RESEARCH

DIGITAL COMPETENCES IN THE IBERIAN CONTEXT: AN EVIDENCE STUDY

Competencias digitales en el contexto Ibérico: Un estudio de evidencias

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ABSTRACT

Introduction. Information and Communication Technologies (ICT) are essential to understand recent economic, social, political, and cultural transformations. To take full advantage of today's technologies and act as a full-fledged citizen, it is important that every citizen proves to be digitally proficient. Different countries have, therefore, invested heavily in the promotion of Digital Competences. **Methodology.** The analysis of the reality of the Iberian Peninsula about the established measures and achieved ambitions in the field of Digital Competences will be carried out, through quantitative and qualitative methodological approaches, and considering four factors: (a) Digital

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Economy & Society Index (DESI) data; (b) the volume of scientific production on digital competence; (c) projects catalogued in DigComp into Action; and (d) structures and actions to support digital competence. **Results.** The Spanish results were more expressive compared to the Portuguese ones, although Portugal has shown, more recently, positive movements on Digitization. **Discussion.** Several public policies and actions implemented in Spain contribute to the country's current results, mainly in the parameters of scientific production and in the analysis of the projects identified in DigComp into Action. It was found that Portugal still has a large gap in the implementation of programs aimed at digital competence. **Conclusion.** Several actions and public policies implemented in Spain contributed to the favorable Spanish results considering the factors under analysis. However, Portuguese pioneering position stands out, not only with the development of a framework, but also in establishing a certificate in this field, anticipating the ambitions of the European Commission by more than a decade.

Keywords: digital competence, digital Skill, digital technologies, digital transformation, digital transition, DESI, DigCompEdu, DigComp into Action.

RESUMEN

Introducción. Las Tecnologías de la Información y la Comunicación (TIC) son esenciales para comprender las recientes transformaciones económicas, sociales, políticas y culturales. Para sacar el máximo partido de las tecnologías actuales y actuar como un ciudadano de pleno derecho, es importante que todo ciudadano demuestre ser competente digitalmente. Por ello, diferentes países han invertido mucho en la promoción de las Competencias Digitales. **Metodología.** El análisis de la realidad de la Península Ibérica sobre las medidas establecidas y las ambiciones alcanzadas en el ámbito de las Competencias Digitales se llevará a cabo, a través de enfoques metodológicos cuantitativos y cualitativos, y considerando cuatro factores: (a) los datos del *Digital Economy & Society Index (DESI);* (b) el volumen de producción científica sobre competencia digital; (c) los proyectos catalogados en DigComp en acción; y (d) las estructuras y acciones de apoyo a la competencia digital. Resultados. Los resultados españoles fueron más expresivos que los portugueses, aunque Portugal ha mostrado, más recientemente, movimientos positivos en materia de digitalización. **Discusión.** Varias políticas públicas y acciones implementadas en España contribuyen a los resultados actuales del país, principalmente en los parámetros de producción científica y en el análisis de los proyectos identificados en *DigComp into Action*. Se constató que Portugal aún presenta una gran laguna en la implementación de programas dirigidos a la competencia digital. **Conclusiones.** Varias acciones y políticas públicas implementadas en España contribuyeron a los resultados favorables españoles considerando los factores analizados. Sin embargo, destaca la posición pionera portuguesa, no sólo con el desarrollo de un marco, sino también en el establecimiento de un certificado en este campo, anticipándose en más de una década a las ambiciones de la Comisión Europea.

Palabras clave: competencias digitales, habilidades digitales, tecnologías digitales, transformación digital, transición digital, DESI, DigCompEdu, *DigComp into Action*.

Competências digitais no contexto Ibérico: um estudo de evidências

RESUMO

Introdução. As Tecnologias da Informação e Comunicação (TIC) são essenciais para entender as transformações económicas, sociais, políticas e culturais recentes. Para tirar pleno proveito das tecnologias atuais e atuar como cidadão de pleno direito, importa hoje que cada cidadão se revele digitalmente proficiente. Diferentes países têm, nesse sentido, investido fortemente na promoção de Competências Digitais. **Metodologia.** A análise da realidade da Península Ibérica, no que diz respeito a medidas estabelecidas e ambições atingidas no domínio das Competências Digitais, será realizada através de abordagens metodológicas quantitativa e qualitativa, e considerando-se quadros fatores: (a) dados do *Digital Economy & Society Index (DESI);* (b) o volume de produção científica; (c) projetos catalogados no *DigComp into Action*; e (d) estruturas e ações de suporte as competências digitais. **Resultados.** Os resultados espanhóis foram mais expressivos em comparação aos portugueses, embora Portugal, nos últimos anos tenha apresentado movimentos positivos em relação à Digitalização. **Discussão.** Diversas políticas e ações públicas implementadas em Espanha contribuem para os atuais resultado do país, principalmente nos parâmetros de produção científica e na análise dos projetos identificados no *DigComp into Action*. Verificou-se que Portugal regista ainda um grande hiato na implementação de programas voltados às competências digitais. **Conclusão.** Diversas ações e politicas públicas implementadas em Espanha contribuem para o favoráveis resultados espanhóis considerando os fatores em análise. Destaca-se, contudo, o pioneirismo português não apenas com o quadro de referencia, mas também em estabelecer um certificado neste domínio, antecipando as ambições da Comissão Europeia em mais de uma década.

Palavras-chave: competências digitais, habilidades digitais, tecnologias digitais, transformação digital, transição digital, DESI, DigCompEdu, *DigComp into Action*.

1. INTRODUCTION

The combination of various social changes registered in the last two decades, as well as the rapid evolution of electronic devices, along with the expansion of the internet and the development of Information and Communication Technologies (ICT), has led to a long list of innovations in the educational sector. Multiple factors are putting pressure for change on the educational system, requiring drastic shifts in the role of teachers, such factors as: (a) the fourth industrial revolution; (b) the emergence of active pedagogies; (c) explosion of on-demand access to information, driven by the growing of internet use; (d) lifelong learning; (e) artificial intelligence; and (f) Open Education movements such as Open Educational Resources (OER), Open Educational Practices (OEP), Open Science, Open Access, and Open Data (Ally, 2019; Martínez et al., 2018; A. Santos, 2017; 2019).

