

## CHAPTER 2

# INNOVATIONS IN THE MANAGEMENT OF EDUCATIONAL INSTITUTIONS

### FORMATION OF DIGITAL COMPETENCE OF PEDAGOGUE IN THE PROCESS OF THEIR PROFESSIONAL TRAINING

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**Abstract.** An important task of education in the XXI century is the formation of digital competence of the teacher of the institution of higher education, directly due to the rapid development of an information oriented society. Teacher for successful professional educational activities It is necessary to master the latest computer information technology. Free possession of them provides a high level of professional culture of the teacher of the institution of higher education, makes it possible to apply them for a full-time or remote day or absentee educational process. The article proposes the following definition of the concept of «digital competence»: the component of the professional culture of the teacher, based on personal abilities and acquired in the process of professional development of skills and skills aimed at the effective and high-quality organization of the educational process with the free and competent use of innovative computer, mobile and telecommunication technologies To prepare specialists in accordance with the requirements of digital society. Also identified the leading place of digital competence in the professional culture of the teacher and its components. Significant work on the creation of framework documents in the field of education and employment is carried out by international organizations, including the European Research Center of the European Commission, which organized the Working Group, developed and presented a framework for a citizen's digital competence. In the process of continuing this design, a frame of digital competence for teachers is presented. She identified the main forms and methods of developing the digital competence of the teacher and applicants for higher educational institutions, as well as the principles of creating a digital educational environment in such establishments. Frame of digital competence for society and the Digital Competence Frame for teachers use most European countries to view and create appropriate training programs, continuously improve the digital competence of teachers and supporting employment opportunities for future specialists.

**Keywords:** competence, digital competence, professional training, IR-competence, computer information technology.

**JEL Classification:** I0; I20

**Formulas:** 0; **fig.:** 1; **tabl.:** 0; **bibl.:** 21

**Introduction.** At the present stage, society is characterized by the accelerated progress of information and digital computer, mobile and telecommunication technologies, which causes natural changes in life of humanity and affects all

engagement aspects, especially education. Therefore, the important task of education in the XXI century is the formation of digital competence of the teacher of higher education, which is directly related to the rapid development of information-oriented society. Certainly, the highest level of modern computer information technologies competence provides professionalism in a process of higher education allows usage of this competence for full-time or distance full-time or part-time learning and standing work for its improving.

The formation of digital competence of teachers today is a priority in the Law of Ukraine «About the National Informatization Program» [19], the Law of Ukraine «On the Basic Principles of Information Society Development in Ukraine for 2007–2015» (p. 3: «giving everyone the opportunity to acquire knowledge, skills and abilities using ICT in education, upbringing and training») [20].

«Digital Agenda for Ukraine 2020» project proposes the concepts of digital literacy, digital competence and digital intelligence, it also stated there about the formation of cross-platform app development, thus in the process of studying disciplines should be used digital technologies «Digital Agenda for Ukraine – 2020: 22). In the Concept of the New Ukrainian school (2016) the term «digital competence» is used, which implies the confident and, at the same time, critical application of information and communication technologies for the creation, retrieval, searching, exchange of information at work, in public space and in private communication; information and media literacy, basics of programming, algorithmic thinking, working with databases, Internet security skills and cybersecurity; understanding the ethics of working with information (copyright, intellectual property, etc.) [10, p. 12].

**Literature review.** The analysis of scientific and pedagogical sources on the research topic shows that the study of ways to form digital competence of teachers is carried out in different directions. Most scientific publications are devoted to the identification and justification of structural components, content and means of forming digital competence of the teacher (M. Bovtenko, L. Bocharova, L. Gorbunova, R. Gurevich, I. Eremina, V. Honcharuk, etc.). According to native and foreign researchers V. Bykov, N. Hendina, S. Zaitseva, N. Morse, F. Uvarov, R. Rice, M. McCready, S. Chang, etc., the issue of identifying information competence as a key component of digital competence of teachers has been the subject of scientific discussions. We still have different opinions about what the competence related to the field of information computer technology should be called: digital literacy, electronic competence (e-competence) (J. Romani), etc. Due to the different approaches to the definition of this concept, it should be noted that this concept is under development and improvement [9, p. 12].

