DigiReady+:

Integrated Framework for assessing HEIs Digital Readiness based on Institutional and Instructional Data Analytics

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Introduction

1.1 Objective

Digital Readiness can have an immediate and significant impact on the efficiency and effectiveness of organizations, but also, on individual stakeholders' goals. For example, students are required to have strong digital skills (in order words, to be "digitally ready") to perform in technology-enhanced learning academic settings (Kim et al., 2019).

We built upon prior research (Volungevičienė et al., 2021) regarding the state-of-the-art methods and tools for assessing the Digital Readiness of HEIs that indicates the lack of a computational framework for assessing Digital Readiness in the context of Higher Education Institutions (HEIs) .

To address this gap, we aim to propose a set of institutional and instructional computational indicators of Digital Readiness. The contribution of this work is three-fold:

a) to record and investigate in a formal, structured, and systematic way what are the challenges and needs that the stakeholders face within their work contexts, that is within the HEI and from the perspective of Digital Readiness and to align these challenges and needs to existing successful paradigms and solutions, and;

b) to propose data-based indicators of Digital Readiness by synthesizing stakeholders' experience and expertise and data-driven insights from practice

c) to propose a data-informed Conceptual Framework for assessing Digital Readiness of HEIs building on the findings of the state-of-the-art and practical experience of academic stakeholders

1.2 Definitions

• **Digital Readiness** in popular media is used to describe people's preparedness regarding the use of digital tools, mainly focusing on factors such as digital skills, trust in technology, and the extent to which people use digital tools to carry out online – or even, every day – tasks (Horrigan, 2016).

• From the **perspective of organizations**, Digital Readiness reflects the willingness and availability of an organization (for example, and in the context of this work, a Higher Education Institution) to adopt digital technology to transform processes and workflows by enabling them with technology (software and hardware), towards achieving the organization's goals faster and more effectively (Ogbevoen, 2020).

• For **individual stakeholders** – for example, students or teachers – Digital Readiness refers to the stakeholders' technology-related knowledge, skills, competencies, and attitudes for accepting, adopting, and using digital technologies to achieve their goals (Kim et al., 2019).

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Methodology

2.1 Desk review

From February to May 2022, the project team attempted to identify frameworks for the assessment of Digital Readiness, focusing on Higher Education. Related work (Volungevičienė et al., 2021) shows that such frameworks use self-assessment instruments that may rely on subjective views. To address this limitation, we gathered and synthesized insights from such self-assessment instruments for HEI contexts with data-driven digital readiness indexes, typically used to assess digital readiness at national levels. To do so, we conducted a desk review of published and grey literature on the two levels (self-assessment frameworks for HEIs and data-driven readiness indexes).

Step 1: We buit on the report of Volungevičienė et al. (2021) that documents **instruments for assessing digitally enhanced learning and teaching in HEIs**, which we enriched with a complementary literature review

Step 2: We conducted a literature search for **data-driven Digital Readiness indexes and computational instruments** for assessing Digital Readiness specifically in educational contexts. However, we were not able to find related work on such instruments. Consequently, we extended our search to data-driven Digital Readiness indexes **beyond the scope of learning**, with the following inclusion criteria:

- *The index (or parts of the index) should be calculated based on metrics from collected data and from various data sources.*

