UDReady: a Data – Driven Platform Measuring Digital Readiness of Higher Education Institutions[*]

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Abstract

The rapidly evolving landscape of Higher Education and the increased demands of our digital society make it imperative for Higher Education Institutions to adopt mechanisms for assessing their Digital Readiness levels. Towards this direction, within the DigiReady+ project, a data-driven framework for the measurement of Digital Readiness in Higher Education has been proposed. In this paper, we present the UDReady platform, an information system that is based on the proposed framework and allows Higher Education Institutions to assess their Digital Readiness based on data available from their heterogeneous information systems.

1 Introduction

During the last years, Higher Education has been a highly impacted sector in terms of increased technological, administrative, and organizational demands, due to several societal changes. For example, during and after the pandemic period, there has been a need for a hybrid learning model, where learning takes place either or both on-site and remotely (Turnbull, D., Chugh, R. & Luck, J., 2021). On the other hand, technological advancements such as those in the field of Artificial Intelligence, provide an opportunity for Higher Education Institutions (HEIs) to reshape and evolve their academic and administrative processes, promoting their strategic transformation (George, B., & Wooden, O., 2023). Moreover, the globalized economy has driven significant transformations within the socio-economic-

education system, particularly in the realm of higher education. These shifts have manifested in various ways, including improvements in educational standards and quality, the decentralization of educational systems, and an increased emphasis on virtual and autonomous learning. These fast-paced changes are drivers requiring HEIs to integrate digital transformation capabilities and follow a digital strategy that will ensure sustainable education management and will allow them to develop and retain competitive advantages (Mohamed Hashim, M. A., Tlemsani, I., & Matthews, R., 2022).

In this evolving landscape, the concept of Digital Readiness, that reflects the willingness and availability of an organization (i.e. the HEI) to adopt digital technology to transform processes and workflows, towards achieving the organization's goals faster and more effectively (Ogbevoen, 2020), (ALZHANOVA, F. G., Kireyeva, A. A., SATPAYEVA, Z. T., TSOY, A. A., & NURBATSIN, A., 2020), (Walczuch, R., Lemmink, J., & Streukens, S., 2007), is a crucial measure of the degree in which the HEI is ready to adapt to the above-mentioned challenges.

The DigiReady+ (DR+) Framework[†] of assessment of Digital Readiness (Gari, C. M., Chounta, I. A., Avouris, N., Daskalaki, S., Dimitriadis, Y., Dorner, H., ... & Yiannoutsou, N., 2022) aims to support Higher Education Institutions in measuring their *Digital Readiness (DR)*, in improving the quality of education and supporting the needs of students, faculty, and staff. Key innovative aspect of this framework is that it is data driven. Most of existing frameworks are implemented in the form of self-assessment questionnaires, that have a strong subjective character. However, a side effect of digital transformation is that a growing amount of data is collected, related to teaching and learning activities. This is because interactions between learners and between learners and tutors take place more and more through digital media, thus generating traces, while more teaching and instructional content is in digital form and learners' interactions with it are logged. Leveraging on these data for understanding the process and measuring performance has increased the potential of the field of learning and institutional analytics. This is the main objective of the DigiReady+ Framework.

According to this framework, the institution's Digital Readiness can be measured through the following seven dimensions:

- *D1. Digital leadership & government*: Firm Leadership and Government related to digital issues.

- *D2. Digital strategy & policies*: Widely communicated Policies and Strategies within the institution.

- *D3. Teaching & Learning*: Wide use of innovative digital technologies in Teaching and Learning

- *D4. Digital Content & Curricula*: Rich Digital Content and presence of digital skills and competences in curricula.

- *D5. Training & Support*: Provision of digital Training and Support to stakeholders.

- *D6. Infrastructure*: Widely available, adequate, up-to-date, Digital Infrastructure.

- *D7. Networks & collaboration*: Participation in Research, Networks and Alliances to improve digital competency and capacity.

