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Review Article

Professional Digital Competence: Definition, Frameworks, Measurement, and Gender Differences: A Systematic Literature Review

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In the current context of increasing digitization, professionals need to be digitally competent. In addition, women's low participation in the technology field indicates the persistence of a digital gender gap in the economic and social spheres. A key aspect to help reducing digital inequality is the role that the digital competence (DC) plays in the professional development of women, allowing them to enter to a job market still coped by men. The current systematic literature review, following the PRISMA protocol, analyzes the existing definitions of professional DC, the frameworks used to develop it at the workplace, and the gender differences observed. Four main ideas emerge from the review of the 41 selected articles: (1) the need of an enabling professional DC definition to help understand how it operates specifically in professional environments; (2) the expanding role of the DigComp framework to carry out initiatives for assessing, training, developing, advising, or certifying digital competence in professional environments; (3) the identification of seven key dimensions of professional DC; and (4) the need of future studies that go further in the measurement of women's professional DC, as a response of the lack of data about gender differences in this field. Although the limitations of a systematic literature review, such as publications and database bias, these results are aimed at fostering a shared definition and framework of professional DC that standardizes the measurement and development of this competence, allowing workers, and women in particular, to adapt to the digital transformation, assuring equal access to qualified jobs.

1. Introduction

It is well known that industry and job demands are nowadays changing because of the massive technological shift of society. Several reports describe how this introduction will turn some tasks currently performed by humans into machine work [1, 2]. Within this scenario, it is expected that 85 million jobs will be displaced by 2025, while 97 million new roles that are more adapted to the new division of labor between humans, machines, and algorithms emerge [2]. Therefore, the future of work will require that the workforce be able to upskill and reskill their capabilities, that is, acquire new competences to help in their current roles and learn new capabilities to take on different or entirely new roles to adapt to the digital transformation [1].

However, this has a transversal impact on job demand, which can pose a threat to some specific collectives, such as women. In particular, there exists a digital gap, especially within the technological sector [3, 4], and in some jobs that are expected to be essential for the future, such as data scientists and digital specialists, women are severely underemployed, even if they already have the necessary skills [2]. That is why, to keep up with these professional challenges, women need to increase their access to technology and raise their technological capabilities to acquire and enhance their digital competence [5].

The digital gender gap extends well beyond access to technology; it carries extensive implications for women's economic prospects, educational attainment, involvement in decision-making processes, access to healthcare, online safety, and the advancement of global development objectives. Providing equal opportunities for all workers—and especially those who are at a disadvantage—to develop their necessary skills to better adapt to the future jobs not only helps to maximize the development of economic growth of all countries but also promotes peace and prosperity, as is reflected in one of the targets of the fifth sustainable development goal (SDG) set by the [6]: "Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women" (p.38). In this context of digital transformation and professional transitions, an in-depth study of the role of digital competence in professional development (also known as professional digital competence) can contribute to better prepare current and future workers to cope with the challenges of future work demands.

However, research reveals that company leaders feel unprepared for the challenge of a deep digital transformation, as they lack "a clear understanding of the impact that future automation and digitization would have on skill requirements" or "the tools or the knowledge to quantify the business case for efforts to reskill their workforces" [1]. Indeed, education systems are not adequately preparing the youth to work in the digital economy [7]. Not only can there be considerable differences in pupils' digital skills during compulsory education [8] but also current vocational training programs are more likely to lead to employment in jobs that are at risk of automation and therefore should be adapted to the changing demands of the digital economy [7].

Even though the European Framework of Digital Skills for Citizens, known as DigComp [9], offers common European guidance on what it means for citizens to have adequate digital skills, the different current needs presented above demonstrate a lack of guidance towards which abilities and skills need to be considered within professional digital competence. Certainly, some sectors already have their own professional framework, such as DigComp for Education (DigCompEdu), but still, further exploration in different professional contexts is required to study the role and specifications of professional digital competence in these complex processes [10], especially for operationally intensive sectors. This reflection should also integrate specific guidelines for company leaders to address existing inequalities to maximize their current and future workers' potential contribution.

This study is aimed at analyzing how the diverse existing digital competence frameworks define, describe, and measure professional digital competence in order to better understand how it operates. More specifically, it is aimed at answering the following research questions:

(i) Q1. How is professional digital competence defined? What do the different definitions have in common and how do they differ?

(ii) Q2. What frameworks are being used to describe professional digital competence?

(iii) Q3. What dimensions make up professional digital competence?

(iv) Q4. What instruments are being used to measure professional digital competence? What do they measure and how?

(v) Q5. Have differences between men's and women's digital competence been measured? What results have been obtained?

Overall, addressing these concerns will contribute to a better understanding of the role of DC in professional development and will assist policymakers in the creation of programs focused on labor market skills analysis, career guidance, workforce development, training design and delivery, skills assessment, and competence certification.

The remainder of the article is structured as follows. In the next section, the research methodology is presented. The "Results and Discussion" section corresponds to the empirical research and discussion of the results of the systematic literature review. The final section summarizes the main contributions, limitations, and practical implications of the research conducted.

2. Materials and Methods

This study presents a systematic review of scientific research with the aim to find plausible answers to clearly formulated questions [11]. It is aimed at being replicable and updateable [12]. It was carried out according to the phases of the preferred reporting items for systematic reviews and meta-analysis (PRISMA) statement [11]. The PRISMA statement "was developed to facilitate transparent and complete reporting of systematic reviews and has been updated (to PRISMA 2020) to reflect recent advances in systematic review methodology and terminology" [13]. The approach and tools proposed by the PRISMA statement offer a rigorous method to achieve the aims of this reviewing process.

2.1. Search Strategy. For this systematic review, we searched in four databases of reference in the field of professional work: Web of Science, Scopus, ERIC, and Dialnet, all of which contain peer-reviewed, high-quality journal articles, reports, conference papers, and books on Educational Sciences. The period covered is from 2000 to 2022, and it is framed in the international context. The search was restricted to study title, abstract, and keywords.

To ensure a broad coverage of publications, the search was done using the keywords, time coverage, and languages shown in Table 1. Because of the lack of consistency in the terms usually used in literature, we considered the set of terms digital competence, e-skills, digital skills, and e-competence. The time coverage was limited by focusing on the literature from the past twenty-two years.

As a result, 2072 records were found. After duplicates were removed, 1722 records were available for screening and selection.

TABLE 1: Overview of the data strategy used in the search.

Database	Language	Boolean search string	Date of search	Records obtained
Web of Science	English	(""E-skills""OR ""digital skills""OR ""digital competence""OR ""e-competence"") AND (""professional""OR ""citizen""OR ""workplace"").	22-10-2022	658
Scopus	English	(""E-skills""OR ""digital skills""OR ""digital competence""OR ""e-competence"") AND (""professional""OR ""citizen""OR ""workplace"").	22-10-22	717
ERIC	English	(""E-skills""OR ""digital skills""OR ""digital competence""OR ""e-competence"") AND (""professional""OR ""citizen""OR ""workplace"").	22-10-2022	248
Dialnet	Spanish	""competencia digital""AND (""profesional""OR ""ciudadana"").	28-3-2023	449

2.2. Selection Criteria

2.2.1. Exclusion Criteria.
The exclusion criteria defined to guide the screening of the publications were the following:

  (i) *EC 1.* The term professional digital competence used by the publication refers to teachers' professional digital competence (in any of the educational stages)

  (ii) *EC 2.* The term digital competence used by the publication refers to students' digital competence (in any of the educational stages)

  (iii) *EC 3.* The publication is in a language other than English, Spanish, or Catalan

  (iv) *EC 4.* There is no access to the full publication

2.2.2. Inclusion Criteria.
To be included in the study, publications had to some of the inclusion criteria defined below.