The issues of effective usage of information computer technologies in the educational process of higher education institutions in Ukraine are dealt with help of such researchers as: V. Bykov, Y. Zhuk, N. Morse, O. Spivakovsky, M. Zhaldak, M. Shut, S. Karakozov, S. Litvinova and others. V. Bykov (information and communication environment), S. Litvinova, N. Morse (requirements and computer-oriented environment), O. Spirin directly touched upon the issues of digital competence of the subjects of the educational process in the free educational process,

N. Soroko, O. Belous (digital competence of teachers of humanities), I. Ivanyuk (computer-oriented environment for the development of information and communication competence of teachers and students) and others [1; 5; 6; 8; 9].

**Aims.** The aim of the article is to reveal the essence of the concept of «digital competence» as a component of the professional culture of a teacher of higher education and highlight the ways of using IC technologies in the educational process.

**Methods.** The usage of information computer, mobile and telecommunication technologies in higher education institutions is especially important for Ukraine in carrying out educational reform, particularly in the process of developing digital competence of teachers.

That is why the Digital Competence Framework for Citizens with a description of descriptors and a model of progress developed and presented in the European Union is becoming relevant (Digital Competence Framework for Citizens (DigComp 2.0 та DigComp 2.1) [7, p. 195; 15]. Describing the definition of digital competence in Ukraine and around the world is still under discussion. Among scientists, different concepts are used to set the same characteristics – information and communication competence, information and digital competence, digital competence. Among the major international organizations, large corporations and projects that support the formation and development of human ability to use modern computer information technologies – the European Education Fund (ETF), the United Nations Educational, Scientific and Cultural Organization (UNESCO), European certification computer users (ECDL), Microsoft Corporation (MICROSOFT), Integrated Electronics Corporation (INTEL), etc.).

The concept of «digital competence» has appeared in the international recommendations and research by experts from the European Union. Already in 2013, the Joint Research Center (JRC) of the European Commission launched a research project to develop and publicize the digital competence system of citizens DigComp, and in 2016 published the Digital Competence Framework 2.0. (English, DigComp 2.0: The Digital Competence Framework for Citizens). Digital competence is defined in this document as the confident and thorough usage of information and communication technology (ICT) tools in areas such as work, employment, education, leisure, involvement and participation in society, which are vital for participation in daily social life, economic life [7, p. 195; 14]. International organizations have proclaimed the skills of the 21st century, among which digital competence is identified by the European Commission as an important component of information and professional culture of educators for innovation, participation in digital society and economic development [15].

**Results.** Including, the necessity mastering in teacher's digital competence The Joint Research Center (JRC) of the European Commission investigated a research project to develop and publish in 2013 the digital competence system of citizens DigComp.

The project was developed on the basis of consultations and active cooperation with a wide range of stakeholders in 2016. ODC has released the Digital Competence Framework 2.0. (English, DigComp 2.0: The Digital Competence Framework for

Citizens) [15]. The first level of demonstration of the was studied and updated Framework 2013 as a conceptual reference model, a benchmark that provides an opportunity to understand the concept of «digital competence», to determine its components and descriptors.

The document, which is mentioned above shows examples of the application of the Framework at European, national and regional levels. The framework is a product of joint activities of international organizations and various authors – experts, scientists, educators, civil society representatives of society. The justification for this document were experience and researches of educational systems of many countries, which collected training practices on the formation of digital skills and competencies of modern man for their application in the field of digital information technology.

The authors of the Framework note that since the first publication of DigComp in 2013, the evolution of digital technologies has undergone radical changes, new needs and requirements that are reflected in the dictionary of DigComp 2.0, related to the dynamic application of digital competence.

The dictionary describes terms such as: «content», «data», «digital communication», «digital content», «digital environment», «digital services», «digital technology», «digital media», «compliance rules», «privacy», «problem solving», «well-being», «social integration», «structured environment,« technological response / solution» [17].