Each one of these dimensions can be measured through measurable indicators that are grouped in topics. The proposed topics and indicators have been defined by workshops organized in three European universities, with the participation of key stakeholders. As an example, we could mention an indicator of dimension D3 (Teaching & Learning) such as D3.2 (Digital courses offerings), which measures the proportion of courses offered in an online or blended format. Two data sources (data points) are needed for the calculation of this metric: a) the number of all active courses of the HEI and b) the number of courses offered in an online or blended format. Furthermore, as discussed in (Tsimpanis, K., Avouris,

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[†] https://digiready.eu/

N., Chounta, I. A., Daskalaki, S., Dimitriadis, Y., Gari, C. M., ... & Balaouras, P., 2023), the feasibility of the data-driven framework DigiReady+ for assessing the digital readiness in HEIs, project, in the case of the European universities involved (University of Patras, GR, University of Valladolid, ES, University of Duisburg-Esssen, DE) was shown.

In this paper, we build on these findings, and we proceed with presenting the design and implementation of a platform used to measure Digital Readiness of HEIs, based and implementing the proposed DigiReady+ framework.

2   The DigiReady+ Framework

The DigiReady+ (full title: *Digital Readiness in European Higher Education Institutions: a Data-driven Framework Guided by Institutional and Instructional Analytics*) project (Gari, C. M., Chounta, I. A., Avouris, N., Daskalaki, S., Dimitriadis, Y., Dorner, H., ... & Yiannoutsou, N., 2022) is a European project, involving five partners from four countries, including three Universities.

Once the DR+ framework for measuring digital readiness has been defined and examples for assessing its indicators were produced, the next phase involved design and development of a web platform to implement and instrument this framework. The main concept and key requirements of this platform is discussed here, while in the next section we provide a more detailed description of its current implementation.

The DR+ platform is a web system, in the form of an institutional dashboard of digital readiness, to be used by HEI's stakeholders (e.g. policymakers, administration councils, faculty, and degree committees) to provide information regarding potential issues and risks in the process of designing from scratch or adapting existing curricula to meet the needs of transitioning to digitally enhanced learning and teaching. Thus, institutional stakeholders will be able to follow an evidence-based structured approach regarding the assessment of digital readiness and take the most appropriate decisions.

The Open-source and flexible nature of the web platform and the related Application Programming Interfaces (APIs) provided by the project will allow, if necessary, the interested HEIs to further expand and customize the use of the framework and the associated analytics to their own needs and special conditions, increasing chances of a sustainable adoption and a significant impact on the HEI practices.

A related component of the architecture should involve a Knowledge Repository that will enable all stakeholders to take advantage of best practices, training materials, datasets, etc. developed throughout the project. It will also allow stakeholders of the participating organizations and other interested HEIs to further enrich such knowledge based on the use of the framework and the associated set of indicators and the provided toolkit in new scenarios.

In summary, the design of the DigiReady+ platform was guided by the following requirements:

- The framework should be communicated to the users (stakeholders) using their language. For this reason, the UDReady platform was designed to be multilingual and as shown in the following sections, there is a special part of it (DR+ Catalog) providing a human-readable description of the framework.

- The dimensions should be uniformly populated with indicators.

- There should be a logical structure in the indicators and grouping of indicators in topics. This requirement led the design of several screens of the platform (e.g. DR+ Catalog and DR+ Campaigns).

- Each dimension and indicator should be presented through a short description. Users can inspect these descriptions from the DR+ Catalog part of the platform.

- Graphical presentations should be included to create a more visual impact. Later, we show the graphical elements that were adopted in the DR+ scoreboard, aiming at improving the visual interaction with the user.

- Each indicator should be abstract enough to be applicable in any higher education institution, however it should refer to possible alternative metrics (data points) that can serve the purpose of measuring the indicator in different HEIs.

The result of the framework design process currently has led to a set of 72 indicators, which are distributed to the seven dimensions (D1-D7) that were presented in the Introduction section and within each dimension, the indicators to be measured are grouped in topics. Each indicator consists of one or more data points (value points from a specific data source) and a formula that computes the indicator's value from the data points values. Examples of the indicators used to measure digital readiness were presented in (Tsimpanis, K., Avouris, N., Chounta, I. A., Daskalaki, S., Dimitriadis, Y., Gari, C. M., ... & Balaouras, P., 2023).

