Mapping of Digital Competence Frameworks Used in Practical Settings

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This article presents our analysis of digital competence frameworks as used in practical settings. Our objective was to evaluate the acknowledgement of digital competence in practical settings and analyse its implementation through digital competence frameworks. The analysis consists of temporal analysis, geographic distribution analysis and the analysis of groups, targeted by identified frameworks. We identified 70 frameworks through means of mainstream search engine queries. Our findings underscore global recognition of digital competence as a crucial and current concept in practical settings.

1 Introduction

Digital competence is being increasingly acknowledged as an integral part of contemporary society, as digitalization of all dimensions of our lives grows. (Broadband Commission, 2022) Within the European Union digital competence is considered as one of eight equally important key competencies that collectively contribute to a successful life in society. These are regarded as competencies "all individuals need for personal fulfilment and development, employability, social inclusion, sustainable lifestyle, successful life in peaceful societies, health-conscious life management and active citizenship. (Council Recommendation 2018/C 189/01, 2018)

Scientific literature devotes significant attention to digital competence in terms of second level digital divide. (Lythreatis et al., 2022) This phenomenon not only perpetuates societal inequalities but also has the potential to intensify them. (Ragnedda, 2017) The interrelation between digital competence extends beyond a unidirectional perspective, acknowledging not only the need for individual's competence in response to the increasing digitalization but also the role of digital competence in addressing societal challenges. Such instance is evident in the digitalization of healthcare, where a wider accessibility of healthcare is anticipated among other benefits. (Maier et al., 2021) However, successful implementation of digital healthcare solutions requires not only access to technology but also a competent workforce capable of effectively utilizing this technology. (Nazeha et al., 2020)

Regarding the importance of this topic, we set out to examine the practical implementation of the digital competence concept. This research was done as a part of broader research project exploring the interconnectedness between digital competence, green competence, and sustainability of healthcare. This article presents our analysis of digital competencies frameworks employed in practice, whether by governmental bodies or private organizations. It does so trough means of temporal distribution, target audience and geographic distribution.

2   What is a digital competence framework?

Digital competence is a highly complex phenomenon that spans various fields and tasks. (Ala-Mutka, 2011) Scientific literature as well as grey literature offer many different definitions for digital competence (Sánchez-Canut et al., 2023), however in this article we adopt the definition proposed by Ferrari et al. that defines digital competence as a "set of knowledge, skills, attitudes, abilities, strategies and awareness that is required when using ICT[1] and digital media." (Ferrari et al., 2012) Two key dimensions which contribute to its complexity are the dynamic nature of the concept across different fields and its evolution over time due to dynamic nature of digital technologies. Moreover, there seems to be a lack of consensus in scientific literature regarding the terminology used, with terms like "digital competence", "digital skills", "digital literacy", and "digital capability" being used interchangeably. (Sánchez-Caballé et al., 2020) For this article, we will use the term "digital competence" as it best depicts the efficiency of performing tasks within a setting that involves digital technologies. We also believe it encompasses all other terms used.

In this article we adopt the definition of a framework as "a repository or a model that identifies, enlists, structures, and organizes competencies into meaningful categories…" (Nazeha et al., 2020). While the original definition includes the condition of being "developed via a systematic methodology or a relevant, established organization", we omit this aspect as we perceive it too vague.

In summary we define digital competence framework for the purpose of this article as a repository or a model that identifies, enlists, structures, and organizes sets of knowledge, skills, attitudes, abilities, strategies, and awareness required when using digital technology into meaningful categories.

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[1] Information communication technologies

3   Methods

The study was conducted in three phases.

The initial phase was literature review. We used Web of Science and Scopus to identify prominent articles on digital competence frameworks. The goal of this phase was to create theoretical foundation and set inclusion and exclusion criteria based on definitions of relevant terms. Included were all findings meeting the definition of framework, as outlined in the theoretical background, irrespective of its form (either presented in a single document or dispersed across a functionally connected website). We included all findings where competence in using digital technologies were covered in at least one part of the framework. Included were only last updates of frameworks. We excluded all frameworks which we found to only exist as scientific articles without practical implementation. We excluded all frameworks which were found to have an updated version or a version overwriting it (as stated either in the framework itself or associated webpage).

