologies** Participate in society through the use of public and private digital services. Seek opportunities for self-development and civic participation through appropriate digital technologies.
2.4. Collaborate through digital channels Use technology and media for teamwork, collaborative processes, and co-construction and co-creation of resources, knowledge, and content.	**2.4. Cooperation through digital technologies** To use digital tools and technologies for collaborative processes, and for the co-construction and co-creation of resources and knowledge.
2.5. Web etiquette / netiquette Possess knowledge and know-how of behavioural norms in online/virtual interactions, be aware of aspects of cultural diversity, be able to protect self and others from possible online dangers (e.g. cyberbullying), develop proactive strategies to detect inappropriate behaviour.	**2.5. Web etiquette / netiquette** Know the norms of behaviour and know-how while using digital technologies and interacting in a digital environment. To adapt communication strategies to specific audiences and be aware of cultural and generational diversity in the digital environment.

Project BG05SFOP001-2.017-0001/28.11.2019 "Digital Transformation in Learning - Digital Competence and Learning", funded by Operational Programme "Good Governance", co-financed by the European Union through the European Social Fund.

2.6. Digital Identity Management To create, adapt and manage one or more digital identities in order to be able to protect its electronic reputation, to handle the data that is created through several accounts and applications.	**2.6. Digital Identity Management** Create and manage one or several digital identities to be able to protect one's own reputation, to deal with the data that is created through different digital tools, environments and services.
3.1. Content development Create content in a variety of formats, including multimedia, editing skills, and enhance content that they create or created by others, express themselves creatively through digital media and technology.	**3.1. Developing digital content** To create and edit digital content in different formats, to express themselves through digital means.
3.2. Integration and transformation Modify, enhance and blend existing resources to create new, original, and appropriate content and knowledge.	**3.2. Integrate and transform digital content** To modify, improve, enhance and integrate information and content into existing knowledge to create new, original and relevant content and knowledge.
3.3. Copyrights and licenses Understand how copyright rights and licenses for information and content.	**3.3. Copyrights and licenses** Understand how copyright is applied rights and licenses for data, information, and digital content.
3.4. Programming Apply settings and modifications to programs, software applications, software, and devices, understand programming principles and what is behind the program.	**3.4. Programming** Planning and developing a series of understandable instructions for a computer system to solve a problem or perform a specific task.
4.1. Protection of devices Protect personal devices and understand online risks and threats, know safety and security measures.	**4.1. Protection of devices** Be able to protect devices and digital content and understand risks and threats in the digital environment. Know safety and security measures and due consideration for reliability and privacy.

4.2 Protection of personal data Understand general terms of service, active privacy protection, understanding other people's privacy to protect yourself from online scams and threats and cyberbullying.	**4.2 Data protection and privacy** To protect your privacy and confidentiality in the digital environment. Understand how to use and share personal information while being able to protect self and others from harm. To understand that digital services use a 'Privacy Policy', to be informed about how personal data is used.
4.3. Health protection Avoid health risks associated with the use of technology in terms of threats to physical and psychological well-being.	**4.3. Protection of health and well-being** Be able to avoid health risks and threats to physical and psychological well-being when using digital technologies. Be able to protect themselves and others from potential dangers in the digital environment (e.g. cyber-mouse). To be familiar with digital technologies for social well-being and social inclusion.
4.4. Environmental protection Be aware of the impact of ICT on the environment.	**4.4. Environmental protection** Be aware of the impact of digital technologies and their use on the environment.
5.1. Solve technical problems Identify possible problems and solve them (from troubleshooting to solving more complex problems) using digital tools.	**5.1. Solve technical problems** To identify technical problems in handling devices and using digital environments, and to solve them (from troubleshooting to solving more complex problems).
5.2. Identification of needs and their technological responses Assess own needs in terms of resources, tools and competence development to meet needs with possible solutions, adapt tools to personal needs, be able to critically evaluate possible solutions and digital tools.	**5.2. Identification of needs and their technological responses** Assess needs and identify, evaluate, select and use digital tools and possible technological responses to address them. Adjust and customize the digital environment for personal needs (e.g., accessibility).