The DigiReady+ Framework defines an algorithm for the calculation of:

- The DR total score for an institution, which is defined as the weighted sum of the scores of the seven DR dimensions.

- The DR score of each dimension, which is defined as the weighted sum of the scores of the topics of the dimension.

- The DR score of each topic, which is defined as the weighted sum of the values of the topic's indicators.

The algorithm, which is implemented in the DigiReady+ platform is presented in Figure 1.

DR Total Score Calculation

$$DR_{\text{Total Score}} = \frac{\sum_{n=1}^{7} VDiWi}{\sum_{n=1}^{7} Wi}$$

$$VDi = \frac{\sum_{n=1}^{topics} VtopicWtopic}{\sum_{n=1}^{topics} Wtopic}$$

$$Vtopic = \frac{\sum_{n=1}^{indicators} VDi, indicatorWDi, indicator}{\sum_{n=1}^{topics} WDi, indicator}$$

Figure 1. The algorithm for the computation of the Digital Readiness (DR) score

3 Design and Development of the UDReady Platform

3.1 Methodology

The DR+ framework and UDReady platform design followed a User-Centered Design approach (Mao, J. Y., Vredenburg, K., Smith, P. W., & Carey, T., 2005). We actively involved users, i.e., several

groups of stakeholders that participated in activities related to design and development of both the framework and the information system: policymakers, leaders, instructors, curriculum developers, students, and ICT administrators.

Regarding the design and implementation of the web platform that instruments and supports the DigiReady+ Framework, the participants were involved in activities that include a simulated assessment of the digital readiness of a hypothetical university. The university's digital readiness was presented through a Scoreboard that displayed both the overall Digital Readiness score and the scores specific to each dimension, as well as the indicators that were related.

The participants engaged in a thorough analysis of the visual representation, carefully examining the scores, and identifying weaknesses of the institution. Through the process of extracting insights from the obtained scores, the participants were engaged in a collaborative effort to formulate five *Recommendation Statements* that better described the digital readiness of the hypothetical university.

Moreover, several other iterative design activities for the actual DigiReady+ tool took place resulting in a design that meets the key requirements, typical scenarios of use, typical user profiles, interfaces to the backend of information systems (through an API) and to a Knowledge Repository. Finally, this iterative process resulted in transforming the initial UI mockups into implemented User Interfaces, presented next.

The result of the above-described process is a web platform called *UDReady* (University Digitally Ready) that implements the required functionalities for the measurement of HEIs' Digital Readiness, that is described in the next section.

3.2   Conceptual Design of the UDReady Platform

The involved stakeholders and the main conceptual principles of the platform are shown in Figure 2. The main concept is that data from several sources are fed into the web platform and the DR+ tool processes them and calculates the Digital Readiness score according to the formulas defined by the DigiReady+ Framework. Reports including visual representations help decision makers assess the Digital Readiness level of the institution, while recommended documents from a knowledge repository help them consider actions that could improve the institutions' digital readiness. From a technical perspective, the architecture of the platform was already proposed and discussed in (Tsimpanis, K., Avouris, N., Chounta, I. A., Daskalaki, S., Dimitriadis, Y., Gari, C. M., ... & Balaouras, P., 2023)
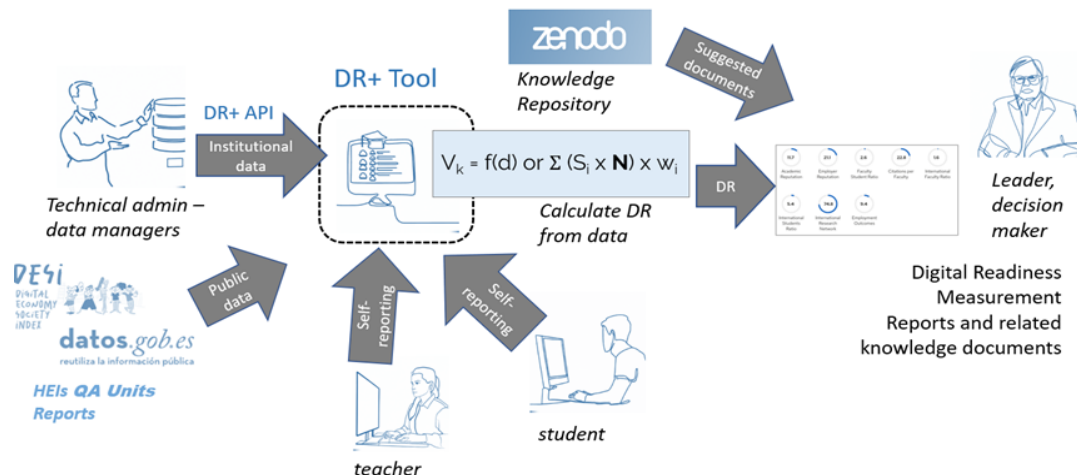