  (i) *IC 1.* The content of the publication provides a definition of professional or citizen digital competence and relates to a work environment

  (ii) *IC2.* The content of the publication refers to a framework related to the development of professional or citizen digital competence

  (iii) *IC 3.* The content of the publication enumerates and/or describes the dimensions that make up professional or citizen digital competence or any digital competence relating to a work environment

  (iv) *IC 4.* The content of the publication describes instruments or variables for measuring digital competence

  (v) *IC 5.* Publications between 2000 and 2022 are covered

  (vi) *IC 6.* Peer-reviewed articles, reports, conference papers, books, and dissertations are considered

2.3. Selection Process.
The 1722 records identified by the search were subject to a process of screening to ensure they met the selection criteria. This process of screening and selection was carried out in two main stages, as shown in the PRISMA flow diagram (Figure 1).

A first stage of screening was done in two steps where titles, firstly, and abstracts, secondly, were checked to determine whether the studies were likely to be relevant. In total, 1567 records were excluded, most of them since they referred to students' or teachers' digital competence or were not related to the context of this study. In a second stage, the 89 remaining publications were read in their entirety to determine whether the research was eligible. As a result, 38 articles were selected to be analyzed in-depth, and 3 more publications identified from citation searching were added to the set.

3. Results and Discussion

3.1. Results.
The aim of this systematic literature review is to analyze the existing definitions and frameworks of professional digital competence and the gender differences observed in its measurement. Among the 41 reviewed publications, there were 31 journal articles, one report, and one dissertation. 61% of them were published during the past five years (2018 to 2022) and the rest of them (39%) between 2012 and 2017. Table 2 lists the reviewed publications. We present the results based on the 5 research questions.

Q1. What definitions of professional digital competence exist? What do they have in common and how do they differ?

From the analysis of all the articles, a key aspect emerged; no specific definition of professional digital competence was found to explain how it operates in the workplace.

The characteristics highlighted by authors to explain the use of this generic term when studying the professional use of digital competence are its broadness [29], pluralism, and interconnectivity [33].

Transversality is another trait that is reported to characterize digital competence. The term refers to the ability of digital competence to transcend sectors of activity and to integrate with other key competences. It is portrayed in DigComp 1.0 [55] as an enabler for the acquisition of other key competences such as language, mathematics, learning to learn, or cultural awareness. Guitert et al. [32] link its transversality to the work environment, highlighting the increasing demand of it across the labor market and its key role in job search processes that currently mostly take place in digital platforms.

The definitions of digital competence used in the selected articles are mostly the ones elaborated by European
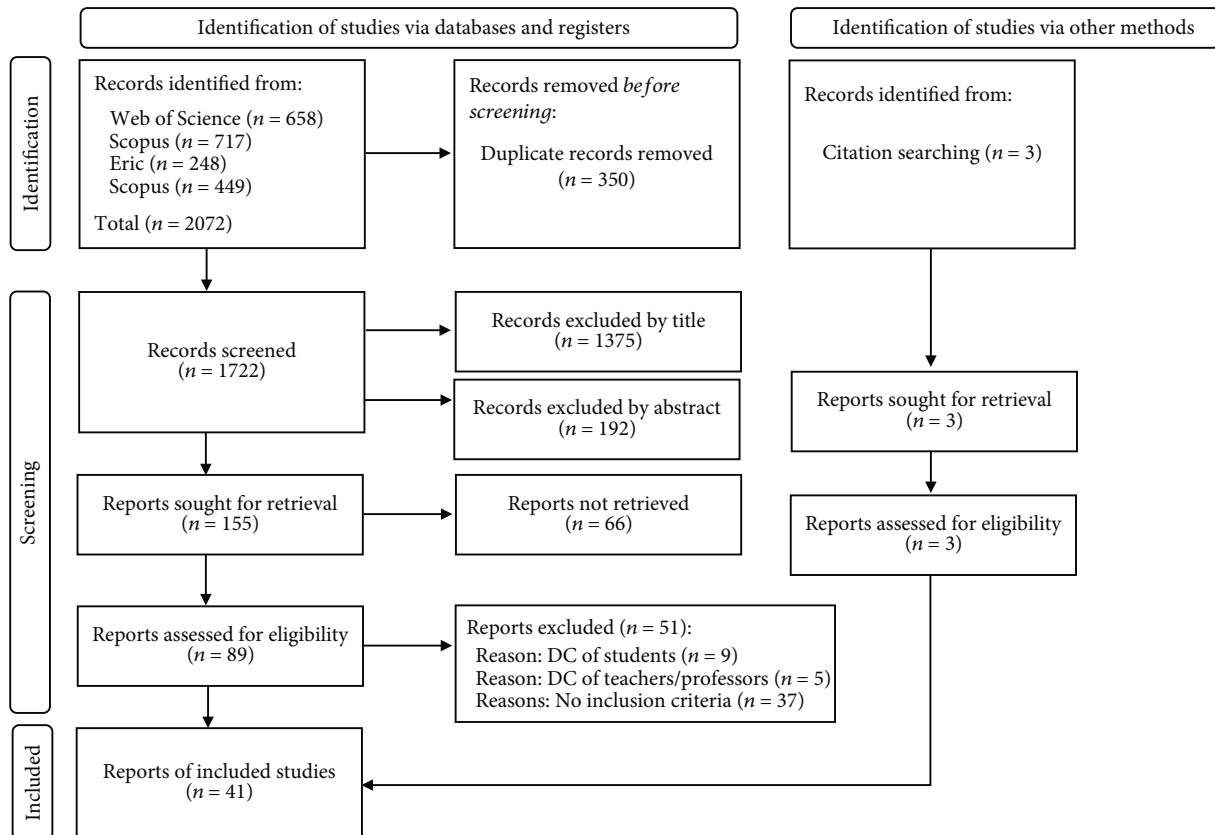
Figure 1: PRISMA 2020 flow diagram.

institutions and initiatives during the past decades. Table 3 provides the definitions of digital competence shown in the articles and highlights how the professional dimension, through the term work, is presented in them.

As shown in Table 3, six definitions of digital competence included the term work or working as one of its domains of application. But any reference to areas of development or domains within the professional environment is missing from these definitions. It needs to be highlighted that the definition provided in the DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe [55] differentiates between work and employability.

Rosas Quintero [48] brings a definition of digital competence that focuses exclusively on the professional environment; they consider digital competence as "the capacity to embrace and utilize new or established technology to scrutinize, choose, and appraise digital data for the purpose of investigating and resolving work-related issues and building a cooperative knowledge base" (p.10).

It is also worth highlighting that Lissitsa et al. [36] present digital career literacy as a concept that can connect digital skills to professional environments through career development. The term digital career literacy "includes the ability to use the online environment to search, make contacts, find answers to questions and build a positive professional reputation in order to promote career development" [36]. It is presented as a facilitator to changing jobs, fighting stereotypes at the workplace, or receiving rewards.

Q2. What frameworks are being used to describe professional digital competence?

The second objective of this review is to identify the frameworks present in the literature to describe how digital competence operates and is assessed and developed in professional environments. More specifically, the aim of this research is to look for frameworks that could provide a specification of factors or dimensions, competence descriptors, examples of use at work, and/or levels of progression at the workplace, all related to digital competence.

The frameworks identified (12 in total) can be categorized into two types: frameworks oriented to citizenship or adulthood that include examples and/or descriptors specifically related to the work domain (Table 4) and frameworks that target specific professional fields such as education, health, or tourism (Table 5). Both tables indicate the name, year, promoter, target group, a brief description, and number of dimensions, competences, and levels of progression. It should be noted that dimensions are mostly labeled as areas of competence or competence areas in the reviewed literature.