The 2016 framework was updated and introduced in 2017 (DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use) [15]. The system of digital competence of citizens is built in five dimensions. Dimensions 1 and 2 were published in 2016 and are a DigComp conceptual reference model (dimension 1 is areas of competence defined as part of digital competence; dimension 2 is competence descriptors and names corresponding to areas. Dimension 3 covers 8 levels of learning outcomes (levels skills for each competence), dimension 4 – examples of knowledge, skills and attitudes, dimension 5 – examples of use, application of competence for different purposes. 3rd, 4th and 5th dimensions were updated and presented in 2017. The developers of the framework also provided a number of examples of the use of competence for various purposes in the educational process and for employment. Areas of digital competence include the following: 1) information and ability to work with data; 2) communication and cooperation; 3) creation of digital content; 4) security; 5) problem solving. The framework contains 21 descriptors for each industry [15; 17].

The developed document (DigComp 2.1) describes eight levels of mastery of each area of digital competence of the teacher at four generalized levels: basic (simple tasks – 2 sublayers), intermediate (1 – clearly defined, routine tasks; 2 – straightforward problems, tasks and clear identified and non-routine problems), higher (1 – various tasks and problems; 2 – the most relevant tasks), expert (1 – solving complex problems with limited solutions; 2 – solving complex problems with many interacting factors) [15, p. 195]. In 2017, the European Research Center of the EU launched the Digital Competence Framework for Educators (DigCompEdu), which provides tools for the development of digital competence of teachers from early childhood to higher



education and adult education (postgraduate education), including vocational education, education of people with special needs, non-formal forms of education [15, p. 195].

This framework covers the digital competence of the teacher and outlines six areas and 22 components. Among the areas outlined by the framework are: Area 1 – aimed at the professional environment and the use of digital technologies by educators in professional cooperation with colleagues, students, parents and other stakeholders for professional development and collective achievement of educational institutions; area 2 – competencies and qualities necessary for the efficient and responsible use, creation and exchange of digital resources for the educational process; Branch 3 is devoted to the management of the use of digital technologies in the educational process; Area 4 – use of digital strategies for evaluation; Industry 5 – focused on the capabilities of digital technologies to improve teaching and learning strategies; Branch 6 – provides a detailed description of the specific competencies of the teacher, which must be possessed to form the digital competence of students [15, p. 195].

It should be noted that the above framework is actively studied by Ukrainian scientists, some of the recommendations contained, taken into account by developers of modern standards and curricula for primary, primary and higher education and used today in developing curricula for higher education [11; 12; 13].

The concept of «digital competence» is defined by educators as: a dynamic combination of knowledge, skills and practical skills, ways of thinking, professional, worldview qualities, which determines the ability of teachers to successfully pursue professional activities and is the result of training at a certain level of higher education [11; 12]; «Skills in the information and communication (digital) environment as a leading feature of digital literacy, socio-cultural component (new artifacts, new practices of digital culture with relevant values and personal experience)» education [3]. According to modern legislation, the concept of digital competence, includes information and media literacy, basics of programming, algorithmic thinking, ability to work with databases, Internet security and security skills, as well as understanding the ethics of working with information (copyright, intellectual property, etc.) education [15].

Scientists-educators claim that the totality of all knowledge, skills and abilities opens before the teacher of higher education such opportunities as: ability to carry out web design, develop presentations, use graphic programs, availability of information from online libraries, web browsers, programs Word, the use of virtual research laboratories, etc. education [11; 12; 14].

R. Gurevich education [3] and L. Penzay [12], studying the development of information and communication and media competencies of teachers in the international educational space, information and communication competence is considered as a complex concept, namely: a set of knowledge and understanding, skills and abilities, as well as personal attitudes and values of people in the field of ICT and the ability to autonomously and responsibly demonstrate them for practical, professional activities and lifelong learning [3; 12].