Figure 2. Conceptual Design of the UDReady Platform

The UDReady platform consists of the following modules:

- DigiReady+ Indicators Catalogue, Weights, and Digital Readiness Measurement Algorithm.

- DigiReady+ Campaigns (including an API to access Data Sources), i.e. tools for collecting data to be used by the DR measurement algorithm.

- DigiReady+ Scoreboard, Reports and Recommendations, that present the results of the algorithm to typical users, along with relevant recommendations.

- DigiReady+ Admin Tool (Users, Roles, HEIs, Settings, etc.)

These modules are available to the users from the home page of the tool (Figure 3). The main functionality of these modules is described in the following sections.
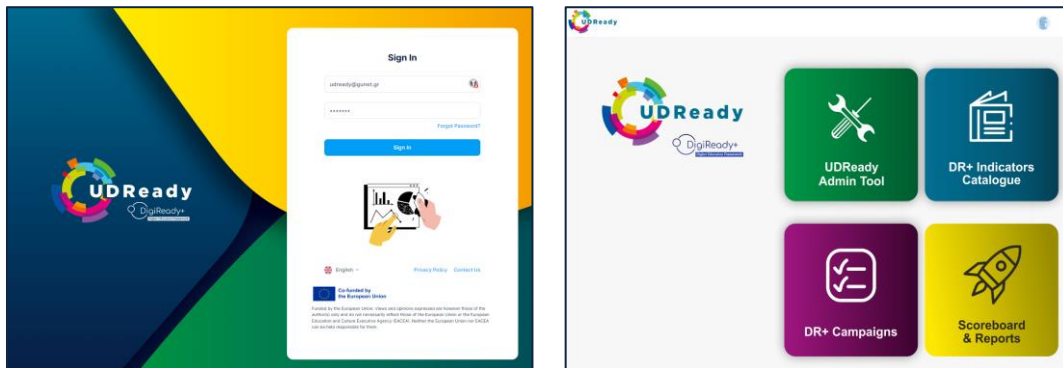
Figure 3. The landing and home screens of the UDReady Platform

3.3 UDReady Admin Tool

The UDReady Admin Tool allows the administrators to perform tasks related to the management of the platform, such as:

- User management (users' creation, users' deactivation, password management etc.)

- Role assignment (assigning or removing roles to existing users)

- Organizations / Institutions management (list of institutions, basic info, reports and scores, option to add a new institution, etc.)

- Settings and framework management (setup campaigns, adding a new framework version, modifying active version, algorithms, weights, general settings)

In the framework management tool administrators can import new or modify existing versions of the DR+ framework and declare the active ones. It should be mentioned that framework characteristics may be modified per university or case, as this approach is not aimed at comparing universities, but rather at helping individual universities assess their state and receive recommendations for actions, so the specific characteristics of the institution can be adjusted accordingly.