For the composition of Table 4, two considerations have been made. First, in the case of the DigComp framework, although different articles mentioned version 1 (2013), version 2.0 (2016), and version 2.1 (2017), the 2022 version was included. Second, in the case of the National Standards for Essential Digital Skills (2019) Framework, information about its precursor is provided, the Essential Digital Skills Framework (2018), because it includes an extensive list of

TABLE 2: List of selected publications.

Author	Year	Title	Type of publication
Bejaković and Mrnjavac [14]	2020	The importance of digital literacy on the labor market.	Article
Buitrago Alonso et al. [15]	2017	Historical perspective and current keys of terminological diversity applied to media education. (Perspectiva histórica y claves actuales de la diversidad terminológica aplicada a la educación mediática.)	Article
Cabero-Almenara et al. [16]	2019	Las TIC y la creación de una ciudadanía crítica e-digital. (ICT and the creation of critical digital citizenship)	Article
Canchola González and Glasserman Morales [17]	2019	Digital adult literacy in virtual learning environments: The case of xMOOCs in energy sustainability.	Article
Canina and Orero-Blat [18]	2021	A practical tool to measure digital competences: Teamschamp	Article
Carrasco-Sáez et al. [19]	2017	The new pyramid of needs for the digital citizen: A transition towards smart human cities.	Article
Castaño-Muñoz et al. [20]	2017	Does Digital Competence and Occupational Setting Influence MOOC Participation? Evidence from a Cross-Course Survey.	Article
Cerezo Medina [21]	2016	Analysis of perceptions and training needs in information and communication technologies in tourism: the case of Andalusia.(Análisis de percepciones y necesidades formativas en tecnologías de la información y la comunicación en turismo: el caso de Andalucía.)	Dissertation
CEN (European Committee for Standardization) [22].	2014	European e-Competence Framework version 3.0. A common European Framework for ICT Professionals in all industry sectors.	Report
Chaker [23]	2020	Digital Skills Are Predictors of Professional Social Capital Through Workplace and Social Recognition.	Article
Csordás [24]	2020	Diversifying Effect of Digital Competence.	Article
de Greef et al. [25]	2015	The Development and Validation of Testing Materials for Literacy, Numeracy and Digital Skills in a Dutch Context.	Article
Dobson et al. [26]	2022	Digital competency of Psychologists in Aotearoa New Zealand: A cross-sectional survey.	Article
Duică et al. [27]	2020	The role of e-skills in developing sustainable organizations and e-activities in the new digitized business world.	Article
Fernández-Sanz et al. [28]	2017	e-skills match: A framework for mapping and integrating the main skills, knowledge and competence standards and models for ICT occupations.	Article
Ferrari et al. [29]	2012	Understanding Digital Competence in the 21st Century: An Analysis of Current Frameworks.	Article
Golz et al. [30]	2021	Technostress and Digital Competence Among Health Professionals in Swiss Psychiatric Hospitals: Cross-sectional Study.	Article
Gómez-Meneses [31]	2014	.Digital competence in auditing. Support or burden in the professional practice of auditors. (Competencia digital en la auditoría. Soporte o carga en el ejercicio profesional de los auditores.)	Article
Guitert et al. [32]	2020	Basic digital competences for unemployed citizens: conceptual framework and training model.	Article
Janssen et al. [33]	2013	Experts' views on digital competence: Commonalities and differences.	Article
Kateryna et al. [34]	2020	Digital literacy development trends in the professional environment.	Article
Kirinic and Kozina [35]	2018	Analysis of quality-related competencies within the european e-competence framework (e-CF).	Article
Lissitsa et al. [36]	2017	Digital skills and extrinsic rewards in late career.	Article
Lister [37]	2020	Smart learning in the community: Supporting citizen digital skills and literacies	Article

TABLE 2: Continued.

Author	Year	Title	Type of publication
Marta-Lazo et al. [38]	2020	Digital journalism competences. Systematic review of the scientific literature on new professional profiles of the journalist. (Competencias digitales en periodismo. Revisión sistemática de la literatura científica sobre nuevos perfiles profesionales del periodista)	Article
Mazurchenko and Maršíková [39]	2019	Digitally-powered human resource management: Skills and roles in the digital era.	Article
Montero Delgado et al. [40]	2020	Key digital skills for healthcare professionals. (Competencias digitales clave de los profesionales sanitarios)	Article
Murawski et al. [41]	2020	Exploring Digital Competence Requirements for Junior Financial Analysts in the UK Banking Industry	Article
Ondrejková [42]	2016	Digital skills and digital divide in context of the digital agenda for Europe focused on slovakia	Article
Passey et al. [43]	2018	Digital agency: Empowering equity in and through education.	Article
Pawlicka et al. [44]	2022	Has the pandemic made us more digitally literate? Innovative association rule mining study of the relationships between shifts in digital skills and cybersecurity awareness occurring while working remotely during the COVID-19 pandemic	Article
Pérez-Escoda and Fernández-Villavicencio [45]	2016	Digital competence in use: From DigComp 1 to DigComp 2	Article
Periáñez-Cañadillas et al. [46]	2019	Assessing the relevance of digital competences on business graduates' suitability for a job	Article
Rebollo-Catalán et al. [47]	2017	Women's digital skills in the use of social network sites: Differences by employment status.	Article
Rosas Quintero [48]	2022	Digital competences of the industrial engineer in industry 4.0 a systematic vision.	Article
Silva Quiroz and Lázaro-Cantabrana [49]	2020	La competencia digital de la ciudadanía, una necesidad creciente en una sociedad digitalizada.(La competencia digital de la ciudadanía, una necesidad creciente en una sociedad digitalizada.)	Article
van Laar et al. [50]	2018	21st-century digital skills instrument aimed at working professionals: Conceptual development and empirical validation	Article
van Laar et al. [51]	2019a	Determinants of 21st-century digital skills: A large-scale survey among working professionals.	Article
van Laar et al. [52]	2019b	Twenty-first century digital skills for the creative industries workforce: Perspectives from industry experts.	Article
van Laar et al. [53]	2017	The relation between 21-st century skills and digital skills: A systematic literature review.	Article
van Laar et al. [54]	2020	Measuring the levels of 21 st-century digital skills among professionals working within creative industries: A performance-based approach.	Article

examples of applications at work that do not appear in the National Standards for Essential Digital Skills.

Below are the frameworks of digital competence organized according to the professional target group and their descriptions (Table 5).

Table 6 provides a list of the competence areas and skills found in the reviewed literature differentiating transversal frameworks from professional/specialized ones. Figure 2, for its part, presents a mapping of the dimensions reported in the main general frameworks.

Q3. What dimensions make up professional digital competence?

As shown in Figure 2, five dimensions are consistently present in the reviewed frameworks: information management and data literacy, digital content creation, communication, and collaboration. Safety and legal issues and problem-solving are, under different labels and with slight differences, common areas in the main general frameworks. Also, it has been observed that some of the competence areas proposed in some of the frameworks are specifically related to

Table 3: Definitions of digital competence and how they refer to work.