According to C. Santos et al. (2022), the first publication in the context of the European Union focusing on the impact of the information technologies occurred in 1994 when the European Council requested the preparation of a report on specific measures to be

studied by the member states for the creation of information infrastructure (Comisión Europea, 1994). However, it was in 2010 that the European Commission launched Europe 2020 - A Strategy for Smart, Sustainable, and Inclusive Growth (European Commission, 2010), with seven initiatives, including the Digital Agenda. This document outlines the main guidelines for overcoming the crisis and preparing the European economy for the challenges of the next decade.

According to Octavio and Párraga (2017), ICTs are a crucial factor in understanding the economic, social, political, and cultural changes of recent years. Public authorities should provide adequate and satisfactory access to everyone, regardless of social class or education level, in response to the needs of society and the current economy and society.

As a result of the recommendation of the European Parliament and the Council of the European Union in 2006, which initially identified digital competence as one of the eight key competences for lifelong learning, the European Commission launched the Digital Competence (DigComp) project in 2010, developed by the Joint Research Centre (JRC) and the Institute for Prospective Technological Studies (IPTS). This led to the publication of "Mapping digital competence: towards a conceptual understanding" (Ala-Mutka, 2011), as well as the technical report "Digital Competence in Practice: An Analysis of Frameworks" (Ferrari, 2012). Subsequently, the framework "DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe" (Ferrari, 2013), commonly known as DigComp 1.0, was published by these organizations, serving as a precursor to a series of frameworks on digital competences in the European context. Today, the document is available in its latest version, DigComp 2.2: The Digital Competence Framework for Citizens (Vuorikari et al., 2022a), which is available in Portuguese (Lucas et al., 2022) and Spanish (Vuorikari et al., 2022b). This framework includes a set of 21 competences, each of which includes approximately 10 to 15 examples that can inspire educators and instructors to update programs, plans, and pedagogical resources. It is important to note that these examples do not aim to cover all the possibilities that the competence entails but merely serve as guidelines.

In 2018, the Council of the European Union redefined these eight key competences for lifelong learning, updating the ones originally established in 2006 (Council of the European Union, 2018), highlighting and consolidating the importance of digital competence in the European context. Specific frameworks have been developed for some of these competences, either by the European Commission through the JRC or by the European Council, as shown in Figure 1.

Figure 1

Key competences for lifelong learning and Frameworks.
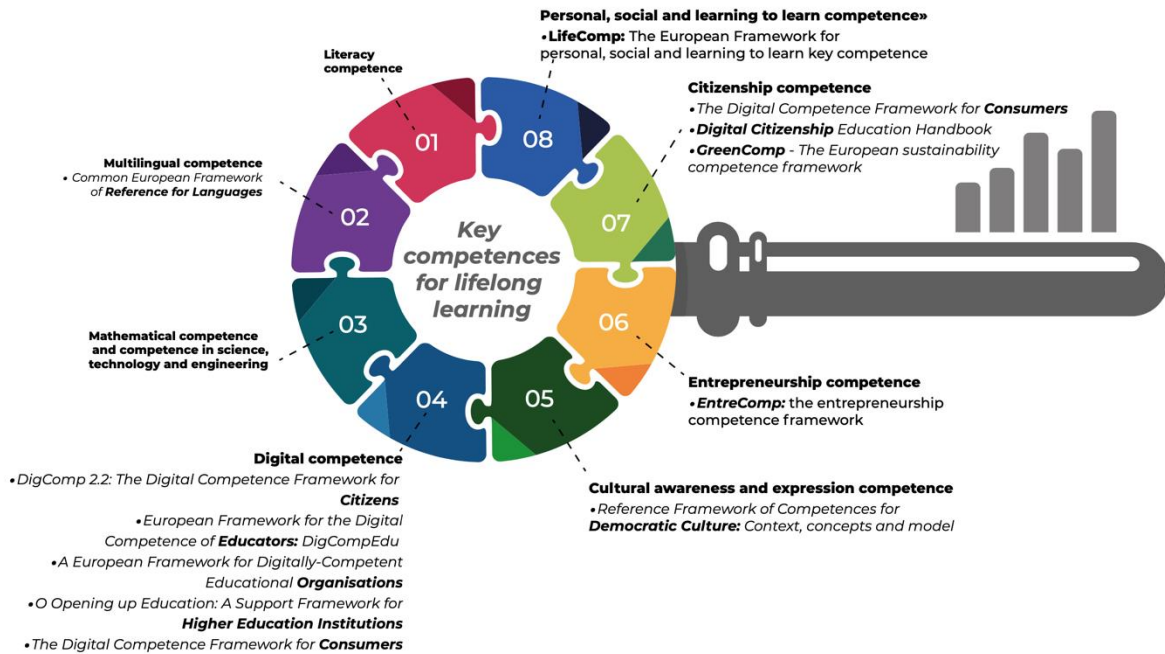
Source: Translated from Santos (2023).

Among the frameworks focused on digital competences, it is possible to indicate that the existing frameworks are mostly centered around education. For example, the European Framework for the Digital Competence of Educators: DigCompEdu, aimed at educators (Lucas and Moreira, 2018; Redecker, 2017, 2020), the European Framework for Digitally-Competent Educational Organizations (DigCompOrg), aimed at educational organizations (Kampylis et al., 2015), the OpenEdu framework for higher education institutions (A. Santos, 2017, 2019), and finally, the aforementioned DigComp framework (Lucas et al., 2022; Vuorikari et al., 2022a, 2022b), which, although directly targeted at citizens in general, can also be understood as applicable to students.