3.4   DR+ Indicators Catalogue

The DR+ Indicators Catalogue is the reference point including all selected indicators that were identified from the DR+ framework stakeholders as crucial to higher education institutions' digital readiness. The catalogue provides the list of indicators organized per DR topic and dimension (as shown in Figure 4), along with their description, instructions on the necessary data sources and the formulas to calculate their values. Since each indicator contributes differently to the respective dimension's DR score, the weights for each indicator are also presented in the DR+ Indicators Catalogue. Users are also able to access information regarding other existing framework versions.
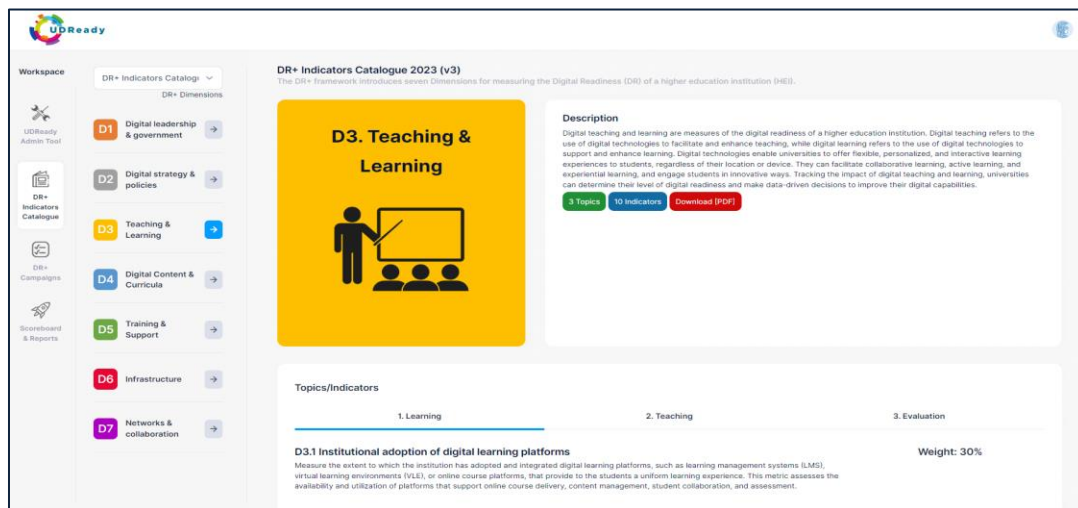
Figure 4. The DR+ Indicators Catalogue, showing information about dimension D3 and its indicators

3.5   DR+ Campaign Tool

The DR+ Campaign Tool (Figure 5) is the core component of the UDReady platform. It allows the setup and execution of campaigns that, based on the DigiReady+ Framework, take advantage of an institution's available data sources to measure individual indicators.

The DR+ Campaign Tool provides a wizard-like form that embraces a multiple step-by-step approach, allowing authorized users, called University Managers, to navigate through each data point associated with the campaign's digital readiness indicators. This wizard provides them with the flexibility to choose between manual data entry or automated collection methods for each data point. This is necessary, since HEIs usually adopt several heterogeneous information systems hosting their data and sometimes these data are only available from handmade reports.

For manual entry, a user-friendly interface allows the administrator to input the required values directly into the platform. This option is ideal for data points that are best captured through human observation or specific qualitative assessments.

Alternatively, for data points that can be automatically collected, the wizard prompts the administrator to define the data source and method (Figure 6). Whether through CSV files, REST APIs, or third-party databases, the tool accommodates a variety of remote data sources. In this step, the administrator configures the necessary parameters, such as API endpoints, database connections, or file paths, along with their specific parameters (e.g., usernames, encoding types) ensuring a seamless and standardized approach to automated data retrieval. From a technological perspective, the data retrieval configuration for each data point is stored in the database as the set of the necessary parameters for the