- *The index should focus on Digital Readiness or aspects of Digital Readiness.*

- *The index should be followed by a publicly available methodological report, and a description of the data and the metrics*
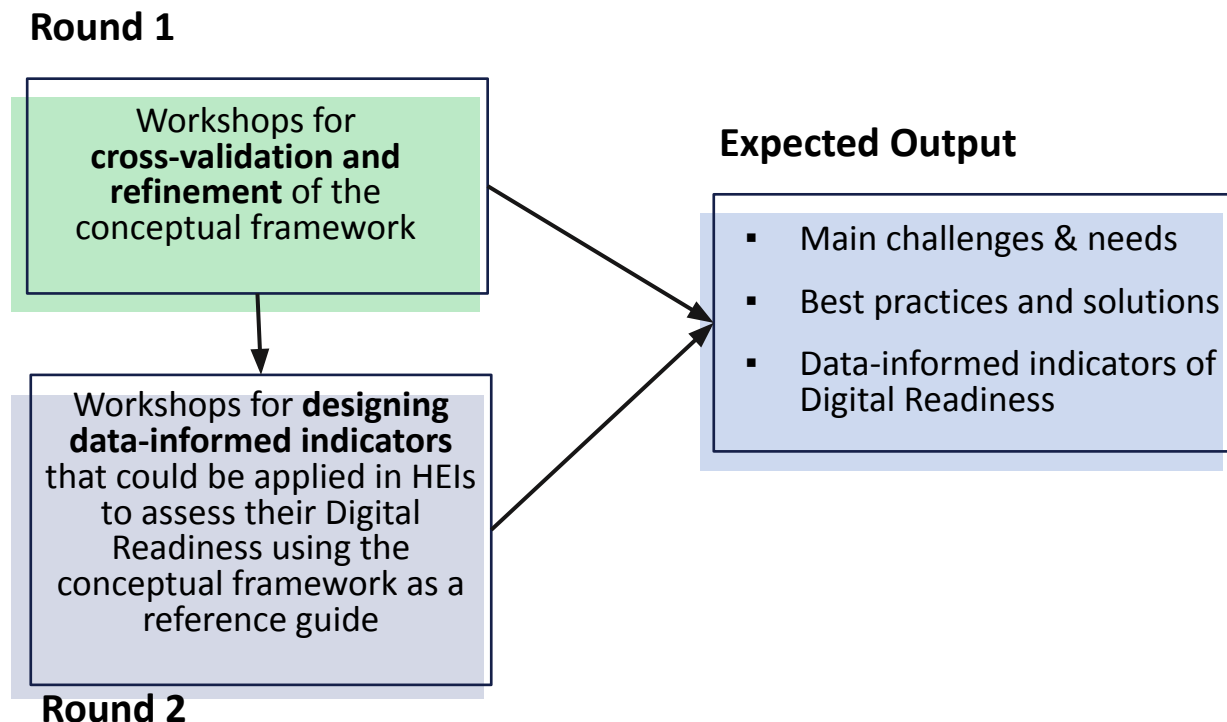
Step 3: We reviewed **four data-driven Digital Readiness indexes** that aim to measure Digital Readiness on national levels and related our findings to Digital Readiness indicators for HEIs, as derived from Step 1.

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2.2 Participatory design workshops

This task focuses on designing and developing a list of institutional and instructional computational indicators of Digital Readiness using a participatory design approach.

- Participatory design: a methodological approach that aims to involve stakeholders in the design of an artifact to ensure that the final outcome will reflect stakeholders' requirements and perceptions and that it will satisfy the stakeholder's needs (Kensing & Blomberg, 1998; Muller & Kuhn, 1993).

- Stakeholders: institutional policymakers and strategic planners, government, administration, technical and teaching staff of HEIs.

- Co-design Artifact: list of institutional and instructional computational indicators for assessing HEIs Digital Readiness

- Overall Goal: Refine and cross-validate the conceptual framework we established from the literature review

Given the objectives, we conducted a series of participatory workshops for each academic partner (UDE, UPAT and UVa) with stakeholders from the respective HEIs in two rounds:

Round 1

Workshops for **cross-validation and refinement** of the conceptual framework

Workshops for **designing data-informed indicators** that could be applied in HEIs to assess their Digital Readiness using the conceptual framework as a reference guide

Round 2

Expected Output

- Main challenges & needs

- Best practices and solutions

- Data-informed indicators of Digital Readiness

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2.3 Participants

To recruit participants for the workshops, we communicated a call for participation via the communication channels of the involved academic partners (respective websites, mailing lists and personal invitations), and via the project's website. Recruited participants attended both rounds, apart from some exceptions of stakeholders who could not be present in the second round. Participants were asked to provide consent for participating in the workshops where we clarified that their input would be anonymized

Our goal was to gather a diverse group of academic stakeholders who would be able to offer complementary – and potentially, contradicting – perspectives regarding the assessment of Digital Readiness and digital transformation of HEIs. To that end, we focused on involving at least one stakeholder from each of the following roles: HEI governance & policy-making, administration, technical staff, lecturers and curriculum developers. The recruited participants per academic institution are presented in Table 1.