In the second phase we utilized Google as primary search engine and Google Scholar as secondary search engine to identify frameworks meeting the defined criteria. We conducted all searches in December 2023. The first round of searches was conducted with queries »digital competencies framework«, »digital competence framework«, »digital skill framework« and »digital literacy framework«. In the second round of searches, we incorporated terms derived from the studied frameworks (e.g., healthcare, teacher, school, employment, sustainability). In the third round of searches, we extended the queries to include names of major countries on which we obtained no data insofar. In the fourth round of searches, we changed search settings to Slovenian, English, German and Croatian language and search region to Slovenia, Switzerland, Austria, Liechtenstein, Germany, Croatia, Bosnia and Herzegovina and Serbia. Results obtained from Serbia were written in Cyrillic script (which the researcher cannot read) and where thus not included in the article. The search continued until no new results were obtained with a rational amount of effort.

The use of mainstream search engines, as opposed to traditional systematic literature identification methodologies, was used intentionally to capture frameworks most likely being actively used in practical contexts.

In the final phase we extracted data trough examination of identified frameworks and their associated websites. Data relevant to our research questions were systematically documented in an Excel spreadsheet.

While we assert the adequacy of our methodology for our intended purpose, we acknowledge two significant limitations. Firstly, relying only on one search engine may yield narrow or biased results. Secondly, the search was limited to languages understood by the researcher performing it (Slovenian, English, German and Croatian), limiting identification of frameworks published in other languages.

4   Results

A total of 70 frameworks were identified spanning different fields, time frames, geographical regions, and other parameters.
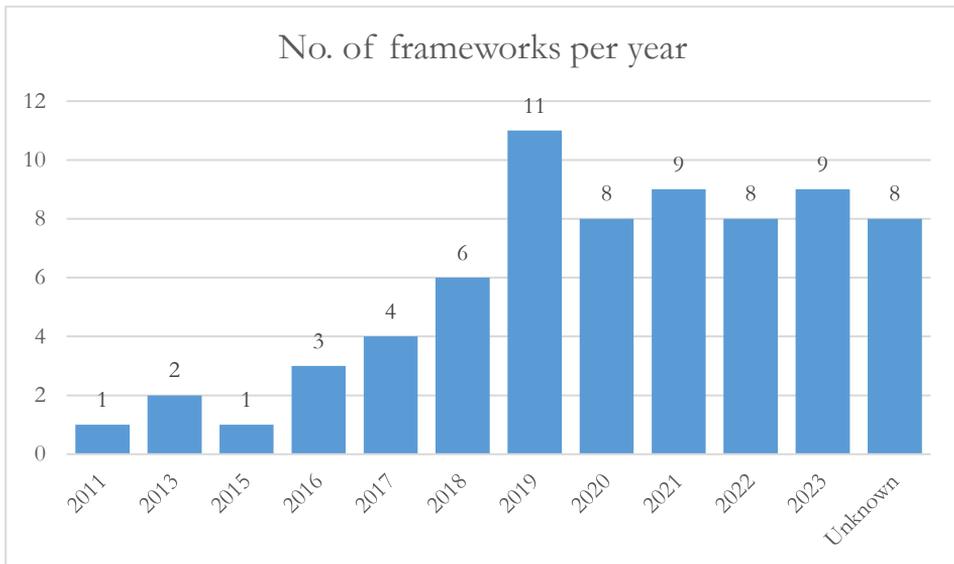
4.1   Temporal distribution

Figure 1: No. of frameworks per year
Source: Own

Figure 1 displays the temporal distribution of identified frameworks, revealing an upward trend with a peak in 2019. Notably we could not obtain data[2] on the last update for 8 frameworks, representing more than 11% of the total sample.

4.2   Target audience

Table 1: Number of frameworks per target group

Education	27
General	21
Healthcare	13
Workforce	3
Accounting	1
Business and technology professionals	1
Mobile phone users	1
Organizations	1
Public sector officials	1
Youth workers	1

Table 1 depicts audience categories for which the frameworks were developed. Larger groupings can be further broken down into smaller, more specific subgroups. For instance, within the group "Education", subgroups include audiences like students, teachers, university staff, curriculum subject specialists, trainers, school leaders etc. Within the group "Healthcare", subgroups include audiences like nursing, caregivers, pharmacy workforce, psychologists, etc.

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[2] A rough estimation could be made for most, but doing this would disrupt the data

4.3   Geographic distribution

Table 2: Number of frameworks per region

NGB[3]		17	Kenya		1
UK		15	Nigeria		1
EU		13	Norway		1
USA		7	Singapore		1
Australia		6	South Africa		1
Canada		3	Switzerland		1
India		1	Tasmania		1
Indonesia		1			

Table 2 illustrates the geographic distribution of the identified frameworks. Many frameworks are not geographically restricted; this includes those that are considered global or those developed by private organizations without a specific regional focus. In the UK, EU, Canada and Australia, frameworks are either general or linked to specific regions. In the UK region specific frameworks are linked to England, Scotland, and Wales. Within the EU, identified region specific frameworks are linked to Slovenia, Croatia, Austria, Ireland, and Spain. In Canada, identified region specific frameworks are linked to Quebec and British Columbia. In the USA, region specific frameworks are affiliated with Baltimore, Maryland, or Seattle. Australia's non region specific frameworks are linked to universities.