Year	Document	Definition	Professional dimension added
2006	Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning. Official Journal of the European Union, L394/310 [56].	"Confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet" (p. 15).	Work at the same level as leisure and communication.
2008	Calvani et al. [57]	"Digital competence consists in being able to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations" (p.186).	No reference to work.
2012	Ferrari et al.	"Digital competence is the set of knowledge, skills, attitudes, abilities, strategies and awareness that is required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; behave in an ethical and responsible way; collaborate; create and share content and knowledge for work, leisure, participation, learning, socialising, empowerment and consumerism" (p.84).	Work at the same level as leisure, participation, learning, socialising, empowerment, and consumerism.
2013	Janssen et al.	"Results indicate that experts see digital competence as a conglomerate of knowledge, skills, and attitudes connected to various purposes (communication, creative expression, information management, personal development, etc.), domains (daily life, work, privacy & security, legal aspects), and levels" (p. 479).	Work as a domain and at the same level as daily life, privacy and security, and legal aspects.
2013	DIGCOMP: a framework for developing and understanding digital competence in Europe.	"Digital competence can be broadly defined as the confident, critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society" (p.2).	Work at the same level as employability, learning, leisure, inclusion, and/or participation.
2019	Key competences for lifelong learning, European Union.	"Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (p. 10).	Work at the same level as learning and participation in society.
2019	ACTIC	"Combination of knowledge, skills and learning in the field of information and communication technologies (ICT) that people deploy in real situations to attain specific objectives efficiently and effectively". (https://actic.gencat.cat/en/actic_informacio/actic_que_es_l_actic_/index.html).	No reference to work.

TABLE 3: Continued.

Year	Document	Definition	Professional dimension added
2020	Guitert et al.	"Digital competence clearly involves more than knowing how to use devices and applications. It consists of (a) technical digital technologies skills, (b) the ability to use digital technologies in a meaningful way for working, studying and other everyday activities, and (c) the ability to critically evaluate digital technologies" (p.4).	Work at the same level as studying and other everyday activities.
2022	Rosas Quintero	"The ability to adopt and use new or existing information technology to critically analyze, select and evaluate digital information to investigate and solve work-related problems and develop a collaborative body of knowledge" (p.10).	Focus in the professional scenario.

professional performance and workplace development. More specifically, that is the case with the dimensions career-related competences, lifelong learning, and self-direction.

Q4. *What instruments are being used to measure professional digital competence? What do they measure and how?*

None of the reviewed sources provided evidence about experiences of broad and integral digital competence measurements in the professional environment. Likewise, only a limited number of the selected articles presented studies that measured particular dimensions or factors of digital competence, most of them about the process of analyzing specific correlations between digital competence and other phenomena such as candidates' suitability for the job market [46], progress in learning digital skills [25], and womens' digital skills in the use of social networks [47] or technostress [30].

Table 7 presents an overview of the type of instruments used in those articles that reported the use of specific instruments of measurement. Among the 10 reported tools, nine were designed from a self-perception approach and one with a performance-based approach.

Canina and Orero-Blat [18] describe the use of a software application (TeamsChamp) to daily measure employees' digital skills. This is achieved by tracking performance indicators in three dimensions: digital collaboration, digital communication, and digital operativity. The design of the indicators took into consideration the digital traces each user leaves when using the tools directly related to each of the selected digital competences, quantified them, and presented them in a friendly format for any user to view.

Q5. *Have differences between men and women's digital competence been measured?*

In general, references to the digital gender gap in the reviewed articles are scarce and more indicative than analytical. Lissitsa et al. [36] pointed to gender differences stating that empirical research studied differences in digital competences based on gender, age, education, and ethnicity. Lister [37] stated that women are at risk of being left behind in a digitized society. Cabero-Almenara et al. [16] highlight that the role of ICTs as social tools that favor people's participation, collaboration, and empowerment is also fostering the empowerment of women and thus promoting gender equity.

The reviewed articles highlight several remarkable differences between women and men regarding the digital gender gap. A study conducted by Castaño-Muñoz et al. [20] found that women tend to participate less frequently in Massive Open Online Courses (MOOCs) compared to men. The researchers also observed that participants' male-to-female ratio varies depending on the topic of the MOOC. For instance, a higher percentage of women engage in hands-on ICT and test anxiety courses (over 70%), while fewer women participate in business intelligence and entrepreneurship courses (38% and 42%, respectively).

Canchola and Glasserman [17] examined the digital skills influencing the completion of xMOOC courses. They noted that most individuals interested in energy sustainability, and thus more likely to complete related courses, are predominantly men with some engineering background. The study suggests that there are gender differences in this area, though further evaluation is required to determine the extent of these disparities.

Van Laar et al. [52] conducted a measurement of digital skills among professionals in the creative industries. Their findings indicate that employed men outperform women in communication expressiveness, collaboration, critical thinking, and problem-solving. On the other hand, employed women exhibit better skills in information evaluation, communication networking, and content-sharing. These results demonstrate gender discrepancies in specific digital skills within the creative industries.

Another study focused on characterizing women's digital competence on social networks but did not directly compare its findings with those of men [47]. Despite the absence of gender-specific comparisons, this research provides valuable insights into women's digital skills in areas crucial to their employability, such as problem-solving, emotional competence, effective communication, and social capital.

Overall, these studies shed light on the gender differences in digital participation and skills, emphasizing variations in MOOC enrollment, interests in specific topics, digital competencies within creative industries, and social networking skills. Further research is necessary to gain a comprehensive understanding of the digital gender gap and

TABLE 4: Overview of non-specialized frameworks.

Name, year, institution, or authors	Target group	Description
Global Framework of Reference on Digital Literacy Skills for Indicator (SDG) 4.4.2. (2018). UNESCO Institute for Statistics	Teenagers and adults	It is intended to serve for monitoring, assessment, and further development of digital literacy, taking into consideration different levels of development. Closely related to the competences of the DigComp framework, it adds to it 2 new areas of competences and 5 new competences. (i) Areas of competence/dimensions: 7 (ii) Competences: 26 (iii) Proficiency levels: not included
Essential Digital Skills Framework (2018). UK Department for Education	Adults	It is intended to be used by everyone in the UK engaged in supporting adults to enhance their essential digital skills (p.2). Describes skills for work and includes extensive work examples. (i) Areas of competence/dimensions: 5 (ii) Competences: 38 (iii) Proficiency levels: not included
The National Standards for Essential Digital Skills (2019). UK Department for Education	Adults	Based on the Essential Digital Skills Framework, the standards are primarily intended for use by awarding organizations in developing new essential digital skills qualifications (p.4). (i) Areas of competence/dimensions: 5 (ii) Competences: 19 (iii) Proficiency levels: 2
ICT for work: Digital skills in the workplace (2016). European Commission, DG CONNECT (carried out by Ecorys and Danish Technological Institute)	Employees	Initiative implemented to examine the transformation of jobs in the digital economy in the European Union, investigating the penetration of digital technologies into workplaces, the digital skills required by employers, and the digital skills available in workplaces. Areas of competence/dimensions: none. Competences: 10. Proficiency levels: none.
ACTIC - Acreditación de competencias en tecnologías de la información y la comunicación (Accreditation of skills in ICT) (2016). Generalitat de Catalunya	All citizens above 16	Certification for accrediting digital competence in the field of information and communication technologies (ICT). Areas of competence/dimensions: none Competences: 8. Proficiency levels: 3. It is currently being adapted to DigComp.
21st-century digital skills (2017). van Laar et al.	Workforce	Its premise is to meet the demands of the workforce proposing a digital equivalent of 21st century skills. Areas of competence/Dimensions: 12. Competences (referred as key components): 27. Proficiency levels: None.
DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes (2022). Vuorikari et al. [58]	All citizens	Latest version of the Digital Competence Framework for Citizens (DigComp). It is presented as a tool to help policymakers to monitor citizen"s digital skills and to support curricula development; and to help citizens with self-evaluation, setting learning goals, identifying training opportunities and facilitating job search. (i) Areas of competence/Dimensions: 5 (ii) Competences: 21 (iii) Proficiency levels: 8 for each competence, 168 descriptors (8 × 21 learning outcomes) Includes some examples in employment scenarios.

its implications. The results of the study showed that most women perceived themselves with a medium-high level of digital skills in the use of social networks, especially in emotional, functional, and security-related skills on social networks, while they lacked some informative and creative skills. Some differences were also found in the level of women's self-perceived digital competence depending on their employment status; indeed, it was professional and

TABLE 5: Overview of frameworks that target specific professional fields.