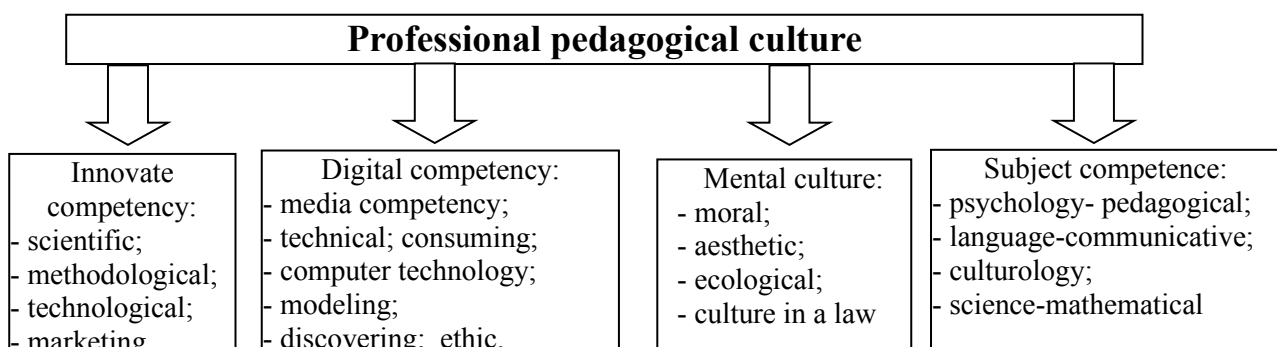
The Fundamentals of Standardization of Information and Communication Competences in the Education System of Ukraine stipulates that information and communication competence is the result of the ability and ability to obtain information from various sources in an understandable form; work with various information and critically evaluate them; to use information and communication technologies in professional activity; knowledge of the features of information flows in their field, the basics of ergonomics and information security, ICT functionality; specific skills in the use of computer technology and ICT; the attitude of the individual to the use of ICT for responsible social interaction and behavior [11, p. 26].

According to pedagogical scientists, information and communication competence of a teacher is a set of such competencies: technological (awareness of the computer as a universal automated workplace for any profession); algorithmic (awareness of the computer as a universal performer of algorithms and a universal means of constructing algorithms); model (awareness of the computer as a universal means of information modeling); research (awareness of the computer as a universal technical means of automation of educational research); methodological (awareness of the computer as the basis of intelligent technological environment) [11].

Currently, the following pedagogical competencies are considered to be indicators of a teacher's information competence: the presence of general ideas in the field of ICT development and use; availability of ideas about electronic educational resources; interface configuration and installation of appropriate software; ability to create multimedia learning tools in a PowerPoint environment; use the capabilities of the Microsoft Office package for the development of didactic materials in the subject area and working papers; ability to process graphic images; possession of basic Internet-services, technologies and basics of technology for building web-sites [6; 10].

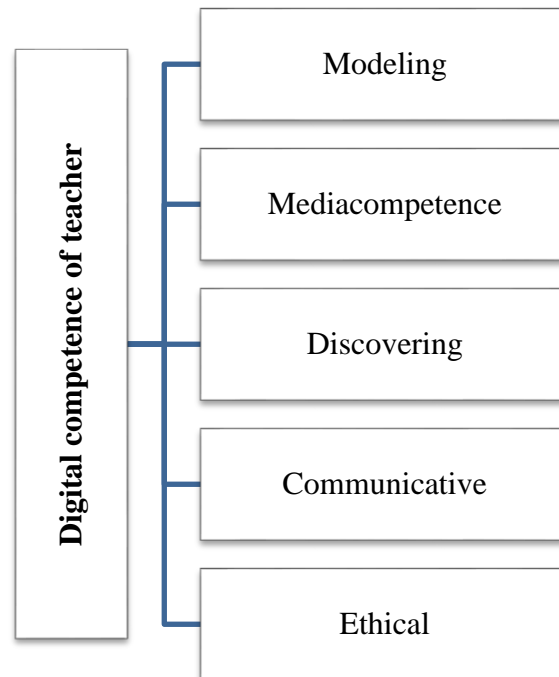
We are interpreting this concept, which is based on opinions of scientists on digital competence of teachers, explained as: a component of professional culture of teachers, based on personal abilities and acquired in the process of professional development skills aimed at effective and quality organization of educational process with free and competent application innovative computer, mobile and telecommunication technologies for training specialists in accordance with the requirements of the digital society.

**Discussion.** Determine the trending of digital competence in the structure of professional pedagogical culture (Fig. 1).



**Figure 1. Structure of professional pedagogical culture**

It should be considered structure of digital competence, as an aspect of Professional pedagogical displayed as scheme (Fig. 2).