5.3. Innovation and creative use of technology Innovate with technology, actively participate in collaborative digital and multimedia creation, express themselves creatively through digital media and technology, create knowledge and solve conceptual problems using digital tools	**5.3. Creative use of digital technologies** Use digital tools and technologies to create knowledge and innovate processes and products. Engage individually and collectively in cognitive processing to understand and solve conceptual problems and problem situations in a digital environment.
5.4. Identify gaps in digital competence Be able to understand where they need to better or update their competence, support others in developing their digital competence, be aware of developments in technology.	**55.4. Identify gaps in digital competence** Understand where to improve or update personal digital competence. Be able to support others with the development of their digital skills. To seek opportunities for self-development and to keep abreast of digital evolution.

ANNEX 2: COMPLIANCE BETWEEN DIGCOMP AND DIGCOMP CONSUMERS

DigComp	DigComp Consumers
1.1 Browse, search, and filter data, information, and digital content	Browse, search and filter information about goods and services
1.2 Evaluate data, information, and digital content	Evaluate and compare information about goods and services
	Recognition and evaluation of commercial messages and advertisements
1.3 Data, information and digital content management	
2.1 Communication through digital technologies	Communicating in the digital marketplace for buying and selling purposes
2.2 Sharing through digital technologies	Sharing information with other users on the digital marketplace
	Participation in collaborative economic platforms
2.3 Taking action on citizenship through digital technologies	Advocating for consumer rights in the digital marketplace
	Managing payments and finances through digital means
2.4 Cooperation through digital technologies	
2.5 Online behaviour etiquette	
2.6 Digital identity management	Digital identity and profile management in the digital marketplace
3.1 Developing digital content	
3.2 Integrate and rework digital content	
3.3 Copyright and licences	Understanding copyrights, licenses, and contracts for digital goods and services
3.4 Programming	
4.1 Device protection	
4.2 Data protection and privacy	Data protection and privacy
4.3 Protection of health and welfare	Protection of health and safety

4.4 Environmental protection	Accounting for responsible and sustainable consumption in digital markets
5.1 Resolving technical problems	
5.2 Identify needs and technology responses	
5.3 Creatively design digital technologies	
5.4 Identify digital technology competency gaps	Identifying gaps and limitations in consumer competence in digital technologies

APPENDIX 3: DIGCOMPORG OVERVIEW (Mladenova, 2019)

Thematic elements	Sub-elements	Descriptions
Leadership and Management Practices	Integration of learning in the digital age is part of the overall mission, vision, and strategy The digital learning strategy is supported by an implementation plan A leadership and management model are in place	1. The potential of digital learning technologies is clearly outlined
		2. The benefits of digital technologies for learning are shared
		3. The strategic plan embraces learning in the digital age
		4. Open education is an aspect of public engagement
		5. Planning is based on factors that help overcome barriers
		6. Internal stakeholders have a degree of autonomy
		7. Opportunities, incentives and rewards for staff are identified
		8. Learning in the digital age is aligned with wider priorities
		9. There are two aims - modernising existing education and offering new opportunities
		10. There is a shared understanding and commitment to an implementation plan
		11. Management responsibility is clearly defined
		12. Resources are aligned with budgets and staffing
		13. Results, quality and impact of the implementation plan are considered
		14. Specific initiatives or pilot projects are evaluated
		15. The state of performance is compared with standards
		16. Monitoring of policy and guidelines is evident
Teaching and learning practice	Digital competence is promoted, benchmarked, and evaluated	17. Staff and students are digitally competent
		18. Safety, risks, and responsible online behavior are provided for
		19. Digital competence of staff and students is benchmarked against standards
		20. Digital competency is included in staff evaluation
	Rethinking roles and pedagogical approaches	21. Staff are partners in change
		22. New roles are envisaged for staff
		23. New roles are envisaged for students
		24. Pedagogical approaches are expanded
		25. Personalised learning is developed
		26. Creativity is encouraged
		27.Collaboration and group work are expected
		28. Social and emotional skills are developed
Professional development	-	29. A commitment to continuous professional development (CPD) is evident
		30. CPD is provided for staff at all levels
		31. CPD is tailored to individual and organisational needs
		32. A wide range of approaches to CPD is evident
		33. Accredited/certified opportunities for CPD are promoted
		30. CPD is provided for staff at all levels
Evaluation practices	Evaluation formats are engaging and motivating	34. The scope forming the assessment is extended
		35. The summary assessment is diverse
		36. Self-assessment and peer evaluation are encouraged.
		37. Broad, personalized, and meaningful feedback is provided.
	Informal and non-formal learning are recognized	38. Prior, experimental and open learning
	Learning design is inspired by analytics.	39. Training analysis is considered strategically
		40. There are established rules of practice for training analysis
		41. Learning is supported by learning analysis
		42. Quality management and the development of training courses/programs are supported by training analysis
Content and curricula	Digital content and open learning resources are promoted and used	43. The staff and students are the creators of the content
		44. Content repositories are widely and efficiently used
		45. Intellectual property and copyright are respected
		46. Digital tools and content are licensed as required
		47. Open educational resources are promoted and used
	Curricula are reviewed or revised to reflect the pedagogical opportunities provided by digital technologies	48. Thematic training is being rethought to create more integrated approaches
		49. The time and place of study have changed
		50. Online resource provision is a reality
		51. Learning in an authentic context is encouraged
		52. The provision of digital learning is evident in the areas of the curriculum
		53. The digital competence of the students is developed in the classrooms
Cooperation and networking	Networking, sharing and collaboration are encouraged	54. Network collaboration for staff to pool expertise and share content is the norm
		55. Knowledge sharing efforts are recognized
		56. Students participate in effective networks
		57. Participation in knowledge exchange activities and events is encouraged
		58. Internal cooperation and knowledge exchange is expected
	A strategic communication approach is applied	59. There is a clear communication strategy
		60. The dynamic online presence is obvious
	Partnerships are being developed	61. The commitment to knowledge sharing through partnerships is evident
		62. Staff and students are encouraged to actively learn in partnerships
Infrastructure	Physical and virtual learning spaces are designed for learning in the digital age	63. Physical learning spaces are optimized for learning opportunities in the digital age
		64. Virtual learning spaces are optimized
	Digital infrastructure is planned and managed	65. An acceptable usage policy is adopted
		66. Pedagogical and technical expertise and direct investments in digital technologies
		67. Various digital learning technologies support learning anytime / anywhere
		68. Device customization approaches are supported
		69. The risks associated with digital inequality and inclusion are considered
		70. The technical and consumer support is visible
		71. Assistive technologies meet special needs