2.4 Data Collection

From the two rounds of workshops, we collected a rich dataset of artifacts: observations, note-taking, transcripts of discussion, and affinity diagrams.

2.5 Validation of the framework and list of data-informed indicators

To validate the conceptual framework and the complementary list of data-informed indicators, we organized an interactive, group activity with participants from various academic institutions during the First Multiplier Event of the project . For this activity, we designed a closed card-sorting exercise where a subset of data-driven indicators was given to participants in the form of cards. Then, we asked participants to classify the indicators as "relevant' or "not relevant" for assessing Digital Readiness. Additionally, we asked participants to take notes on the cards themselves regarding their interpretation of the indicator, the feasibility of implementation and their applicability to their academic organization.
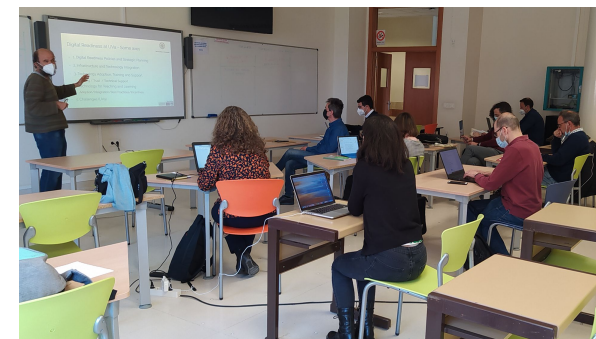
Table 1. Recruited workshop participants per role and academic institution

	UDE	UPAT	UVa
Governance	1	2	3
Administration	1	1	
Technical staff	1	2	3
Lecturers and Curriculum Developers	2	5	4
Total	5	10	10

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03
Results

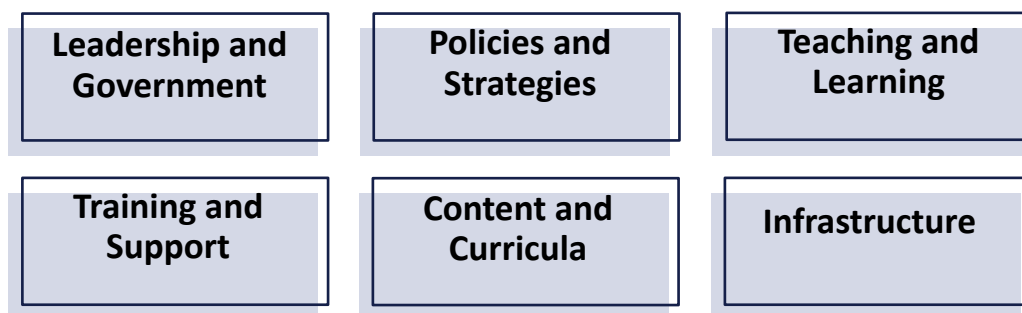### 3.1.1 Digital readiness frameworks for Higher Education Institutions

Using the work of Volungevičienė et al. as a basis, we conducted a meta-review of these 20 instruments. The objective of the meta-review was to identify which instruments could be used directly – or with minor adaptations – to assess the Digital Readiness of European HEIs. As such, **the instrument should satisfy the following criteria**:

C1: The instrument should offer assessments or insights regarding HEI's Digital Readiness

C2: The instrument should be HEI-specific

C3: The instrument should address multiple stakeholders and roles within the HEI and have a wide focus in terms of assessment. The stakeholders' target group should include HEI governance, administration, faculty (professors/lecturers), curriculum developers, and staff (e.g., technical staff). In terms of assessment, the focus should extend over various areas that may affect Digital Readiness, from teaching and learning to digital education policies and technical infrastructure and support

C4: The instrument and the produced evaluation results should be openly and freely accessible and in a language that can be used by the HEIs

C5: The instrument should be tested, in similar contexts or structures as the ones applying to the HEI and provide practical evidence