In line with these reference frameworks, the JRC has also produced a series of "into action" documents that exemplify how these frameworks are and can be used in practice. For example: (a) EntreComp into Action: get inspired, make it happen (McCallum et al., 2018); (b) DigComp into Action, get inspired make it happen (Kluzer and Priego, 2018); and (c) LifeComp into Action: Teaching life skills in the classroom and beyond (Sala and Rámila, 2022).

Specifically, DigComp into Action (Kluzer and Priego, 2018) aimed to support different stakeholders in promoting digital competences by sharing inspiring implementation experiences related to DigComp. This mapping was conducted between June and October 2017 through a questionnaire distributed in the European

Union and additional interviews conducted by mail or phone, resulting in 38 collected examples.

The importance given to digital competence is not limited to the European common space. Among other official organizations that support and demand the development of these competences in the 21st-century society we are immersed in (Díaz et al., 2019), we can also highlight UNESCO through the UNESCO ICT Competency Framework for Teachers (ICT CFT) (2018a) and the Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2 (2018b); the International Society for Technology in Education (ISTE) through the ISTE Standards for Teachers and Students (2023), and the Education and Training Foundation (ETF) through the Digital Teaching Professional Framework: Full reference guide (2018).

The European Digital Agenda (European Commission, 2010) aimed to stimulate the European economy by harnessing the sustainable economic and social benefits of a single digital market based on fast and ultra-fast internet services and interoperable applications. Within its scope of actions, it included "Enhancing digital literacy, skills and inclusion" (p. 24), indicating as an established action, by 2013, the creation of "indicators of digital competences and media literacy" (p. 27), which resulted in the creation of the Digital Economy & Society Index (DESI) (Comissão Europeia, 2014; European Commission, 2016).

The DESI is an index composed of relevant indicators on Europe's digital performance that seeks to portray and longitudinally monitor the evolution of Member States in the digital domain (European Commission, 2023a). Initially launched in 2015, it underwent methodological changes in 2021 (European Commission, 2021), including the exclusion of the "Use of Internet services Digital" dimension and the reference to 27 Member States (EU-27), recalculating all indices since 2017 (European Commission, 2021, 2022a). It currently encompasses four dimensions: (a) human capital; (b) connectivity; (c) Integration of digital technology; and (d) digital public services.

Over the past years, Portugal and Spain have shown relative improvement in their DESI Index (European Commission, 2023a). In the case of Portugal, although the values are numerically higher than in previous years, they are still below the average of the Member States. On the other hand, Spain has surpassed the country with the highest per capita GDP in the EU in 2020, Luxembourg (Figure 2). Therefore, more in-depth statistical studies are necessary to examine the economic activity of a country, measured by per capita GDP, and its digital development, measured by the DESI.

Figure 2

Evolution 2017 – 2022 of the General DESI Index.
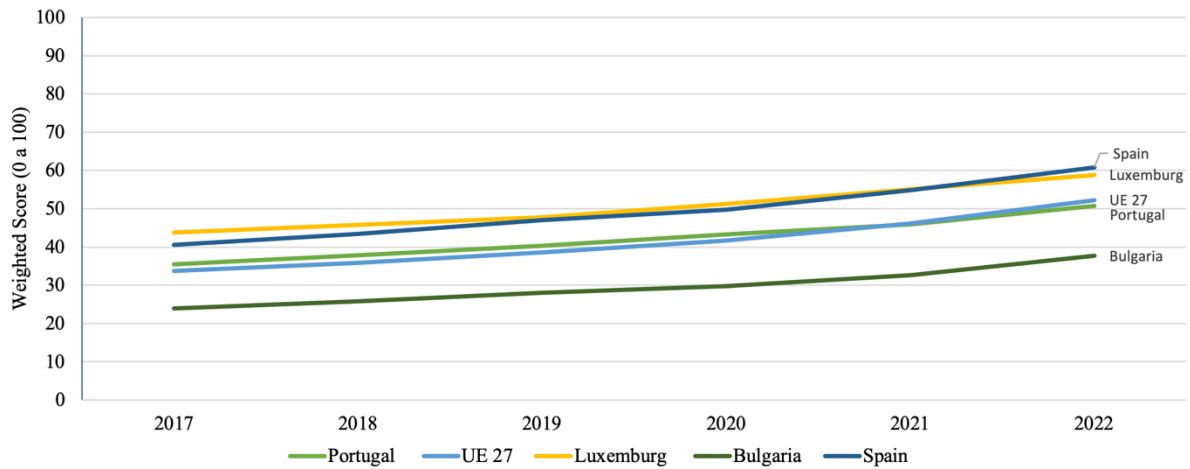
Source: Adapted from European Commission (2023a).

2. OBJECTIVES

This article aims to analyze the reality of the Iberian Peninsula regarding established measures and achieved ambitions in the field of Digital Competences, considering specifically: (a) DESI data; (b) the volume of scientific production on digital competence; (c) projects cataloged in DigComp into Action; and (d) support structures and actions related to digital competences.

3. METHODOLOGY

The selection of a research approach should consider the nature of the problem and/or research objectives, as well as the researchers' personal experiences, the context, and/or the audience to which the study is directed. The methodology consists of the planning and procedures that encompass the research decisions made, from general assumptions to detailed methods of data collection, analysis, and interpretation, with the latter typically classified as qualitative, quantitative, or mixed methods (Mattar & Ramos, 2021). This article adopted both quantitative and qualitative methodological approaches, although they were considered separately. The variables to be studied, their operationalization, as well as the relational analyses established among them, are described below.

3.1. Digital Economy & Society Index (DESI)

For the analysis of data related to the DESI, the Digital Scoreboard - Data & Indicators (European Commission, 2023a) was adopted as the database, both for the isolated analysis (overall index or by dimension) and in conjunction with the per capita GDP data (2020) (European Commission, 2022b), aiming to identify a possible statistically significant correlation between economic activity and the digital evolution.

The statistical test adopted to assess the correlation coefficient was Spearman's rho, which is suitable when dealing with a small number of participants/observations and when there is uncertainty about whether the assumptions for Pearson's r are met

(Dancey and Reidy, 2019). The analysis was performed using the IBM Statistical Package for the Social Sciences (SPSS Statistics) version 26.0.0.0.