communication with the respective data source and the retrieval of the point's value. When the campaign is executed, the platform uses this configuration to connect to the defined data sources and retrieve the desired values. In this way, the platform can receive as input all necessary data that needs to be processed.
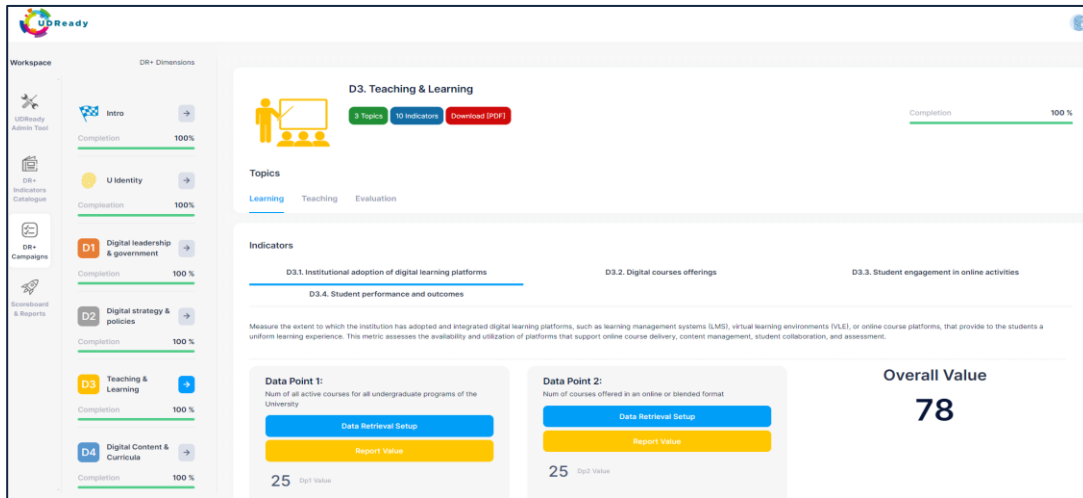

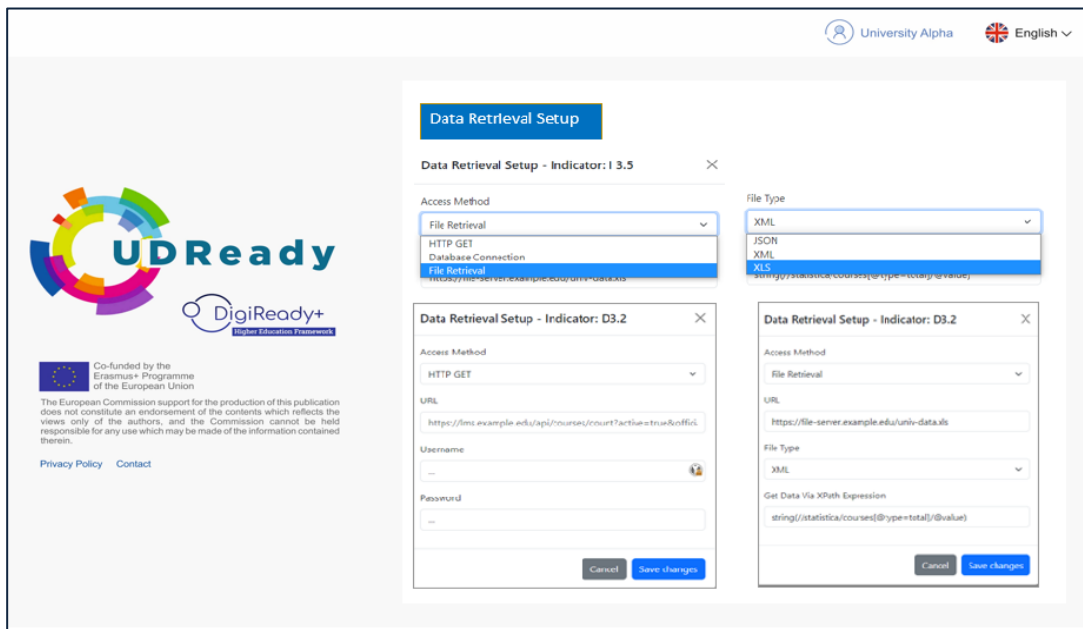**Figure 5. Screenshot from a running Digital Readiness Campaign**

Figure 6. UDReady automated data collection wizard

Furthermore, the tool provides clear guidance and validation checks, ensuring that the entered or configured data values adhere to specified formats and requirements. The wizard also allows for the

review and modification of configurations before finalizing the setup, promoting accuracy and completeness. Once the configuration is complete, the tool actively manages the collection of data values during the campaign, executing the defined methods to gather information from the designated sources. This automated process minimizes manual intervention, reducing the likelihood of errors and ensuring a more efficient and consistent data collection mechanism.