Framework, year, promotor/author	Target group	Description
European Framework for the Digital Competence of Educators: DigCompEdu (2018). Joint Research Centre (JRC)	Educators	The DigCompEdu framework is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and nonformal learning contexts. Areas of competence: 6. Competences: 22. Proficiency levels: 6.
European e-Competence Framework (e-CF) (2018). European Committee for Standardization (CEN)	ICT professionals, jobs, and organizations	The eCF is presented as a tool to support mutual understanding and provide transparency of language through the articulation of competences required and deployed by ICT professionals. It is the first sector-specific implementation of the European Qualifications Framework (EQF) (p.5). Areas of competence: 4. Competences: 40. Proficiency levels: 5.
Key digital skills for healthcare professionals (2019). Montero Delgado et al.	Health professionals	It defines key digital competences of healthcare professionals to cope with the transformation towards digital health. It is based on DigComp 2, DigCompEdu and sector-specific literature. Areas of competence: 6. Competences: 26.
ICT competence framework in tourism (2016). Cerezo Medina	Tourism professionals	Proposal of a framework for the tourism sector that defines and describes professional profiles and establishes standards for a correct performance in different professional areas (p. 147). Areas of competence: 5. Competences: 40 Proficiency levels: 5
Digital skills of the industrial engineer (2022). Rosas Quintero	Industrial engineer	The proposed framework differentiates two sorts of competences: basic digital competences and digital transversal competences (p.12). Areas of competence: 8. Competences: 28.

entrepreneur women who obtained more advanced digital skills in the use of social networks compared to unemployed women.

4. Discussion

This last part of the article is devoted to the four main outcomes that emerge from the main aim of the systematic literature review: (1) the enabling nature of the definition of professional digital competence, (2) the expanding role of the DigComp framework in professional environments, (3) the seven key dimensions of professional digital competence, and (4) the lack of data on gender differences in relation to professional digital competence.

The findings of the study are significant as they collectively emphasize the evolving nature of digital competence in professional contexts and provide valuable insights for researchers, policymakers, educators, and employers seeking to enhance digital competence and inclusivity in the professional world.

4.1. The Nature of the Definition of Professional Digital Competence. According to the results, there is a common understanding of the definition of digital competence as an umbrella term that shelters different kinds of domains such

as work, employment, leisure, communication, participation, learning, socialization, empowerment, consumerism, daily life, and privacy and security. However, one of the aspects which previously needed to be discussed is the necessity, or not, to produce a specific definition for professional digital competence. Several factors need to be considered first.

In one hand, there is a positive effect in the use of the umbrella term for initiatives in the working domain: its inclusiveness can facilitate an agile approach to any problem, opportunity, or challenge which needs to be addressed, whatever the domain it belongs to. On the other hand, a general definition could hide the complexity and particularities of the different purposes or domains that it enumerates. For instance, the differences between the domains of leisure, social participation, or consumerism are qualitatively significant and the lack of a specific definition of digital competence in relation to them could be understood as a simplification.

Therefore, in the case of professional digital competence, it might be beneficial to provide a definition reflecting the main purposes of highly digitized work environments to highlight its transversal and enabler nature. Professional digital competence could, thus, be defined as the set of knowledge, skills, and attitudes that enable the effective and responsible use of digital technologies to perform tasks and solve problems in increasingly digitized working environments; build meaningful

TABLE 6: List of dimensions and skills found in the reviewed literature.

References	Dimensions	Competences
Ferrari et al. [29]	Information management Collaboration Communication and sharing Creation of content and knowledge Ethics and responsibility Evaluation and problem-solving Technical operations	
Janssen et al. [33]	Seamless use demonstrating self-efficacy Informed decisions on appropriate technologies Learning about and with digital technologies Specialized and advanced competence for work and creative expressions Use in everyday life General knowledge and functional skills Legal and ethical aspects Privacy and security Technology-mediated communication and collaboration Information processing and management Understanding the role of ICT in society	
ACTIC [59]		Culture, participation, and digital civility Digital technology and use of the computer and operating system Navigating and communicating in the digital world Processing written information Processing graphic, sound, and moving image information Processing numerical information Processing data Presenting content
ICT for work: Digital skills in the workplace (2016) EU		Using a word processor (e.g., Word); Create a spreadsheet (e.g., Excel); Search for, collect, and process information using ICT (e.g., online/Internet); Communicate through ICT using email; Communicate through ICT using social media, Skype/video calls; Use software for design, calculation, or simulation; Undertake programming and software development; Design and maintain ICT architecture for the workplace; Programme and use CNC machines; Programme and use robots

TABLE 6: Continued.

References	Dimensions	Competences
DIGCOMP 2.1. (2017)	(1) Information and data literacy	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 collaboration	2.1 Interacting through digital technologies
		2.2 Sharing through digital technologies
		2.3 Engaging in citizenship through digital technologies
		2.4 Collaborating through digital technologies
		2.5 netiquette
		2.6 Managing digital identity
	(3) Digital content creation	3.1 Developing digital content
		3.2 Integrating and reelaborating digital content
		3.3 Copyright and licenses
		3.4 programming
	(4) Safety	4.1 Protecting devices
		4.2 Protecting personal data and privacy
		4.3 Protecting health and well-being
		4.4. Protecting the environment
	(5) Problem-solving	5.1 Solving technical problems
		5.2 Identifying needs and technological responses
		5.3 Creatively using digital technologies
		5.4. Identifying digital competence gaps
21st-century digital skills (2017)	**Core 21st-century digital skills dimensions**	
	Technical	ICT knowledge
		ICT usage
		Navigation
	Information management	Define
		Access
		Evaluate
		Manage
	Communication	Transmitting information
	Collaboration	Interactive communication
		Participation in discussions
	Creativity	Content creation
	Critical thinking	Clarification
		Assessment
		Justification
		Linking
		Novelty
	Problem-solving	Knowledge acquisition
		Knowledge application
	Contextual 21st-century digital skill dimensions	
	Ethical awareness	ICT responsible use
		ICT social impact
	Cultural awareness	Cross-cultural communication
	Flexibility	Adapting to frequent and uncertain situations
	Self-direction	Goal setting
		Control
		Initiative
		Monitor progress
	Lifelong learning	Knowledge creation efficacy

TABLE 6: Continued.

References	Dimensions	Competences
Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2 (2018)	**Added areas and competences to DigComp 2.0 framework**	
	0. Devices and software operations	0.1 Physical operations of digital devices
		0.2 Software operations in digital devices
	5. Problem-solving	Added: Computational thinking*
	6. Career-related competences	6.1 Operating specialized digital technologies for a particular field*
		6.2 Interpreting and manipulating data, information, and digital content for a particular field*
Essential Digital Skills Framework (2018)	Communicating	
	Handling information and content	
	Transacting	
	Problem-solving	
	Being safe and legal online	
National Standards for Essential Digital Skills, UK Department for Education (2019)	Using devices and handling information	Using devices
		Finding and evaluating information
		Managing and storing information
		Identifying and solving technical problems
		Developing digital skills
	Creating and editing	Creating and editing documents
		Creating and editing digital media
		Processing numerical data
	Communicating	Communicating and sharing
		Managing traceable online activities
	Transacting	Using online services
		Buying securely online
	Being safe and responsible online	Protecting privacy
		Protecting data (includes 3 subskills)
		Being responsible online (includes 2 subskills)
		Digital wellbeing
Guitert et al. [32]	Digital problem-solving	Using and configuring the most common digital solution systems
		Applying digital solutions to identified needs.
		Solving technical problems.
	Digital citizenship	Developing digital identity with privacy.
		Protecting data and digital systems and using digital technologies ethically and responsibly.
		Engaging in citizenship using digital technologies.
	Digital information seeking and organizing	Seeking digital information.
		Seeking digital information.
	Digital content creation	Developing digital content
	Digital communication and collaboration	Communicating with digital technologies.
		Collaborating with digital technologies.