3.2. Scientific production

To quantify the volume of scientific production related to digital competences by country, the strategy adopted was to specifically map Systematic Literature Reviews (SLR) on the topic under analysis: digital competences. From these reviews, those that presented literature results expressed by country were selected. A search was conducted in the EBSCO database (in May 2022) using the following string "(*revisión sistemática* OR *revisión sistemática de la literatura* OR *revisão de literatura* OR *revisão sistemática de literatura* OR *systematic literature review or systematic review*) AND (digital competence OR digital skill OR digital literacy OR digital competencies OR *literacia digital* OR *competência digital*)". Filters were applied in the EBSCO database search tool regarding the period (2009-2021), source types (academic journals), access (full text), and language (English, Portuguese, and Spanish).

3.3. Digcomp into Action

The DigComp into Action (Kluzer and Priego, 2018) contains 38 examples classified as: (a) case studies, which aim to tell a story of why and how DigComp was used, highlighting the key actors involved, the steps taken, the products, and the future steps when possible; and (b) tools, which are activities, methods, and products developed using DigComp. The objective was to identify quantitatively the participation of Portugal and Spain in national or European projects related to digital competences listed in this reference document issued by the JRC.

3.4. Support Structures and Actions

To map the structures and support actions for digital competences in the context of the countries under analysis (Portugal and Spain), we sought to identify the legal frameworks and the existence of national frameworks on digital competences. For this purpose, a bibliographic search was conducted in scientific articles, dissertations, theses, book chapters, and books available in institutional and European repositories, as well as international scientific databases (EBSCO, WoS, and SCOPUS), and legal databases such as the Official Journal of the European Union[2], Portuguese Electronic Gazette[3] and Spanis *Boletín Oficial del Estado* (BOE)[4].

4. RESULTS

The results of this article are described considering the data obtained from the parameters previously described: DESI, scientific production, analysis of DigComp into Action, and the mapping of structures and support actions for digital competences (legal frameworks and reference frameworks).

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[2] https://eur-lex.europa.eu/oj/direct-access.html?locale=pt

[3] https://dre.pt/dre/home

[4] https://www.boe.es/

4.1. Digital Economy & Society Index (DESI)

The results of DESI 2022, in terms of rankings among EU Member States, indicate that Portugal is in 15th position, while Spain is in 7th position. Both countries are on opposite sides in relation to the EU average, as shown in Figure 3, with Portugal clearly having a lower position. Both countries have shown improvement in their indicators, with Portugal growing by 43.06% (from 35.48 in 2017 to 50.76 in 2022) and Spain by 49.99% (from 40.52 in 2017 to 60.77 in 2022), while the average growth among EU Member States was 55.05% (from 33.72 in 2017 to 52.28 in 2022).

Figure 3

DESI 2022.
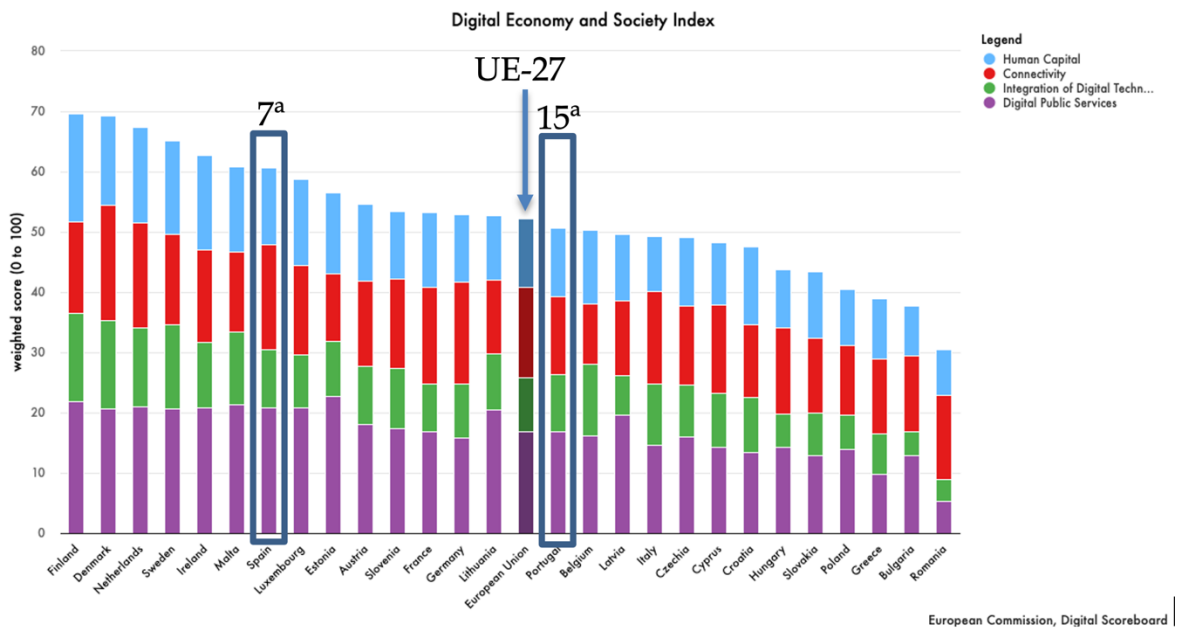
Source: Adapted from European Commission (2023a).

Considering the DESI 2022, in terms of dimensions, it was possible to identify clearer differences between Portugal and Spain. Portugal has index scores for the dimensions of (a) Human Capital, (b) Integration of Digital Technologies, and (c) Digital Public Services above the EU average, whereas in Spain, both the overall index score and the scores for all dimensions are above the average, as shown in Figure 4.

