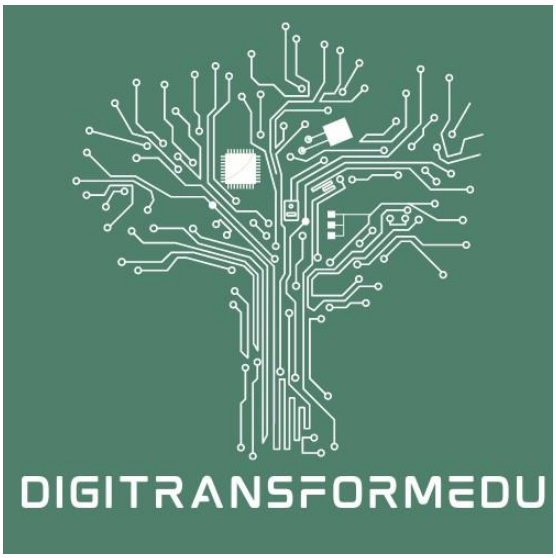

Strategical Approach to Digitalisation in Education

Institutional Concepts, Best Practices, Blueprint, and Case Studies

October 2023

Title:
Strategical Approach to Digitalisation in Education: Institutional Concepts, Best Practices, Blueprint, and Case Studies

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Publisher:
Algebra d.o.o.

For the Publisher:
Mislav Balković

Place and year of publication:
Zagreb, 2023

This publication has been prepared as part of the Digital Transformation of Higher Education and Training (DigiTransformEdu) project (No: 2021-1-BG01-KA220-HED-000031185) co-funded by the Erasmus+ Programme, Strategic Partnerships for Higher Education, Cooperation for innovation and the exchange of good practices (Key Activity 2).

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The CIP record is available in the computer catalogue of the National and University Library in Zagreb under the number 001204990

ISBN 978-953-322-511-1

Co-funded by the
Erasmus+ Programme
of the European Union

This project has been funded with support from the European Commission. This document and all its content reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Acknowledgments:

In this document we publish the report *Strategical Approach to Digitalisation in Education: Institutional Concepts, Case Studies, Best Practices, and Blueprint*. This Report represents the combined Result 3 (R3) of the Digital Transformation of Higher Education and Training (DigiTransformEdu) project (No: 2021-1-BG01-KA220-HED-000031185) co-funded by the Erasmus+ Programme, Strategic Partnerships for Higher Education, Cooperation for innovation and the exchange of good practices (Key Activity 2). All activities preceding this Report were performed between January and September 2023. The DigiTransformEdu project is aiming at fostering the digital transformation of educational and training institutions in EU.

This is to recognise and acknowledge that the report comes as the result of an effort, multiple contributions and commitment by the DigiTransformEdu Project Team members and other individual contributors representing the following project partners:

- Digital National Alliance, Bulgaria (lead partner)
- EFMD, Belgium
- New Bulgarian University, Bulgaria
- ESI CEE, Bulgaria
- Academy Nikola Tesla, Bulgaria
- Algebra University College, Croatia
- Munster University of Applied Sciences, Germany
- Fondazione Giacomo Brodolini, Italy
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Content

Abbreviations:

AI	Artificial Intelligence
CDO	Chief Digital Officer
CEFR	Common European Framework of Reference
COVID	Coronavirus Disease
CPD	Continuous Professional Development
DT	Digital Transformation
EU	European Union
EDSC	European Digital Skills Certificate
HE	Higher Education
HEI	Higher Education Institution
ICT	Information and Communication Technology
ILO	International Labour Organization
IoT	Internet of Things
LLL	Lifelong Learning
LMS	Learning Management System
MIT	Massachusetts Institute of Technology
OECD	Organization for Economic Cooperation and Development
OER	Open Educational Resources
STEM	Science Technology Engineering and Mathematics
TVET	Technical and Vocational Education and Training
UNESCO	United Nations Educational Scientific and Cultural Organization
VET	Vocational Education and Training

Foreword

This Report represents Project Result 3 (R3), Activities 1-4 (A1-A4), of the Erasmus+ KA2 KA220-HED-DAAC2117 titled: "Digital Transformation of Higher Education and Training" (DigiTransformEdu) project. This intellectual output and related activities are led by the project partner institution ALGEBRA University College (Croatia) in collaboration with other project consortium partners.

R3 refers to: **Concepts, case studies, best practices, and blueprint for the strategical approach to digitalisation**. The ultimate scope of R3 was to design a blueprint for digital transformation of educational institutions and the entire education process, through the research of the current concepts and practical approaches, and presentation of the selected best practices in higher education (HE) and vocational education and training (VET) institutions and their case studies. The scope was defined by but not limited to the institutional reactions on COVID pandemic situation.