5   Discussion

Our analysis shows the global recognition od digital competence as an important present-time topic, aligning with findings from previous studies. (Radovanović et al., 2020) Despite language constraints in our methodology, we linked frameworks to 12 different regions spanning 5 continents. Governments, both at different levels and internally, are implementing digital competence frameworks into their agendas, which is further echoed by private for-profit and non-profit organizations, who implement digital competence frameworks to achieve their organizational goals.

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[3] Not geographically bound

Analysing geographic distribution, the UK government stands out for its active role, for not only has the region been associated with a relatively large number of frameworks in our sample, but a major part of frameworks was issued by governmental bodies or affiliated organizations.

Worth noting is the systematic approach to the implementation of digital competence frameworks within the EU, where on behalf of the European Commission, the Joint Research Centre implemented The Digital Competence Framework for Citizens (DigComp). DigComp aims to establish a common understanding of digital competence. (Vuorikari et al., 2022) While member states are not obligated to implement DigComp, it's use is widespread, as many member states adapt it to suit their specific requirements, due to its comprehensive nature and rigorous methodology. (Carretero et al., 2018) Our analysis revealed nine frameworks from five EU member states. Four of these frameworks, originating from Slovenia (Javrh et al., 2018), Croatia (Žuvić et al., 2016), Austria (BMDW, 2021), and Spain (INTEF, 2017), explicitly reference DigComp as their foundational framework. The EU holds an extensive network of frameworks and digital learning toolkits grounded in DigComp, as articulated in "DigComp into Action". (Carretero et al., 2018) Importantly, the recognition of DigComp as a framework of significant quality is not confined to EU. Several frameworks from regions outside the EU also reference DigComp. (Wedlake et al., 2019) This broad recognition underscores the impact and credibility of DigComp within the field of digital competencies.

The temporal analysis shows that 45 out of 70 frameworks within our sample were released or updated either in 2019 or later. Adding the frameworks of which we could not determine the exact release date, but can be dated after 2019 from cited reference, more than 50% of frameworks within our sample are no older than four years at the time of writing. Some frameworks or their associated web pages state the date of their future revision which additionally shows a general awareness of the dynamic nature of the concept.

From the analysis of target group distribution of our sample "education", "general", "healthcare" and "workforce" emerge as four leading fields of digital competence framework implementation. Standing out is education, suggesting that these frameworks are primarily utilized for the purpose of learning, with educational institutions, particularly schools, being the primary facilitators. This claim is

underscored by the notion that a significant number of frameworks within our sample were introduced by universities.

Our sample delineates healthcare as a second significant area of interest, revealing a recognition of the impact of inefficient digital processes on the healthcare sector. Interestingly, there is a limited diversity of frameworks tailored to specific professions. Despite the dynamic nature of digital competence across different fields, our analysis only identified frameworks specifically designed for accounting professionals, business and technology professionals, public sector officials, and youth workers, besides healthcare. This limited range shows potential gaps in the development of profession-specific digital competence frameworks.

6   Conclusion

In conclusion, our analysis of digital competence framework shows their global recognition and importance in practical settings. It is evident that a diverse range of entities worldwide consider the concept current and vital. Notably, we observed a significant focus on education as a target audience of digital competence frameworks. Our work contributes to the understanding of real-world significance of digital competence, moving beyond theoretical models.

Two major limitations in our research methodology should be noted. Firstly, the reliance on a single search engine, specifically Google, might give biased results. Secondly, the language constrains of our searches conducted in English, Slovenian, Croatian, and German narrow the results which should be extended to a larger set of languages. However, these limitations provide potential possibilities for further research. For instance, incorporating snowballing search strategies on various frameworks and review articles could present a more comprehensive picture.

Our future research will delve into a more detailed analysis of each framework's content. Additionally, a comparative analysis of the components of these frameworks will be conducted. These steps aim to build a comprehensive foundation upon which we aspire to show their relation to green competencies and sustainability.

Acknowledgements

Data availability statement

Full excel spreadsheet including hyperlinks to frameworks and associated webpages is available upon request.

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