Figure 4

DESI 2022 – Human Capital Dimension Portugal and Spain.
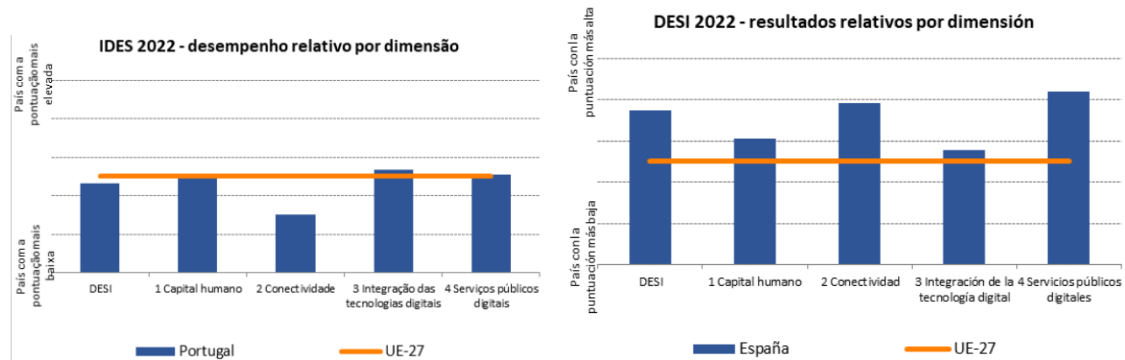
Source: European Commission (2022a, p. 5) and Comisión Europea (2022, p. 4).

The results also showed that Portugal is in the 14th position in the Human Capital dimension when compared to other EU Member States. This represents the best historical position achieved by the country in this index, indicating progress as Portugal was ranked 19th in 2017. Conversely, Spain currently occupies the 10th position, compared to 9th in 2017 (European Commission, 2023a). It is important to highlight that this dimension is directly linked to digital competence.

In Table 1, it is possible to observe the differences in the indicators and sub-dimensions (1a and 1b) that compose the Capital Human dimension of the analyzed index.

Table 1

DESI 2022 – Human Capital Dimension Indicators.

Subdimension - Indicator	EU-27	PT	ES
1a Internet user's skills.	24,5	25,2	31,3
1a1 At least Basic Digital Skills	27,0	27,7	32,1
1a2 Above basic digital skills	10,0	10,8	14,4
1a3 At least basic digital content creation skills	13,7	12,0	16,2
1b Advanced Skills and Development	20,4	20,7	20,0
1b1 ICT Specialists	15,0	15,7	13,7
1b2 Female ICT specialists	12,7	13,8	12,9
1b3 Enterprises providing ICT trainingg	6,6	7,6	6,7
1b4 ICT graduates	6,5	4,3	6,7

Source: European Commission (2023a).
Note: Weighted score scale (0 - 100), PT = Portugal, ES = Spain.

It is advantageous to analyze a possible correlation between DESI (index) and GDP per capita (value in Euro) (Table 2) of the Member States (European Commission, 2022b, 2023a). This analysis was performed using a correlation coefficient, in this case

the Spearman's rho. The results indicate a positive and significant correlation (r = 0.759; p < 0.01), and the recorded value is considered by Mattar and Ramos (2021) to be associated with a high correlation.

Table 2

DESI 2021 and PIB per capita 2020.

Member State Code	DESI (2021)	PIB per capita (2020)
BE	46,71	33 870.00 €
BG	32,65	6 380.00 €
CZ	43,37	17 340.00 €
DK	65,25	48 150.00 €
DE	47,07	34 310.00 €
EE	53,15	15 010.00 €
IE	57,11	62 980.00 €
EL	32,51	16 180.00 €
ES	54,81	22 350.00 €
FR	45,92	30 610.00 €
HR	43,07	17 340.00 €
IT	40,85	24 900.00 €
CY	43,46	23 840.00 €
LV	46,13	12 130.00 €
LT	47,02	14 030.00 €
LU	55,04	82 250.00 €
HU	41,23	12 710.00 €
MT	54,46	20 320.00 €
NL	62,36	40 160.00 €
AT	56,87	35 390.00 €
PL	36,53	12 750.00 €
PT	45,86	17 070.00 €
RO	27,43	8 820.00 €
SI	47,96	19 720.00 €
SK	39,95	15 180.00 €
FI	67,15	36 240.00 €
SE	60,49	42 570.00 €

Source: European Commission (2022b, 2023a).

4.2. Scientific production

A total of 444 studies that met the established inclusion criteria (literature reviews focused on the topic of digital competencies and with results organized by country) were found. After applying the previously described filters, this resulted in a total of 193 studies. The following exclusion criteria were then applied to these studies: 1) lack of presentation of results by country; and 2) focus on non-educational/formative

contexts. This left us with five studies that were included in this research, as shown in Table 3. This table allows us to identify the total amount of literature considered (mapped studies = 361) in the identified literature reviews.

Table 3

Selected Literature Review Articles.

| Author (year)	Articles included in the review	Spanish	Portuguese
Reis et al. (2019)	41	27	1
Rodríguez-García, Raso Sánchez et al. (2019a)	154	74	0
Rodríguez-García, Aznar Díaz, et al. (2019b)	112	65	2
Santos et al. (2021)	14	9	2
Sillat et al. (2021)	40	9	3
	361	181	8

Source: Author's own work.

Table 3 shows that the number of publications included in the literature reviews is substantially higher in the Spanish context (181) compared to the Portuguese context (in a ratio of 22 to 1). These results highlight the importance attributed to the topic in research conducted by the scientific community in each respective country.

4.3. Digcomp into Action

The results from the analysis of the projects listed in DigComp into Action revealed a greater number of Spanish projects compared to Portugal. Furthermore, these numbers showed superiority in comparison to other member states, as shown in Figure 5.