Table 6: Continued.

References	Dimensions	Competences
Specific professional sectors		
European e-competence Framework (e-CF) 3.0.	A. Plan	A.1. Is and business strategy alignment
		A.2. Service level management
		A.3. Business plan development
		A.4. Product/service planning
		A.5. Architecture design
		A.6. Application design
		A.7. Technology trend monitoring
		A.8. Sustainable development
		A.9. Innovating
	B. Build	B.1. Application development
		B.2. Component integration
		B.3. Testing
		B.4. Solution deployment
		B.5. Documentation production
		B.6. Systems engineering
	C. Run	C.1. User support
		C.2. Change support
		C.3. Service delivery
		C.4. Problem management
	D. Enable	D.1. Information security strategy development
		D.2. Ict quality strategy development
		D.3. Education and training provision
		D.4. Purchasing
		D.5. Sales proposal development
		D.6. Channel management
		D.7. Sales management
		D.8. Contract management
		D.9. Personnel development
		D.10. Information and knowledge management
		D.11. Needs identification
		D.12. Digital marketing
	E. Manage	E.1. Forecast development
		E.2. Project and portfolio management
		E.3. Risk management
		E.4. Relationship management
		E.5. Process improvement
		E.6. Ict quality management
		E.7. Business change management
		E.8. Information security management
		E.9. Is governance
European Framework for the Digital Competence of Educators. DigCompEdu (2017)	Professional engagement	Organizational communication
		Professional collaboration
		Reflective practice
		Digital continuous professional development (CPD)
	Digital resources	Selecting digital resources
		Creating and modifying digital resources
		Managing, protecting, and sharing digital resources
	Teaching and learning	Teaching
		Guidance
		Collaborative learning
		Self-regulated learning

TABLE 6: Continued.

References	Dimensions	Competences
	Assessment	Assessment strategies Analyzing evidence Feedback and planning
	Empowering learners	Accessibility and inclusion Differentiation and personalisation Actively engaging learners
	Facilitating learners' digital competence	Information and media literacy Digital communication and collaboration Digital content creation
Key digital competences of healthcare professionals	Digital health literacy	
	Effective management of scientific-health information	
	Health communication 2.0	
	Creation of scientific-health digital content	
	Collaborative networking with health teams	
	Data analysis and management	
ICT competence framework in tourism	Accommodation	
	Restoration	
	Intermediation	
	Transport	
	Destinations	
Digital skills of the industrial engineer	Information and data management	Understands and effectively uses devices and systems typical of technologies. Browse, search, filter, compare, and validate the information. Collect, process, store, and share information across multiple devices, apps, and cloud services.
	Communicative and collaborative	Interact through technologies. Share information and content. Use social networks and communicate through ICT. Manage their digital identity. It is inserted into digital citizenship. This can communicate with others and collaborate using tag codes.
	Digital security	Develop strategies to uncover inappropriate behaviors. This can protect yourself and others from threats and possible dangers online. It has strategies for protecting personal data, health, and the environment.
	Solve complex engineering problems with modern technology tools.	Solving complex problems with the application of digital resources. Identifies technological needs and responses. Use technology creatively and innovatively.
	Collaborative work in virtual and multidisciplinary environments	Proactively participate in virtual learning environments, social networks, and spaces for academic collaboration. Maintains a positive attitude to collaborate, carry out projects, and build learning collaboratively with digital tools.
	Critical technological thinking	Distinguishes and uses different search tools according to the type and format of the information: text, image, numerical data, maps, audiovisual, and audio. Build, classify, and organize information according to schemes or genre. Identifies and recognizes the appropriate time to incorporate digital tools and resources into learning. Identifies gaps in your digital competence.
	Digital content creation	Develop, integrate, rework, work, and publish, effectively, digital content as representations of knowledge. Uses diverse digital media to represent knowledge (text, audio, video, graphics, images, etc.) Uses tools for the collective production of knowledge in educational tasks and projects.

References	Dimensions	Competences
	Digital responsibility	It can use office packages (or other applications related to study and work) and edit and create advanced content.
		Know, understand, and attend to the rules of copyright and reproduction licenses.
		Avoid health risks related to the use of technology in terms of threats to physical integrity and psychological well-being.
		Considers the impact of technologies on the environment.

professional relationships through digital collaboration; foster innovation in the workplace; facilitate lifelong continuous professional development; and enhance individuals' employability.

4.2. The Expanding Role of the DigComp Framework in Professional Environments.
The analysis of the frameworks, dimensions, and instruments of measurement used in the reviewed sources has made it possible to verify that the DigComp framework, despite its main orientation towards citizenship, is consolidating and expanding as a central tool for many initiatives related to the professional environment; more specifically, it focuses on the assessment and certification of competences and the advice on and training in digital competence in professional contexts. Most of the cases and initiatives analyzed in the reviewed sources were based on DigComp, or took it into account, to a greater or lesser extent. Such are the examples of Guitert et al. [32] when defining their Basic Digital Competences Framework for Unemployed Citizens, the Global Framework of Reference on Digital Literacy defined by the UNESCO Institute for Statistics (2018), or the Key Digital Skills Framework for Healthcare Professionals [40].

In this line of consolidation of the DigComp framework, Kluzer et al. [60] recently offered a detailed description of the different uses that DigComp has been given by Labour Market Intermediaries (LMIs). The latter have implemented initiatives for increasing the employability of different profiles, such as the unemployed, jobseekers, employees, and entrepreneurs, by developing their digital competence. The orientation of the nine cases reported by Kluzer et al. [60] is diverse and shows the adaptability of DigComp to draw initiatives for improving employability; providing career counseling; guiding training and professional development; or preparing for seeking work. Some of the key mentioned reasons which motivated the adoption of DigComp in the reported cases were its clear and solid structure, flexibility, and neutrality.

4.3. The Seven Key Dimensions of Professional Digital Competence.
A third aspect to highlight is the identification of key dimensions for the development of digital competence. Although key digital competences are different depending on the sector of the economy, it is possible to identify certain "knowledge blocks" that are common to all sectors [61].

In this sense, after mapping (Figure 2) and analyzing the key dimensions reported in the reviewed frameworks (Table 6), it can be concluded that seven competence areas make up professional digital competence. Its structure would have a T-shape, with six transversal dimensions (professional engagement and development, digital information, digital content creation, digital communication and collaboration, digital problem-solving, and safety) supplemented by the specific dimension of industry-related competences (Figure 3).

Professional engagement and development has been included among the transversal dimensions due to the importance of using digital technologies and resources for continuous professional development [62]. In our understanding, lifelong learning and self-direction [53] would also be part of it. Moreover, the dimension of digital communication and collaboration would include competences related to collaborative work in virtual and multidisciplinary environments as proposed by Rosas Quintero [48] in his framework for industrial engineers. Also, the dimension of industry-related competences would include different sets of expert skills, knowledge, and attitudes that would be adapted to the particular needs of the professional field [63] or even of a professional position.