		72. Measures to protect privacy, confidentiality and safety are well established
		73. Effective planning for the purchase of necessary infrastructure elements is evident
		74. There is an operational plan based on ICT and services

APPENDIX 4: DIGCOMPEDU OVERVIEW (Competencies and Frameworks of Reference, 2019)

1. Professional engagement	**1. Digital resourse**	**5. Empowering learners**	**6. Support students' digital competences**
1.1. Organisational communication	**2.1. Selection**		
	2.2. Creation and modification	**5.1. Accessibility and inclusion**	**6.1. Information and media literacy**
	2.3. Manage, protect, share		
1.2. professional cooperation	**3. Teaching and learning**		
	3.1. Teaching		**6.2 Communication**
	3.2. Guidance		**6.3. Content creation**
1.3. Reflection	**3.3. Supporting learning**	**5.2. Differentiation and personalisation**	**6.4. responsible use**
	3.4. Self-regulated learning		
	4. Assessment		
1.4. Digital continuing education	**4.1. Assessment strategies**	**5.3. Active learner engagement**	**6.5 Problem solving**
	4.2 Analysing evidence		
	4.3. Feedback and planning		

APPENDIX 5: OVERVIEW OF THE EUROPEAN FRAMEWORK FOR ELECTRONIC COMPETENCE 3.0 (Mladenova, 2019)

Dimension 1 5 e-CF areas (A-E)	Dimension 2 the 40 competencies are identified	Dimension 3 Skill levels for e-competence f-1 to f-5 related to EQF levels 3-8				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. Aligning IP with business strategies				■	■
	A.2. Managing the level of obsolescence			■	■	
	A.3. Business plan development			■	■	■
	A.4. Product/service planning		■	■	■	
	A.5. Architecture design			■	■	■
	A.6. Application design	■	■	■		
	A.7. Technology trends monitor				■	■
	A.8. Sustainable development			■	■	
	A.9. Innovation				■	■
B. CONSTRUCTION	B.1. Development of applications	■	■	■		
	B.2. Integration of components		■	■	■	
	B.3. testing	■	■	■	■	
	B.4. Implementation of the solutions	■	■	■		
	B.5. Creating documentation	■	■	■		
	B.6. System engineering			■	■	
C. ACTION	C.1. User support	■	■	■		
	C.2. Maintenance of changes		■	■		
	C.3. Service delivery	■	■	■		
	C.4. Problem management		■	■	■	