Figura 5

Projects Mapped by Country in DigComp into action.
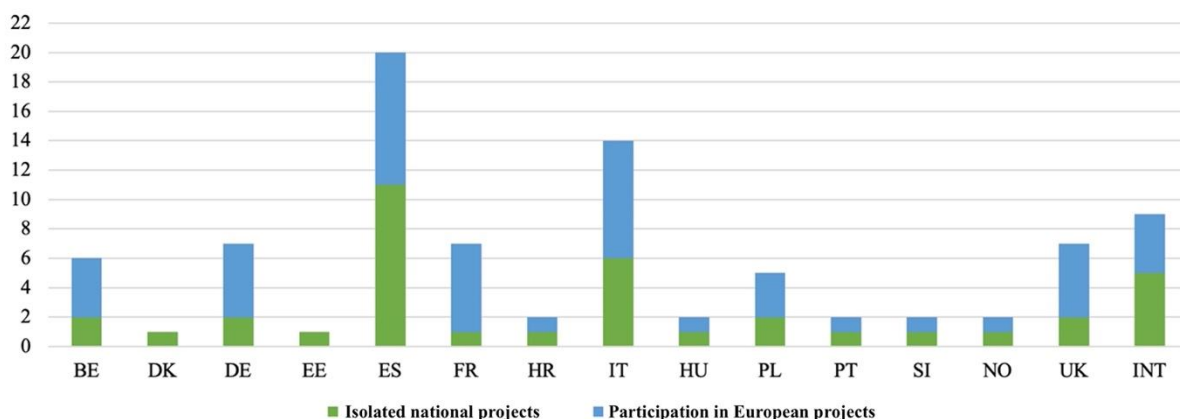
Source: Adapted from Kluzer and Priego (2018).

Out of the total mapped projects (87), involving 15 different countries, approximately 23% are associated with Spain (11 national projects and participation in 9 European projects), while Portugal is only associated with 2.3% of these projects (one national project and participation in one European project).

4.4. Structures and Support Actions

The mapping of structures and support actions regarding digital competence considered legal frameworks and the existence of reference frameworks, mapping what was found regarding each of the countries under study. These elements are described below.

4.4.1. Legal Framework

In Portugal, there is evidence of three legal frameworks related to digital competence: (a) *Estrategia Portugal 2030* (Conselho de Ministros, 2020c); (b) *Certificado de Competências Digitais* (Governo de Portugal, 2021); and (c) *Plano de Ação para a Transição Digital* (Conselho de Ministros, 2020a).

The *Estrategia Portugal 2030* (Conselho de Ministros, 2020c) is structured around four agendas, including "digitalization, innovation, and qualifications as drivers of development" (p. 12), which has "qualification of human resources" as its strategic domain. This strategy includes five intervention axes, three of which are related to digital competence: (a) aligning the initial qualification of young people with new economic specializations, with particular attention to digital competence and promoting the professional integration of young people; (b) promoting continuous training and Lifelong Learning, including raising qualification levels and improving and retraining the skills of workers, with particular attention to digital competence and new skills aligned with emerging professions; and (c) promoting advanced training of human resources in all knowledge areas, with particular attention to domains and areas aligned with new economic specialization areas and the needs of the labor market, as well as digital competence.

The Portuguese government has developed a program for acquiring and certifying competence in the field of digital technologies and media, called the *Certificado de Competências Digitais* (Governo de Portugal, 2021), with the strategic objective of enhancing the digital competence of the Portuguese population as a factor for social inclusion and employability promotion, in response to the emerging needs of the digital economy and societies. The program was created considering the objectives of the *Quadro Dinâmico de Referência de Competência Digital para Portugal* (QDRCD) (Conselho de Ministros, 2019), the *Plano de Ação para a Transição Digital* (Pillar I) (Conselho de Ministros, 2020a), and the *Aprova o Programa de Estabilização Económica e Social* (ATIVAR.PT) (Conselho de Ministros, 2020b).

The *Plano de Ação para a Transição Digital* (Conselho de Ministros, 2020a) is a strategic document that supports the implementation of measures aimed at the digital transition of the Portuguese State, companies, and citizens. It proposes, in an integrated manner, a set of actions that seek to coordinate various synergies and sectoral policies. In its Pillar I, digital empowerment and inclusion, the digital empowerment and inclusion of individuals are marked as mandatory in response to the impact that digitalization has on each person's life, indicating as measures "II - The expansion of the training offer of higher education institutions and their approach to

companies, ensuring a response to the specific needs of the labor market in the field of digital competence" (Conselho de Ministros, 2020a, p. 12).

In Spain, evidence of four legal frameworks related to digital competence was found: (a) *España Digital 2025* (Gobierno de España, 2020); (b) *Educa en Digital* (Ministerio de la presidencia relaciones con las cortes y memoria democrática, 2020); (c) *Plan nacional de Competencias Digitales Español* (Gobierno de España, 2021); and (d) *Plano uni-digital* (Gobierno de España, 2020), described below.

The program *España Digital 2025* (Gobierno de España, 2020) It includes actions "aimed at promoting more sustainable and inclusive growth, driven by the synergies of digital and ecological transitions" (p. 8). It encompasses a set of measures, reforms, and interventions articulated in 10 strategic axes, including digital competence: "In this sense, it is crucial to have the necessary digital competence that guarantee an effective and responsible use of available digital tools" (p. 27), focusing on three groups: "(1) citizens in general; (2) the active population, which includes employed and unemployed individuals; and (3) technological professionals from all sectors of the economy" (p. 27).

The program *Educa en Digital* (Ministerio de la presidencia relaciones con las cortes y memoria democrática, 2020) it consists of a set of actions arranged around three axes to support the digital transformation of the educational system, with a close relationship with digital competences, as stated in its axis three, which aims to "adapt the competence of the entire teaching staff to the use of ICT in their daily work, as well as the development and application of methodologies for teaching in a digital and potentially remote context" (Ministerio de la Presidencia relaciones con las cortes y memoria democrática, 2020, p. 50060).

The *Plan Nacional de Competencias Digitales Español* (Government of Spain, 2021) it consists of four axes and seven lines of action. In particular, under Axis II - Digital Transformation of Education, the plan includes the digitalization of education and the development of digital competence for learning, indicating several measures: (a) digitalization and digital competence plan for the educational system; (b) incorporation of digital competence and programming in mandatory curricula; (c) creation of Open Educational Resources (OER) for teaching with digital media; (d) digital vocational training plan (FPDigital); and (e) plano uni-digital for the modernization of the Spanish university system.