After the meta-analysis, we identified 4 most relevant and appropriate instruments:

- COL's Benchmarking Toolkit for Technology-Enabled Learning *(Sankey & Mishra, 2019)*
- The European Framework for Digitally Competent Educational Organisations (DigCompOrg) *(Kampylis et al., 2015)*
- The E-xcellence manual: Quality Assessment for E-learning *(Kear et al., 2016)*
- The Jisc guide for Developing organizational approaches to digital capability *(Clare Killen et al., 2017)*

Next, we juxtaposed the four instruments regarding the **assessment dimensions for digitalization** and we identified six dimensions that overlapped between the different instruments:

Leadership and Government	**Policies and Strategies**	**Teaching and Learning**
Training and Support	**Content and Curricula**	**Infrastructure**

In brief: HEIs should consider aspects regarding the involvement and initiative of the HEIs leadership in digitalization efforts, the development of strategies and policies especially in terms of introducing and integrating digital technologies, the investment in digital infrastructure, stakeholders' training and support and digitization of content and, in promoting the acquisition and life-long training of digital competencies of teachers and learners.

3.1.2 Complementary literature on frameworks for assessing Digital Readiness

An alternative approach for addressing aspects of readiness is taken by **HEInnovate** - a tool that implements both a framework and a self-assessment tool with the aim to promote innovation in Higher Education on eight dimensions which look at the different key aspects of HEIs as organizations. These eight dimensions namely are: Leadership & Governance, Organisational Capacity: Funding, People & Incentives, Entrepreneurial Teaching & Learning, Preparing & Supporting Entrepreneurs, Digital Transformation & Capability, Knowledge Exchange & Collaboration, The Internationalised Institution, and Measuring Impact (Hofer & Kaffka, 2018). We acknowledge that primarily the focus of HEInnovate is to promote innovation and some dimensions are oriented towards entrepreneurship which is not relevant for this project. However, we consider concepts such as **collaboration and internationalization**, to be **critical for assessing Digital Readiness** and therefore, should potentially be included to achieve a holistic assessment. At the same time, Digital Readiness can be perceived as an innovation for certain HEIs and therefore the assessment of organizations' capability to embrace innovation could be relevant.

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3.2 Data-driven readiness indexes for assessing digitalization

The Index of Digital Readiness for Lifelong Learning (IDRLL) *(Beblavy et al., 2019)*	▪ IDRLL aims to depict the situation of digital learning in European countries quantitatively
Digital Economy and Society Index (DESI) *(2022)*	▪ DESI resulted as a European Commission initiative for monitoring and assessing the digital progress of its member states and aims to evaluate key digital areas and to identify actions for policy decision-making.
Cisco global Digital Readiness index (CISCO DRI) *(2021)*	▪ CISCO DRI aims to model the Digital Readiness of a country, taking into account aspects beyond the adoption, integration, and use of technology. The rationale is that for a country to take advantage of digital opportunities, it should have established a quality of life and to accommodate the basic needs of citizens/residents
Network Readiness Index (NRI) *(2021)*	▪ NRI aims to demonstrate how countries around the world are leveraging technology (with a focus on information technologies) aiming to support digital transformation

Among the indicators implemented in these indexes, **common thematic areas** can be established that could support the assessment of Digital Readiness of HEIs:

Humans Factors	**Digital Usage and Adoption**	**Business and Finance**	**Goals and Outcomes**
Indicators that relate to human needs, well-being, attitudes, and skills, e.g., internet user skills, digital skills or participation and attitude towards digitalization.	Indicators that relate to the adoption and use of digital technologies in sectors of everyday life, e.g., metrics of internet usage, broadband coverage, availability of resources, connectivity.	Indicators that aim to assess business and financial aspects of Digital Readiness, either referring to investments for supporting digitalization or the impact of Digital Readiness on business and investments.	Indicators that assess the impact of Digital Readiness on goals or outcomes, e.g., the IDRLL focuses on learning outcomes while the NRI focuses on sustainable development goals, such as quality health being and quality education.