4.4. Lack of Data on Gender Differences in Relation to Professional Digital Competence.
Finally, one of the most striking findings of this literature review was the lack of data on women and professional digital competence; the reviewed sources provided scarce information on the traits of women's digital competence, gender differences, or the distinctiveness of its measurement. Neither are there any references among the study cases provided by Kluzer et al. [60] to initiatives targeting collectives of professional women.

The measurement examples identified in this review were limited and mostly based on self-perception tools. Several studies showed that the improvement of self-perception of technological skills promotes the use of technologies and, thus, greater digital inclusion [64]. Therefore, it seems clear that there is a need to continue working on measurement tools focusing on the levels of self-confidence according to gender to design initiatives to develop the digital competence of women workers. As Guzzani et al. [65] point out, depending on the tool used, the results show a greater or lesser gender digital divide, and in the case of online tasks, no significant results are obtained.

Furthermore, the measurement of digital competence should be integrative and designed with a longitudinal approach to facilitate the follow-up of its progress; it should also combine different types of activities, like the ones indicated by the European Commission [10] and van Laar et al. [51]. Indeed, performance-based tests and knowledge questions could enrich self-assessment tools and help to build robust measurement tools. Finally, as observed, the lack of sex-disaggregated data is making it difficult to assess and
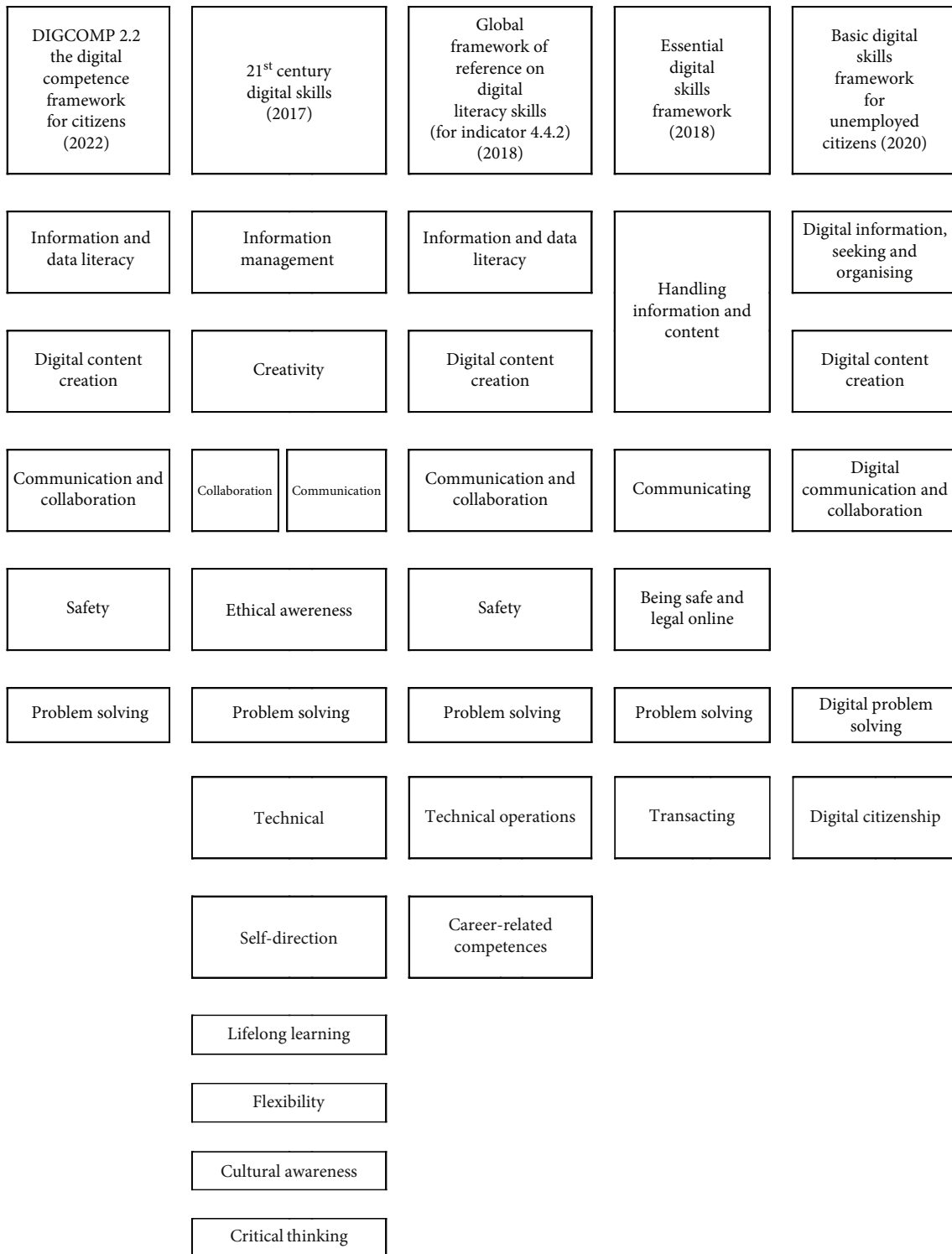
DIGCOMP 2.2 the digital competence framework for citizens (2022)	21st century digital skills (2017)	Global framework of reference on digital literacy skills (for indicator 4.4.2) (2018)	Essential digital skills framework (2018)	Basic digital skills framework for unemployed citizens (2020)
Information and data literacy	Information management	Information and data literacy	Handling information and content	Digital information, seeking and organising
Digital content creation	Creativity	Digital content creation		Digital content creation
Communication and collaboration	Collaboration / Communication	Communication and collaboration	Communicating	Digital communication and collaboration
Safety	Ethical awereness	Safety	Being safe and legal online	
Problem solving	Problem solving	Problem solving	Problem solving	Digital problem solving
	Technical	Technical operations	Transacting	Digital citizenship
	Self-direction	Career-related competences		
	Lifelong learning			
	Flexibility			
	Cultural awareness			
	Critical thinking			

FIGURE 2: Map of the competence areas of the main general frameworks.

monitor the implications of the digital gender gap and to contribute to the design of initiatives and policies to address it.

For all the reasons mentioned above, more research is needed to gather sex-disaggregated data, deepen the study of professional digital competence, and gain a better comprehension of the role it plays in professional performance and development.

Future research should explore the ways in which digital competence intersects with gender dynamics. Studies could investigate the underlying factors contributing to gender disparities in acquiring and applying digital skills, considering sociocultural influences and educational backgrounds.

Moreover, research could delve into the effectiveness of training programs tailored to address potential gaps in

TABLE 7: Overview of instruments of digital competence or digitals skills measurement instruments reported in the reviewed articles.