The *Plano uni-digital* it is presented as specific to higher education, established between two legal frameworks, being one of the measures of the *España Digital 2025 Initiative*(Axis three) (Gobierno de España, 2020) and measure number 10 of the *Plan nacional de Competencias Digitales Español* (Gobierno de España, 2021). It was also noted that a key factor for the success of this measure is the coordination between the *Ministerio de las Universidades* and the *Conferencia de Rectores de las Universidades Españolas* (CRUE) to: (a) provide technical resources and digital educational methodologies; (b) teacher training; (c) inclusion of digital training in the curriculum of different degrees, including the allocation of credits for Massive Open Online

Courses (MOOCs); (d) development of a network of centers of excellence in artificial intelligence; (e) reducing administrative barriers to accelerate the implementation of new university degrees; and (f) modifying curricula for future teachers.

4.4.2. Reference Framework on Digital Competences

In Portugal, two frameworks on digital competence were identified: (a) "*Competências TIC: Estudo de implementação*" (Costa et al., 2008, 2009), which is a study on the implementation of ICT competence; and (b) "*Quadro Dinâmico de Referência de Competência Digital para Portugal*" (QDRCD) (Conselho de Ministros, 2019).

Although not directly related to all citizens, the "*Competências TIC: Estudo de implementação*" (Costa et al., 2008, 2009) was developed based on the training axis of the *Plano Tecnológico da Educação* (PTE 2007-2010) (Conselho de Ministros, 2007). It proposes a framework of ICT competences for non-higher education teachers and other education/training professionals, organized into three levels of certification: (a) Certificate of Digital Competences: uses ICT as functional tools in their professional context; (b) Certificate of Pedagogical Competences with ICT: integrates ICT as a pedagogical resource, using them to develop teaching and learning strategies to enhance students' learning outcomes; and (c) Certificate of Advanced Pedagogical Competences with ICT. Similarly, it suggests that the same ICT competences should be developed among students in primary and secondary education.

The *Quadro Dinâmico de Referência de Competência Digital* para Portugal (QDRCD), inspired by DigComp 2.1 (Carretero et al., 2017), was developed by adapting this framework to the Portuguese context. The adaptations include: (a) simplifying the designations of the competence areas; (b) removing competence 3.4, Programming, as it was considered redundant with other competences; (c) reducing the number of proficiency levels to four for greater operationality; and (d) providing an example of use for each proficiency level of all competences, related to the citizen's everyday life.

In Spain, a specific framework for digital competence for citizens developed exclusively for the national context was not identified, which may indicate the full adoption of the European framework for citizens (DigComp). Evidence was found of a framework related to the digital competence of teachers, the *Marco Común de Competencia Digital Docente*, developed by the *Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado* (INTEF).

The *Marco Común de Competencia Digital Docente* was established in 2012, and its version 1.0 was published in 2013. Its purpose was to provide a descriptive reference that could be used for training purposes and in processes of assessment and recognition of competences (INTEF, 2014), as part of the *Plan de Cultura Digital en la Escuela* and the *Marco Estratégico de Desarrollo Profesional Docente*. Although its focus is on teachers, it was based on DigComp 1.0 (Ferrari, 2013), which focuses on digital competence for citizens.

The current version, *Marco Estratégico de Desarrollo Profesional Docente: Enero - 2022* (MRCDD) (INTEF, 2022), is intended for teachers in non-higher education, being an

adaptation and complementation of aspects addressed with less depth in DigCompEdu , such as: (a) adaptation to Spanish legislation; (b) consideration for the protection of personal data and guarantee of digital rights in alignment with general data protection regulations; (c) review of names and descriptions to adapt to the Spanish educational context and provide conceptual specificity; (d) linguistic revision to adapt the terms and expressions used to those commonly used in the Spanish context; (e) establishment of new criteria according to teachers' professional development; and (f) definition of achievement indicators for each competence at different levels, in order to clarify the expected degree of development. Such changes also resulted, among other factors, in the addition of a competence in area 1, specifically 1.5, related to "Protection of personal data, privacy, security, and digital well-being "in the use of technologies, particularly those that involve profiling and artificial intelligence, collect biometric data, or use services that store data in the cloud." (p. 8).

5. DISCUSSION

The presented results demonstrate that Portugal has invested in the digitalization process in the recent years, which tends to justify its current evolution in the DESI index, currently ranking 15th (DESI 2022), very close to the EU average. These results can be considered satisfactory from an internal perspective; however, the registered progress (43.06%) is lower compared to Spain (49.99%) and to the EU average (55.05%). This indicates that Portuguese measures are not having the expected effect as planned in the INCoDe.2030 initiative, which aims to "improve the level of digital competence of the Portuguese, puting Portugal closer to the most advanced European countries in this dimension" (Conselho de Ministros, 2021, p. 24), even though there is a time horizon to achieve these ambitions as they extend until 2030. Similarly, as expected in the *Plano de Ação para a Transição Digital*, it is hoped that "Portugal will be at the forefront of the countries that are best prepared to face the challenges and changes inherent in a global transition" (Conselho de Ministros, 2020a, p. 7).

This scenario is indeed highlighted by the European Commission in the DESI 2022 report: "Progress in Portugal is generally slightly lower than that other countries, so there is room for the country to accelerate its digitalization efforts" (Comissão Europeia, 2022a, p. 3).

The superior evolution observed in Spain is more clearly identified through a dimension analysis of the DESI, where it was possible to observe that the country performs above the EU average in all dimensions.

When it comes specifically to the analysis of the "Human Capital" dimension, directly related to digital competence, the indicators for these two countries show more significant differences, in percentage points, in the sub-dimension (1a) Internet User Skills (PT=25.2 and ES=31.3). Portugal had lower data compared to Spain in all three indicators. Only in the sub-dimension (1b) Advanced Digital Skills, Portugal had slightly higher data than Spain (PT=20.7 and ES=20.0), especially in the indicator (1b1) ICT Specialists.