**Figure 2. Components of digital competence of a teacher**

**Conclusion.** The results indicate that there is amount of approaches to determine digital competence as a component of professional culture of teachers in the use of innovative computer, mobile and telecommunications technologies in professional activities. At the same time, the definition of information and digital competence of modern teachers, formulated by foreign and native scientists, are typo-logically related and differ only in component structure.

In order for ICT to be really useful in pedagogical activities, it is necessary to take into account the following conditions, namely: professional readiness of teachers to use computer technology, their literacy in the use of software to work with information; taking into account the impact of computers on the health of teachers and students; availability of high-quality hardware and software; understanding the problems in this and supporting the management of educational institutions.

Readiness to master and use information technology is a psychological prerequisite for the formation of digital competence of teachers and requires specially organized quality motivational and educational activities among higher education educators, improving the material and technical base of higher education institutions, organizing appropriate training in ICT. Modification of professional training of teachers, development of norms of ICT competence in accordance with the state educational standards of higher education is the task of higher education institutions of Ukraine. Prospects for further implementation of ICT in pedagogical activities are the study of domestic and foreign experience in the development of digital competence as part of the professional culture of teachers. The growing role of ICT in the education

system and everyday life requires the formation of digital competence from the beginning of the formation of professional knowledge of future professionals.

This process is entrusted to the teacher as the main agent of action and the driving force of modern educational reforms. It provides a clear understanding not only of the components and characteristics of this category, but also the forms, methods and tools that contribute to the acquisition and further development of digital competence of teachers. The Digital Competence Framework for Society and the Digital Competence Framework for Teachers are today reference models developed by European countries to create a common language, scientific terminology and educational standards for the formation of digital competence of teachers in Ukraine.

They are used by most European countries to develop a strategy for the formation of digital competence, review and create appropriate curricula, continuous development and improvement of digital competence of teachers and support employment opportunities for future professionals. The main approaches outlined in the Framework are the basis of the concept and standards of the new Ukrainian school. Prospects for further research in the formation of digital competence according to the requirements of the digital society, in our opinion, are to further study the international experience of practical implementation of the Digital Competence Framework for Citizens and Teachers' Framework, analysis of opportunities for digital competence of teachers and higher education, new Ukrainian school.

**Author contributions.** The authors contributed equally.

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### References:

1. Bikov, V. YU., Spirin, O. M., Pinchuk, O. P. (2017) Problemi ta zavdannya suchasnogo etapu informatizacii osviti [Problems and tasks of the modern stage of education informatization]. *Scientific support of education development in Ukraine: current issues of theory and practice (to the 25th anniversary of the NAPS of Ukraine)*, pp. 191–198. URL: <https://lib.iitta.gov.ua/709026> [in Ukrainian].
2. Boichuk, P., Honcharuk, V., Redko, O., Dziubyshyna, N., Vlasiuk, O. and Tiaska, V. (2020). Pedagogical Conditions for Ensuring the Formation of Information and Communication Competences of Higher Education Applicants. *SRP*, 11 (11), 1130-1134. doi:10.31838/srp.2020.11.162. URL: <https://cutt.ly/mLlp3GO>
3. Ghavrilova, L. G., Topolnik, Ya. V. Digital Culture, Digital Literacy, Digital Competence as Modern Educational Phenomena. URL: <https://cutt.ly/ILlpXSL> (in Ukrainian)
4. Goncharuk, V. V., Goncharuk, V. A., Makarevich, I. M., Chistyakova, L. O. Innovacijna pidgotovka majbutnix uchyteliv u zakladax vyshhoyi osvity v umovax dystancijnogo navchannya [Innovative training of future teachers in higher education institutions in the conditions of distance learning]. *Bulletin of Zaporizhzhia National University. Collection of scientific works. Pedagogical Sciences: Zaporizhzhya: Zaporizhzhia National University*, 2020, № 2 (35), p. 88–94.
5. Gurevich, R. S. Formuvannya informacijnoï kompetentnosti majbutnih vchiteliv zasobami multimedia-tehnologij [Formation of information competence of future teachers by means of multimedia technologies]. *Naukovi zapiski. Seriya: Pedagogika*, 2007, № 3, p. 38–41 [in Ukrainian].
6. Karakozov, S. D. Informacionnaya kultura v kontekste obshchej teorii kultury lichnosti [Information culture in the context of the general theory of personality culture]. *Pedagogicheskaya informatika*. 2000, № 2, pp. 41–55 [in Russian].
7. Kartashova, L. A., Baxmat, N. V., Plish, I. V. Rozvytok cyfrovoyi kompetentnosti pedagoga v informacijno-osvitnomu seredovyshhi zakladu zagalnoyi serednoyi osvity [Development of digital competence of a teacher in the information and educational environment of general secondary education]. *Information technologies and teaching aids*, 2018, Tom 68, № 6, pp. 193–205. URL: <https://cutt.ly/VLlp4np> [in Ukrainian].
8. Litvinova, S. G. Metodika vikoristannya tehnologij virtualnogo klasu vchitelem v organizacii individualnogo navchannya uchniv [Methods of using virtual classroom technologies by the teacher in the