A1 refers to: **Analysis and presentation of the existing digital transformation concepts**. This task was focused on the qualitative research of the currently available concepts, methodologies, and frameworks of digital transformation, specifically in the area of education. The scope of the research was centred around the publicly available European and international academic knowledge base and other theoretical work, including the major international business consultants and systems integrators, done in that area so far, before but also after the COVID pandemic crisis. The output of this analysis came out in the form of a report.

A2 refers to: **Exploring the institutional approach to digital strategy**. This task was building upon the exploration done in R1 (*Lessons learned from the COVID-19 crisis: governance and enabling services*), and was focused on the analysis of the institutional reactions to COVID pandemic from the strategic rather than only operational or tactical perspective. The scope of the research was based on the data collected in the R1, but also open to other available data researched in this area, the analysis was focused on examination, selection, and qualitative research of the strategical institutional practice developed in that area in the meantime. The output of this analysis also came out as a report.

A3 refers to: **Collection of best practices and development of case studies.** Continuing with the work done in R3/A2, this task concentrated on developing, describing, and presenting the selected best practices in the institutional strategic approach to digital transformation. The aim was to provide at least one best practice selected per every participating country, but the task was not limited to this goal. The output of this task was delivered in the form of a collection of the selected case studies.

A4 refers to: **Blueprint for digital transformation strategy in education.** Using the outputs created in the previous A1-A3 tasks, this task was determined to provide a general, widely applicable, and structural scheme for the approach of HE/VET institutions to the development of their long-term digital strategy. It has encompassed a variety of organisational, business, logistics, process, and user experiential elements required for the design of an appropriate institutional approach to long-term digital transformation and development in the years to come.

All these R3 documents referred above were designed and issued sequentially as standalone papers, but subsequently are published here as an integrated electronical publication made available through the DigiTransformEdu project website.

Analysis and Presentation of the Existing Digital Transformation Concepts

Authors: Ivana Ogrizek Biškupić and Goran Radman, Algebra University College

Digital transformation is one of the key dimensions of modern social, economic and organizational development in adapting to the increased internal and external use of digital technologies, and to the features of the ascending digital society and economy. In order to successfully initiate and implement transformation, educational and all other organizations need to be able to answer a number of related questions: how to manage processes and communicate digitally, which social networks to use, how to optimize online operations, how to dynamically manage costs, should physical libraries be kept? These are just some of the questions that need to be answered in order to prepare the appropriate plan, harmonize procedures and master changes that will affect all activities of the organization. The digital transformation also implies making changes in the strategy, operational model, processes as well as in organization's culture. Digital transformation brings an opportunity for reinterpretation and fundamental change in almost all aspects and segments of living and doing work. But digital transformation also bears many transitional risks when it comes to understanding and grasping its complexity, formulating appropriate digital alternatives, implementing and transforming processes, coping with transformation obstacles and barriers, and achieving expected added value gains out of transformation.

Before moving on to the particular subject of digital transformation, it is important to make clear semantic distinction between the correlated terms and expressions of the digital phenomena. *Digital, digitization*, *digitalization* and *digital transformation* are specific subject constructs that have to be appropriately differentiated. The term *digital* in the social context is defined as "a system that can be used by a computer and other electronic equipment, in which information is sent and received in electronic form as a series of the numbers 1 and 0"[1]. It can also refer to both data and their algorithms, like software and hardware, and the affective, political, economic, social, and physical effects on human, objects, and spaces (Elwood and Leszczynski, 2018), or "digital systems that encode, store and manipulate data; the forms of the material objects that mediate environments and human engagements with digitality; the structuring of everyday life through digital praxes; and the knowledges that secure and reproduce digitality" (Ash, Kitchin and Leszczynski, 2018; Gieseking, 2019). The term 'digitization' refers to the process of conversion of something that is of analogue[2] nature (recorded signals) to digital. The term 'digitalization' is referred in a broader scope and often used in context when digital technologies and digitized information are shaping how work is done. Sometimes 'digitization' also refers to the rationalization and optimization of internal processes (e.g., computerization) aiming at productivity and reductions in costs. Digitalization often goes beyond the implementation of technology and implies a more profound change in the entire business model and

[1] DIGITAL | meaning in the Cambridge Business English Dictionary. Available at: https://dictionary.cambridge.org/dictionary/english/digital (Accessed: 9 March 2022).
[2] ANALOGUE | meaning in the Cambridge English Dictionary. Retrieved March 9, 2022, from https://dictionary.cambridge.org/dictionary/english/analogue

in the evolution of work (Holmström, 2021). Process-wise, digitization precedes digitalization, and digital transformation cannot happen without these preconditions. When sequencing *digitization, digitalization,* and *digital transformation* we may also distinguish and classify three the most important stages of digital transformation process (Verhoef *et al.*, 2021).