In summary, the wizard-like tool serves as a versatile and user-centric solution for configuring, managing, and collecting digital readiness indicators. Its intuitive interface, coupled with the flexibility to choose between manual and automated methods, empowers University Managers to tailor data collection strategies to the unique needs of each campaign, thereby enhancing the accuracy and efficiency of the overall process.

3.6   DR+ Scoreboard & Reports

The Scoreboard & Reports module allows involved members of HEIs to review the campaigns' results, assess their digital readiness and identify their strengths and weaknesses. As shown in Figure 7, the scoreboard page consists of two parts: the first part is a visual representation of the DR+ Score, while the second part is the analysis of DR scores per dimension. Moreover, users can access a detailed report regarding the DR score for each one of the seven dimensions.
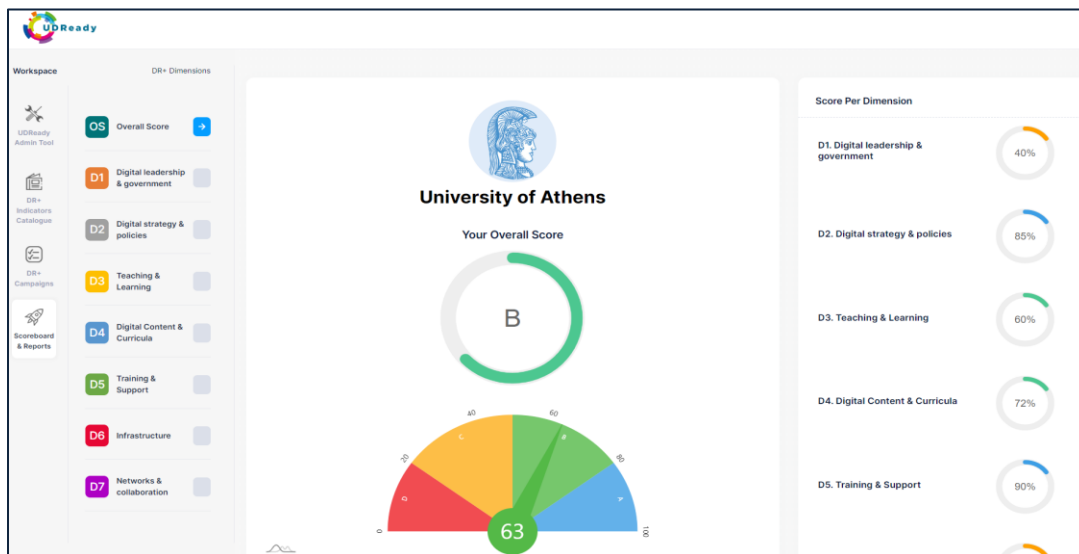

Figure 7. The Digital Readiness Campaign Scoreboard

Finally, the DR+ Recommendations, linked with the DR+ Knowledge Repository (which contains documents that are related to specific dimensions of the framework and enable stakeholders to take advantage of best practices, training materials, datasets, etc.), provide actionable insights to HEIs both horizontally (general recommendations) and vertically (recommendations per dimension) and include specific action plans to help the institution improve the digital readiness: a) **General recommendations** based on the HEI's profile and the overall Digital Readiness score to up-scale. b) **Vertical recommendations** per DR+ dimension based on dimension's score and weak points. c) **Targeted recommendations** based on the values of specific DR+ Indicators in order to identify weak points and give suggestions for improvements.