- organization of individual learning of pupils]: avtoref. dis. na zdobuttya nauk. stupenya kand. ped. nauk: spec. 13.00.10. Kiev, 2011. 22 p. [in Ukrainian].
9. Morze, N. V. Yak navchati vchiteliv, shchob kompyuterni tekhnologii perestali buti divom u navchanni? [How to teach teachers to stop computer technology as a miracle in learning?]. *Computer at school and family*, 2010, № 6 (86), p. 10–14 [in Ukrainian].
  10. Nova ukraïnska shkola. Konceptualni zasadi reformuvannya serednoï osviti [New Ukrainian school. Conceptual principles of secondary education reform]. Ministry of Education and Science of Ukraine, 2016, pp. 11–12. URL: <https://cutt.ly/5Llp6s2> [in Ukrainian].
  11. Osnovi standartizacii informacijno-komunikacijnih kompetentnostej v sistemi osviti Ukraïni [Fundamentals of standardization of information and communication competencies in the education system of Ukraine]: metod. rekomendacii / [V. YU. Bikov, O. V. Bilous, YU. M. Bogachkov ta in.]. Kyiv: Atika, 2010. 88 p. [in Ukrainian].
  12. Penzaj, L. I. Informacijna kompetentnist&apos; yak vagoma skladova fahovoï kompetentnosti vchatelya [Information competence as an important component of a teacher&apos;s professional competence]. *Education UA. Methodology and technology*, 2012. URL: <https://cutt.ly/7Llaq2d> [in Ukrainian].
  13. Petukhova, L. Ye. Informatichna kompetentnist&apos; majbutn&apos;ogo fahivcya yak pedagogichna problema [Computer competence of the future specialist as a pedagogical problem]. *Computer at school and family*, 2008, pp. 3–5 [in Ukrainian].
  14. Selevko, G. K. Suchasni pedagogichni tekhnologii [Modern pedagogical technologies]: navch. posibn. Moscow: Narodna osvita, 1998. 256 p. [in Ukrainian].
  15. Carretero, S.; Vuorikari, R. and Punie, Y. (2017). DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use, EUR 28558 EN, doi: 10.2760/38842, 48 p.
  16. Learning and Skills for the Digital Era. URL: <https://cutt.ly/VLlatno> .
  17. Redecker, C. European Framework for the Digital Competence of Educators: DigCompEdu. Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73494-6, doi:10.2760/159770, JRC107466
  18. Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G. (2016). DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model. Luxembourg Publication Office of the European Union. EUR 27948 EN. doi:10.2791/11517/, 44 p.
  19. Zakon Ukrayiny «Pro Nacionalnu programu informatyzaciyi» [Law of Ukraine «On the National Informatization Program»]. Vidomosti Verhovnoyi Rady (VVR), 1998, № 27–28, st. 181. URL: <https://cutt.ly/yLlaiQQ> [in Ukrainian].
  20. Zakon Ukrayiny «Pro osnovni zasadi rozvitku informacijnogo suspilstva v Ukraïni na 2007–2015 roki» [Law of Ukraine «On the basic principles of information society development in Ukraine for 2007–2015»]. *Information of the Verkhovna Rada (VVR)*, 2007, № 12, pp. 102 [in Ukrainian].
  21. Digital Agenda of Ukraine Project – 2020 (Digital Agenda – 2020) Conceptual Principles (version 1.0) (2016, December). URL: <https://cutt.ly/7LlasML>.

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