3.3 Round 1: Cross-validation of the conceptual framework for assessing HEIs Digital Readiness

To analyze the affinity diagrams created during the first round of workshops, the researchers who facilitated these workshops collected and recorded the notes for each diagram, and they mapped them to the respective dimension of Digital Readiness (as defined in 3.1.1).

In total, the participants produced 255 statements over the 6 dimensions of the conceptual framework. Next, we normalized the number of statements to take into account the number of participants per workshop. This was deemed necessary since the workshops conducted by UPAT and UVa had double the amount of participants than UDE. The distribution (simple and normalized) of the participants' statements per academic institution and dimension is presented in Figure 1.
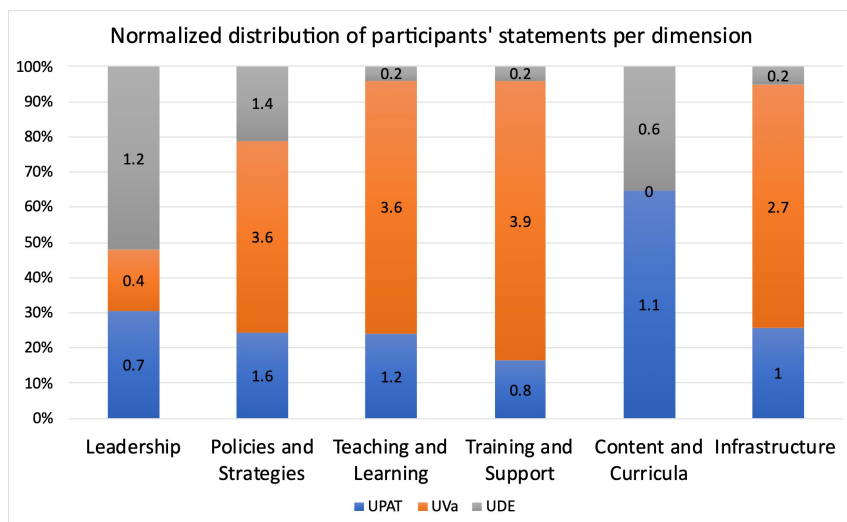

Figure 1. Distribution of participants' statements per dimension of the conceptual framework. Each statement represents one note of the affinity diagram created during Round 1 workshops.

The participants' input is suggestive of the institutions' focus and direction regarding digitalization. All institutions perceive the dimensions derived from literature as fundamental and central for the assessment of digital readiness:

- The three HEIs typically adopt actions such as establishing policies or strategic plans, launching training and support events or investing in technologies and infrastructure. One HEI (UVa) reported they have established an evaluation plan of Digital Readiness and provide incentives to support digital transformation
- The roles involved in decision-making are common between the three institutions and include HEI Government, ICT teams and potentially faculty/instructor One HEI (UDE) pointed out that the decentralized structure of the organization occasionally allows for other roles, such as university boards and services, to participate in decision-making.
- Communication of digital-readiness initiatives is typically top-down and initiated by the HEIs leadership. Common communication channels include email announcements or press releases.
- Some statements could not be grouped in any of the given dimensions. The participants indicated the need for introducing additional dimensions to provide holistic assessments of Digital Readiness over different institutions. Therefore, one additional dimension was introduced: **Research, Networks and Alliances**. This dimension aims to capture aspects that relate to communication and dissemination as well as sharing of resources and planning between institutions, collaboration initiatives and umbrella-actions.

3.4 Round 2: Designing data-informed indicators for assessing Digital Readiness of HEIs

The second round of workshops focused on delivering a list of data-informed indicators for assessing Digital Readiness in HEIs. Participants used the conceptual framework for the assessment of Digital Readiness as an underlying structure for enabling brainstorming and mapped data-informed indicators to dimensions of Digital Readiness.

The affinity diagram and brainstorming activity resulted in 202 participants' statements that proposed conceptual data-informed measures for assessing Digital Readiness. As in section 3.3, we normalized the number of participants' statements per institution to take into account the number of participants in each workshop.