4 Challenges and Future Work

The design process of the platform and the underlying framework that is an integral part of it proved to be harder than originally anticipated. The process of identifying indicators through an iterative process that involved many stakeholders of the participating institutions, enhancing, validating, and critiquing these indicators through the auditing phase, and finally the attempt to implement the framework through typical examples of measuring indicators using available data sources, was tedious and often not as successful as originally expected. The current framework version still needs further cycles of validation with stakeholders and examples of measuring the indicators/topics/dimensions using real data from the HEIs involved. Among other tasks, the transferability of the proposed solution to different countries and different HEIs also needs validation, although the project already involves HEIs from three different countries with widely different national digital readiness level. As part of our ongoing work for the project, a multiplier event focusing on this issue is planned. Questions that still need to be addressed include: How to address missing or not high-quality data? How to measure the topics/dimensions if several indicators are not measurable? How to address the issue of measuring topic/dimensions that by their nature are not measured through available numerical data, but they are based on document data, communication actions, etc. As a result, the next steps of the project present important challenges.

The assessment of digital readiness encompasses various interconnected challenges that, when considered together, could impact the outcome of this endeavor. At its core, the availability of data is a fundamental issue. Furthermore, a significant challenge is the heterogeneity of the structure and content of the information systems used by different HEIs. This is a fact that was considered in the early design phase of the platform, and thus the platform provides a wide variety of interoperability options that technical administrators can use to report the data values needed to undertake a digital readiness assessment campaign, however the effectiveness of this architecture still has to be proven in various different cases.

Finally, it should be highlighted that the involvement of various stakeholders in the design and development phase is of crucial importance. The functionality of the platform, the developed components and interfaces, and UX/UI testing and evaluation in general involve the users ensuring seamless operations; a process that we hope will continue through the next implementation and deployment phases, especially as the future work regarding the UDReady platform mainly focuses on the conduction of an evaluation study of the UI/UX of the platform and its functionalities, the adoption of the platform under real world conditions and the accomplishment of digital readiness assessments from the respective partners from Higher Education.

References

ALZHANOVA, F. G., Kireyeva, A. A., SATPAYEVA, Z. T., TSOY, A. A., & NURBATSIN, A. (2020). Analysis of the level of technological development and digital readiness of scientific-research institutes. *The Journal of Asian Finance, Economics and Business, 7(12)*, pp. 1133-1147.

Gari, C. M., Chounta, I. A., Avouris, N., Daskalaki, S., Dimitriadis, Y., Dorner, H., ... & Yiannoutsou, N. (2022). Towards a Data-driven framework for the Assessment of Digital Readiness in Higher Education Institutions. *EDEN annual conference*.

George, B., & Wooden, O. (2023). Managing the strategic transformation of higher education through artificial intelligence. *Administrative Sciences, 13(9)*.

Mao, J. Y., Vredenburg, K., Smith, P. W., & Carey, T. (2005). The state of user-centered design practice. *Communications of the ACM, 48(3)*, pp. 105-109.

Mohamed Hashim, M. A., Tlemsani, I., & Matthews, R. (2022). Higher education strategy in digital transformation. *Education and Information Technologies, 27(3)*, pp. 3171-3195.

Ogbevoen, L. (2020). *What is digital readiness? Meaning, examples, breakdown.* Retrieved from Oden Tech.: https://oden.io/blog/what-is-digital-readiness/

Tsimpanis, K., Avouris, N., Chounta, I. A., Daskalaki, S., Dimitriadis, Y., Gari, C. M., ... & Balaouras, P. (2023). Implementing a data-driven framework for measuring digital readiness across European universities. *Proceedings of European University, 95*, pp. 129-139. Retrieved from Templates for proceedings.

Turnbull, D., Chugh, R. & Luck, J. (2021). Transitioning to E-Learning during the COVID-19 pandemic: How have Higher Education Institutions responded to the challenge? *Educ Inf Technol 26*, pp. 6401–6419. Retrieved from Wikipedia.

Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information & management, 44(2)*, pp. 206-215. Retrieved from easychair.org