Due to the experience in the process of educational institutions digitalisation gained before and after the pandemic, we have now achieved the preconditions to setup more comprehensive approach to the process of digitalisation (and not just one part of it i.e., e-learning). This can be achieved through strategic planning with regular measurement of the given results. The EU has recommended to develop longer-term strategic approaches in its *November 2021 Council Recommendation on blended learning for the member states* (Official Journal of the European Union, 14.12.2021, p. 5, no. 1) to develop longer-term strategic approaches to blended learning and build on successful innovations introduced or tested during the pandemic to share and scale good practices, in line with the principles set out in the official Council Recommendation. Furthermore, on the page 8 the EU Council invites the EU Commission, with due regard for subsidiarity and national circumstances to support the implementation of the Recommendation by facilitating mutual learning and exchanges among Member States and all relevant stakeholders, subject to the establishment and further elaboration of measures, through the Strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021-2030). It is the establishment of the framework that is the key for strengthening institutional capacity, provide synergies with other stakeholders and to foster quality. The framework should represent solid base for developing comprehensive digital strategy with concrete action plan and measurement indicators.

In the OECD 2022 document (Fernando M. Reimers et al., 2022) on disrupted and rethought schooling (how the Covid-19 pandemic is changing education) the authors discuss possibility to create a business culture for manage innovation in the education system, cause for the most of them it's easier to buy new tools and systems than to redesign the organisation with all its processes. They point out (ibid.) that it's worthwhile to explore how industry can help the education sector close the productivity gap with new tools and new practices, organisations, and technology. Success is less about the app, LMS or disruptive business model that will somehow turn existing practices upside down but is more about how to identify, interpret and cultivate a capacity for learning across the entire ecosystem that produces education outcomes. It's about convincing strategies to build teachers' capacity not just to use but also to develop new tools. In that context the policy makers or institutional management will need to become better at building support for this agenda. To support innovation, resilience and change, education systems need to become better at communicating the need and building support for a change (Ibid.).

On the other hand, disruption in the context of HE (higher education) requires better quality of its models that have been built around and inside HEI and its programme quality. Disruption is here about redefining quality of knowledge in the existing *ex ante* models. Hence, possible elements for creating a framework that would provide a starting point for planning institutional digital strategy as well as performance measurement mechanisms should be considered.

The university system is large, which is why the process of digital transformation is extremely complex and it is necessary to consider all its segments integrally with the aim to achieve an essential, planned and comprehensive transformation. In this paper some of these relevant segments will be listed and described, and some contexts will be problematised. European Union is making great efforts to

support further development and research regarding digital knowledge and skills in their frameworks for European educational institutions in their further development.

Digital Context in European Education

The digital context in European education recognises three large segments known as a European framework(s) which are indispensable for considering before the actual process of digital transformation of a higher education institution even starts:

1) Digital Competences of Citizens (learners),
2) Digital Competence of Educators and
3) Digitally Competent Educational Organisations.

Digital Competences of Citizens

Digital competence is a combination of knowledge, skills and attitudes with regards to the use of technology to perform tasks, solve problems, communicate, manage information, collaborate, as well as to create and share content effectively, appropriately, securely, critically, creatively, independently and ethically (Skov, Anders; 2016). Digital competence represent key for learning, working and active participation in society. Following sub-chapters discuss new DigComp 2.2 updates (March 2022) and research findings (i. e. descriptors) that can be integrated in the structure of HEI Digital strategy.

The process of the DigComp 2.0 started in early 2015 with feedback from the Education and Training 2020 Working Group for Transversal Skills. These Groups are part of a way for the European Commission and Member States to cooperate in addressing key challenges at national and European levels in the field of education (Vuorikari, R. et al.; 2022). The Digital competence framework DigComp 2.0 identifies the key components of digital competence in 5 areas with 21 associated competence dimensions that represent The DigComp Conceptual reference model (EU Science HUB):

I. **INFORMATION AND DATA LITERACY**: to articulate information needs, to locate and retrieve digital data, information, and content. To judge the relevance of the source and its content. To store, manage, and organise digital data, information, and content.
   1) **Browsing, searching, and filtering data, information, and digital content** - to articulate information needs, to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies.
   2) **Evaluating data, information, and digital content -** to analyse, compare and critically evaluate the credibility and reliability of sources of data, information, and digital content. To analyse, interpret and critically evaluate the data, information, and digital content.
   3) **Managing data, information, and digital content** - to organise, store and retrieve data, information and content in digital environments. To organise and process them in a structured environment.