The results reflect, to some extent, the different priorities institutions set in terms of Digital Readiness and that were pointed out during the first round of workshops and what data the participants believed can be collected from existing platforms or databases and consequently be useful for assessing digital readiness.
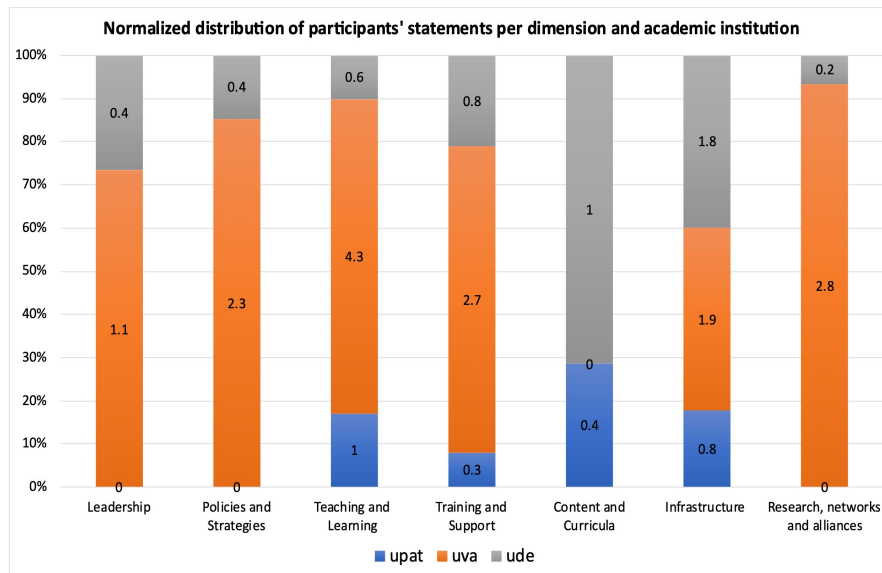

Figure 2. Distribution of participants' statements per dimension of the conceptual framework. Each statement represents one note of the affinity diagram created during Round 2 workshops. . For the normalization, we calculated the ratio of participants' statements per number of workshop participants

3.5 Validation of the framework and the list of data-informed indicators of Digital Readiness

During the First Multiplier Event, organized at the University of Duisburg-Essen in October 2022 , we had the opportunity to present the Conceptual Framework to stakeholders from European HEIs and to conduct an interactive activity that aimed to validate the proposed approach. From this activity, we collected participants' input regarding the value of data-informed indicators as proxies for assessing Digital Readiness, and comments regarding the naming of the indicators, their feasibility and applicability.

Based on this input, we further refined the framework and the list of indicators. In brief: some of the indicators were eliminated due to the unanimous agreement of stakeholders regarding their value, some indicators were re-formulated to increase their interpretability. Finally, participants indicated that the seven core dimensions of the framework are consistent across different educational organizations and are able to provide a holistic picture of the state of an organization in terms of Digital Readiness.

3.6 A Conceptual Framework for Assessing Digital Readiness of Higher Education Institutions using Institutional and Instructional Data Analytics
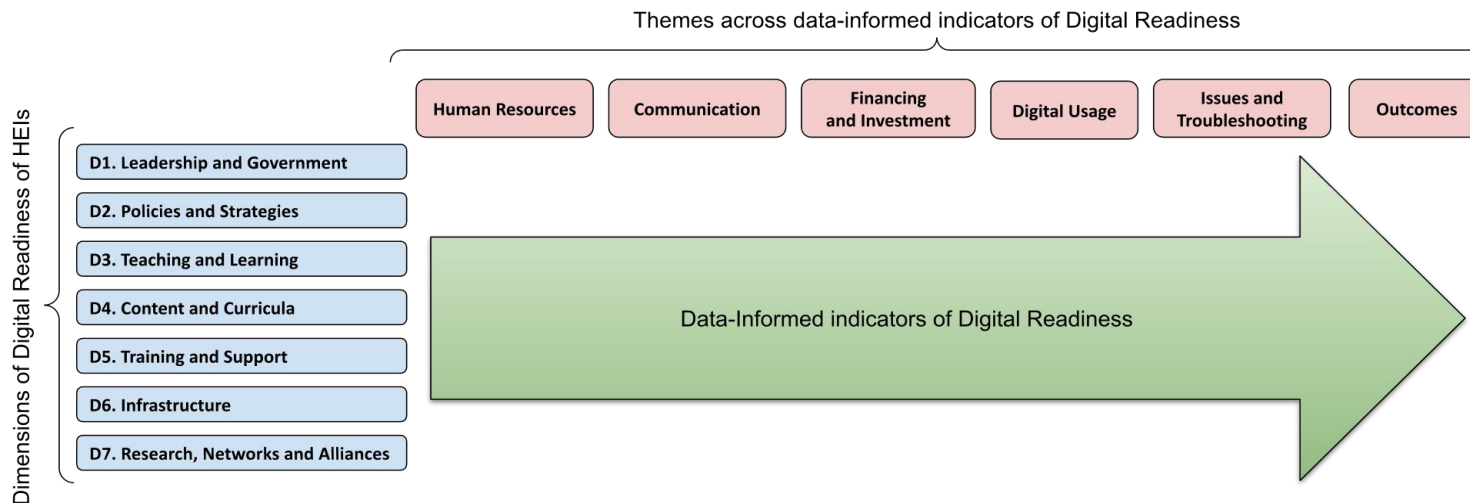