Author	Aim of the study	Approach	Type of instrument used
Periáñez-Cañadillas et al. [46]	Study aiming to explain how digital competence influences candidates' suitability for the job market.	Self-assessment	Telephone survey which was designed adapting the DigComp framework: (i) It includes only those competences concerning professional skills (p.142) (ii) It "eliminated the competences referring to aspects of the personal life of citizens, namely, aspects of digital citizenship such as engaging in online citizenship, or Netiquette" (iii) As a result, it identified 13 digital skills to be analyzed in the study (p.142)
de Greef et al. [25]	Assessment of learners' progress in digital skills.	Self-assessment	Paper-based self-assessment questionnaire with 27 items based on the new Dutch Adult Education Framework.
Gómez-Meneses [31]	Measurement of the technological level of accounting professionals and companies in Bucaramanga (Colombia).	Self-assessment	Online survey with 36 items divided into 3 parts: (i) Sociodemographic data (ii) Technological level of the company (iii) Technological level of accounting professionals: 12 variables
Rebollo-Catalan et al. [47]	To know the digital skills of women in the use of social networks and determine the profiles according to their level of skills.	Self-assessment	Survey of 1340 women from Andalucía and Extremadura (Spain) with different profiles depending on their employment status and their age. The sample was formed by women with a minimum experience of one year by using social networks. The survey had two blocks of questions: (i) *Block 1.* Sociodemographic characteristics and use of technologies. Participants were asked about their age, place of residence, educational level, employment status, and issues related to their experience of using the Internet (frequency of use, access devices, social networks, etc.) (ii) *Block 2.* Scale of digital competence in social networks: 30 items grouped into five categories (informative, functional, emotional, security, and creative competences) Response range: from 0 (never) to 3 (always).
Chaker [23]	Study of the role of ICT use in people's social and professional Integration and how structural, cognitive, and relational capital can be predicted by digital skills.	Self-assessment	Printed questionnaire. The study was conducted among the Lebanese workforce (18-47 years old) and it presents six variables related with ICT use.

| Author	Aim of the study	Approach	Type of instrument used
van Laar et al. [52]	Study of the level of five digital skills from the 21st-century digital skills framework among workers of creative industries.	Self-assessment	Online survey among 1222 professionals of knowledge-intensive creative industries in the Netherlands. Self-assessment questionnaire with 58 items that measured the frequency of five skills (information, communication, collaboration, critical thinking, creativity, and problem-solving) and 34 items on eight determinants¿. The scales ranged from 1 "never" to 5 "(almost) "always."
Pawlicka et al. [44]	Study of the digital skills and cybersecurity awareness of academic women.	Self-assessment	Online questionnaire among 380 women working in Polish universities.
Golz et al. [30].	Study aiming to assess the association between digital competences and techno-stress among health professionals.	Self-assessment	In-house-developed digital competence questionnaire among 493 health professionals in Swiss psychiatric hospitals. The questionnaire had 5 items which were scored on a 5-point Likert scale ranging from 0 (fully disagree) and 4 (fully agree).
Dobson, R. et al. [26].	Study aiming to explore the digital competence of psychologists working in Aotearoa, New Zealand, and their use of digital tools in practice.	Self-assessment	Online questionnaire among 195 psychologists from Aotearoa, New Zealand, with the following: 41 items to rate their ability to conduct different tasks on a scale from 1 to 5; 2 open-ended questions about the motivators and barriers to using digital technologies in psychological practice.
van Laar et al. [54]	Study of the level of four digital skills from the 21st-century digital skills framework among creative industry workers	Performance-based	Performance test aiming to examine four digital skills (information, critical thinking, creativity, and problem-solving) among 87 professionals of the creativity industries in the Netherlands. The participants had to accomplish seven assignments on the Internet, each related to a specific skill. The observational test directly measured a refined set of indices for each skill.
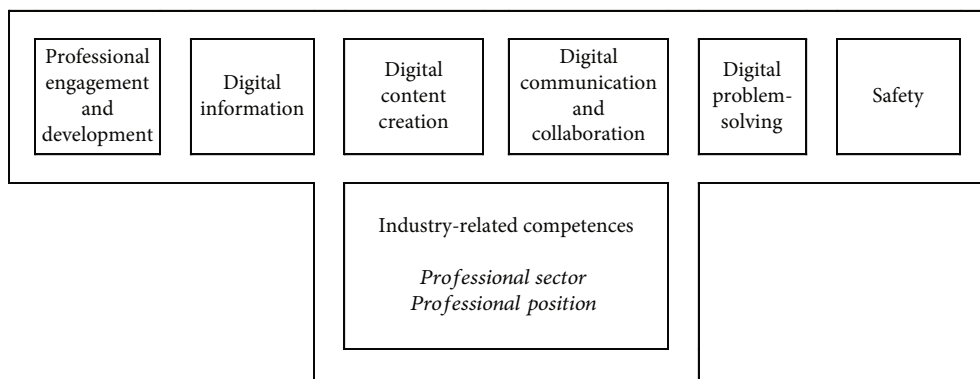
FIGURE 3: Dimensions of professional digital competence.

digital competence. By identifying specific areas where gender disparities exist, upskilling and reskilling initiatives can be developed to address the gaps and empower individuals with the skills necessary for success in digitalized professional environments. Among potential lines of applied research, the analysis of the effectiveness of reskilling and upskilling initiatives based on digital learning and microlearning could help policymakers, educators, and employers to design and implement scalable training programs.

All new research related to gender differences in the field of digital competence and professional environments will help to achieve those SDG related to gender equality and women's empowerment.

5. Conclusions

In conclusion, the results of this systematic literature review highlight four main outcomes related to professional digital competence. Firstly, there is a common understanding of digital competence as an umbrella term that covers various domains such as work, employment, leisure, communication, and daily life. Although a general definition facilitates an agile approach, a specific definition of professional digital competence has been proposed by the authors, after the literature review, that could be useful to researchers and practitioners working in this field. Therefore, professional digital competence has been defined as the set of knowledge, skills, and attitudes that enable the effective and responsible use of digital technologies to perform tasks and solve problems in increasingly digitized working environments; build meaningful professional relationships through digital collaboration; foster innovation in the workplace; facilitate lifelong continuous professional development; and enhance individuals' employability. Such a definition could provide a clearer understanding of the term, its areas of competency, and contexts of development.

Secondly, the DigComp framework is expanding as a central tool for many initiatives related to the professional environment. The framework's clear and solid structure, flexibility, and neutrality have made it adaptable to various initiatives aimed at improving employability, providing career counseling, guiding training and professional development, or preparing for seeking work.

Thirdly, after mapping and analyzing the key dimensions included in the frameworks reviewed, it can be concluded that seven competence areas structure professional digital competence. Six correspond to generic competence areas (engagement and professional development, digital information, digital content creation, digital communication and collaboration, digital problem solving, and security), and the last one is specific and depends on the professional family to which one belongs (industry-related competences).

Lastly, the literature review identified a lack of data on women and professional digital competence. The reviewed sources provided scarce information on the traits of women's digital competence, gender differences, or the distinctiveness of their digital competence.

Albeit the valid and reliable process of the SLR conducted in this research, some limitations must be highlighted. Firstly, the study relied on the quality and availability of existing literature, which could introduce inconsistencies due to variations in research methods and publication bias. Additionally, there was a time lag between the review and the most recent developments in the field. The scope was also limited by the search strategy, potentially missing relevant research. Lastly, subjectivity in study selection and interpretation could have introduced bias. Despite these limitations, the study is valuable for synthesizing existing knowledge and identifying future research directions.

Future research should focus on addressing the gender gap in professional digital competence through targeted efforts. Investigating potential gender disparities in accessing digital competence training and opportunities would contribute to more inclusive policies. Another future research direction should delve deeper into the root causes of the gender gap in professional digital competence and the tools with which self-efficacy measurements are made.

Additionally, applied research in the fields of digital learning and microlearning would provide evidence-based recommendations for the development and enhancement of scalable and far-reaching digital training programs and the creation of inclusive workplaces to promote gender diversity in the digital sphere.

Overall, the results of this review provide valuable information on the development and application of digital competence in the professional context. A clear definition of the term, involving the seven key dimensions described, will facilitate the development and assessment of this multidimensional construct. In particular, various initiatives can take advantage of this knowledge to improve employability and professional development in digital competence. Further research in this field will undoubtedly help to develop digital competence among workers, thus guiding them in the process of digital transformation, responding to the need to fill increasingly skilled jobs.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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