When considering the GDP per capita together with the DESI, a high correlation was identified. These results make sense when we see that among the top 10 EU Member States with the highest DESI indices (FI, DK, NL, SE, IE, AT, LU, ES, MT, and EE), seven are among the top 10 countries with the highest GDP per capita (LU, IE, DK, SE, NL, FI, and AT). From this, we can note that Germany, Belgium, and France, although among the top 10 GDP per capita (ranked 8th, 9th, and 10th, respectively), are not among the top 10 EU Member States with the highest DESI indices (ranked 13th, 16th, and 12th, respectively). The correlation found may be based on the viability of economic power in implementing large-scale projects, especially those related to digital competence, which require significant investments and mobilization. Conversely, Malta, Spain, and Estonia, which are among the top 10 EU Member States with the highest DESI indices (ranked 6th, 7th, and 9th positions, respectively), are not among the top 10 countries with the highest GDP per capita (ranked 14th, 13th, and 21st, respectively). This suggests the development of strong public policies and the creative use of resources.

Spain ranks 7th in the DESI and 13th in GDP per capita, which indicates a favorable position in the domain under analysis, both compared to Portugal and many other EU Member States. This highlights the existence of factors that are not exclusively economic, justifying the observed growth. It suggests the presence of policies and public programs specifically targeted towards digital competence.

The implementation of policies and public programs can currently be observed in the European Recovery and Resilience Plan (ERRP) (European Commission, 2022b), which requires that a minimum of 20% of the financial allocations of the program be directed towards the digital sphere. Portugal allocated 22.1% (Comissão Europeia, 2022a) of the total resources to the digital dimension, while Spain allocated 28.2% (Comisión Europea, 2022).

The literature indicates a prominent position for Spain as the country with the highest scientific production related to digital competence among the Member States (Palacios-Nunez et al., 2022; Sillat et al., 2021). The higher scientific production in Spain, compared to other Member States, can also be associated with a greater presence, consistency, and longevity of public policies in this area. These results may have been reinforced by the existence of specific structures such as *Comisión Sectorial de Tecnologías de la Información y las Comunicaciones de la Conferencia de Rectores de las Universidades Española*s (CRUE-TIC, 2022) and INTEF. It is worth noting that the *Marco Común de Competencia Digital Docente* project by INTEF started in 2012, prior to the first version of the European reference framework DigComp 1.0 (Ferrari, 2013). This innovation is also reflected in the latest version of the *Marco de Referencia de la Competencia Digital Docente: Enero – 2022* (MRCDD) (INTEF, 2022), which presents a more analytical model compared to its European counterpart, DigCompEdu. It brings it closer to the new format implemented in DigComp 2.2, which was launched after the MRCDD and included examples of Knowledge (K), Skills (S), and Attitudes (A) (KSA) for each competence. This higher scientific production in Spain, as indicated in the literature and found in this article, justifies, at least in part, Spain's greater participation in projects mentioned in DigComp into Action.

Regarding the support structures and actions, it is not possible to indicate different advancements between the countries under study based on legal frameworks, due to contextual differences in their application. However, quantitatively, it is identified that Spain has four frameworks, while Portugal has three.

However, regarding frameworks, Spain has had a framework for non-higher education teachers since 2013, undergoing several updates, with the most recent version published in 2022. This indicates a continuity of the program, a process not found in Portugal, which published its reference framework in 2008. However, it is worth noting Portugal's pioneering role with the model of ICT competency framework for teachers published in 2008, anticipating not only European reference models in digital teaching competencies but also a means to achieve the ambitions of the European Commission in establishing a European Digital Skills Certificate (EDSC) (European Commission, 2023b), as foreseen in Action 9 of the Digital Education Action Plan 2021-2027 (European Commission, 2020): "European citizens will thus be able to indicate their level of digital competence, with reference to the proficiency levels of the Digital Competence Framework" (p. 18). It also anticipates, by over a decade, the creation of the "*Certificado de competências Digitais*" program in the Portuguese context, a program for the acquisition and certification of competence in the field of technology and digital media (Governo de Portugal, 2021). As for general digital competence frameworks for citizens, Portugal has developed a specific reference framework (QDRCD), while no such framework was found in the Spanish context, indicating that Spain has chosen to entirety use the European framework (DigComp).

6. CONCLUSIONS

The present study aimed to analyze the reality of the Iberian Peninsula regarding established measures and achieved ambitions in the field of Digital Skills, considering specific data from DESI, scientific production related to this field, projects cataloged in DigComp into Action, and support structures and actions related to digital competence.

In general, it was found that both countries have made considerable progress in this field, with significantly more pronounced progress observed in the Spanish context. Several actions and public policies implemented in Spain certainly contribute to its favorable results, which can be easily identified in its position in DESI, scientific production parameters, and analysis of initiatives listed in DigComp into Action. Regarding DESI, a positive and statistically significant correlation with GDP per capita was identified. It was noted that Spain is among the top 10 EU Member States with the highest DESI scores but not among the top 10 in terms of GDP per capita. This may indicate the efficiency of public policies and the creative use of resources that are not as abundant.

This article corroborates the literature (Palacios-Nunez et al., 2022; Sillat et al., 2021) regarding Spain's prominent position as the EU Member State with the highest scientific production related to digital competence. Additionally, this study adds that Spain has the highest participation in the projects mapped in DigComp into Action.

In terms of support structures and actions, including legal frameworks, it is not possible to indicate different advancements between the countries under study due to contextual differences in the application of these legal frameworks. However, concerning frameworks, Spain has had a framework for teachers (non-higher education) since 2013, undergoing several updates, with the most recent version published in 2022, indicating continuity of the program. This process is not found in Portugal, although Portugal was a pioneer not only in the development of a reference framework but also in the certification process of digital teaching competence. This ambition is now established by the European Commission in the Digital Education Action Plan 2021-2027.

In conclusion, this study indicates evidence of increment of concerns as well of the measures established by both the countries under analyze regarding the digital competence.

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