Figure 6. A diagrammatic representation of the Conceptual DigiReady+ Framework. The vertical level represents the seven core dimensions of Digital Readiness of HEIs and the horizontal level represents the measurable themes across data-informed indicators of Digital Readiness.

Our overarching goal was to propose an data-informed Conceptual Framework for assessing Digital Readiness of HEIs building on the findings of the state-of-the-art and practical experience of academic stakeholders. To achieve our goal, we synthesized the findings of the literature review and the findings of the participatory design workshops we conducted. To further refine and validate our framework, we invited external stakeholders (that is, stakeholders who had not been engaged at any other point of our research) to review our framework and list of data-informed indicators through an interactive activity. Their feedback was used to further refine our output, as described in section 3.3.

We propose a 2-level, vertical integrated framework for assessing the Digital Readiness of HEIs:

a) one level that reflects the organizational structure of HEIs and that includes the seven dimensions of: Leadership and Governance, Policies and Strategies, Teaching and Learning, Training and Support, Content and Curricula, Infrastructure, and Research, Networks and Alliances. This level addresses what organizational sectors or organizational structures and processes one should consider when assessing the Digital Readiness of a HEI. In other words, "what to measure";

b) a second, horizontal level that reflects the "measurable" themes of data-informed indicators of Digital Readiness that can be found transversely across the dimensions of the first level.

These themes are: Human Resources, Communication, Financing, Digital Usage, Issues and Troubleshooting, Outcomes. This level addresses what are the aspects that can provide insights regarding Digital Readiness in a HEI. In other words, "*how to measure*". A diagrammatic representation of the 2-level framework is presented in Figure 6.

The DigiReady+ Data-driven Framework for Assessing Digital Readiness in HEIs with examples of data-informed indicators is published and can be accessed online at: https://digiready.eu/wp-content/uploads/2022/10/DigiReady-Framework-and-List-of-Indicators.pdf

04
Conclusions

To summarize our findings and contributions, we established the following points:

- We proposed a Conceptual Framework for Assessing Digital Readiness of Higher Education Institutions that assesses Digital Readiness on seven dimensions: 1) Leadership and Governance, 2) Policies and Strategies, 3) Teaching and Learning, 4) Content and Curricula, 5) Training and Support, 6) Infrastructure, 7) Research, Networks and Alliances. We argue that these dimensions reflect the organizational structure of HEIs.

- We delivered a list of 72 data-informed indicators of Digital Readiness. These indicators aim to reflect aspects of Digital Readiness that can be mapped and measured using data sources of modern HEIs, such as Learning Management Systems and Study Information Systems.

- We identified six themes of "measurable" aspects of Digital Readiness deriving from the thematic analysis of the 72 data-informed indicators. These themes are: Human Resources, Communication, Financing, Digital Usage, Issues and Troubleshooting, Outcomes..

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