II. **COMMUNICATION AND COLLABORATION:** to interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity. To participate in

society through public and private digital services and participatory citizenship. To manage one's digital identity and reputation.

1) **Interacting through digital technologies -** to interact through a variety of digital technologies and to understand appropriate digital communication means for a given context.
2) **Sharing through digital technologies -** to share data, information and digital content with others through appropriate digital technologies. To act as an intermediary, to know about referencing and attribution practices.
3) **Engaging in citizenship through digital technologies -** to participate in society through the use of public and private digital services. To seek opportunities for self-empowerment and for participatory citizenship through appropriate digital technologies.
4) **Collaborating through digital technologies -** to use digital tools and technologies for collaborative processes, and for co-construction and co-creation of resources and knowledge.
5) **Netiquette** - to be aware of behavioural norms and know-how while using digital technologies and interacting in digital environments. To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments.
6) **Managing digital identity** - to create and manage one or multiple digital identities, to be able to protect one's own reputation, to deal with the data that one produces through several digital tools, environments and services.

III. **DIGITAL CONTENT CREATION:** to create and edit digital content and to improve and integrate information and content into an existing body of knowledge while understanding how copyright and licences are to be applied. To know how to give understandable instructions for a computer system.

1) **Developing digital content -** to create and edit digital content in different formats, to express oneself through digital means.
2) **Integrating and re-elaborating digital content** - to modify, refine, improve and integrate information and content into an existing body of knowledge to create new, original and relevant content and knowledge.
3) **Copyright and licences** - to understand how copyright and licences apply to data, information and digital content.
4) **Programming** - to plan and develop a sequence of understandable instructions for a computing system to solve a given problem or perform a specific task.

IV. **SAFETY:** To protect devices, content, personal data and privacy in digital environments. To protect physical and psychological health, and to be aware of digital technologies for social well-being and social inclusion. To be aware of the environmental impact of digital technologies and their use.

1) **Protecting devices -** to protect devices and digital content, and to understand risks and threats in digital environments. To know about safety and security measures and to have due regard to reliability and privacy.
2) **Protecting personal data and privacy -** to protect personal data and privacy in digital environments. To understand how to use and share personally identifiable information while being able to protect oneself and others from damages. To understand that digital services use a "Privacy policy" to inform how personal data is used.
3) **Protecting health and well-being -** to be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies. To be able to protect oneself and

others from possible dangers in digital environments (e.g. cyber bullying). To be aware of digital technologies for social well-being and social inclusion.

4) **Protecting the environment - t**o be aware of the environmental impact of digital technologies and their use.

V. **PROBLEM SOLVING**: To identify needs and problems, and to resolve conceptual problems and problem situations in digital environments. To use digital tools to innovate processes and products. To keep up-to-date with the digital evolution.

1) **Solving technical problems - t**o identify technical problems when operating devices and using digital environments, and to solve them (from trouble-shooting to solving more complex problems).
2) **Identifying needs and technological responses -** to assess needs and to identify, evaluate, select and use digital tools and possible technological responses to solve them. To adjust and customise digital environments to personal needs (e.g. accessibility).
3) **Creatively using digital technologies -** to use digital tools and technologies to create knowledge and to innovate processes and products. To engage individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.
4) **Identifying digital competence gaps -** to understand where one's own digital competence needs to be improved or updated. To be able to support others with their digital competence development. To seek opportunities for self-development and to keep up-to-date with the digital evolution.

For competence descriptors, DigComp 2.0 adopted a device-agnostic wording of "digital technologies" so that it is not necessary to name a specific technology, software or application and the use of a catch-all term of "digital environment" to describe the backdrop to digital actions (Ibid.). The idea was that these terms encompass not only the use of personal computers but also other and held devices, games consoles and other media players or e-book readers which, more often than not, are also networked. Nowadays sensors and other devices under the Internet of Things (IoT) are included.

DigComp 2.2 (2020-2022) is more focused on the examples of knowledge, skills and attitudes (KSA) applicable to each one of the 21 DigComp competences. The working groups' mission (Vuorikari, R. et al.; 2022) was to identify the new digital competence requirements for citizens which stem from new developments in the digital world and then to make initial suggestions for relevant knowledge, skills and attitudes (KSA) examples related to those requirements. Both requirements and examples were to be drawn from: a wide-but-shallow desk review of academic and grey material; the learning goals and subject content outlined in training materials, syllabi and other educational and information sources; the analysis of important policy documents (European Commission, Digital Education Plan 2021-2027) and subjects on Information literacy, Data literacy, Artificial intelligence, Internet of things, Programming, Privacy and personal dana, Safety and security, Consumer transaction services, Creating multi/social media content, Digital environment, Teleworking and Digital accessibility.

There are many EU policies, recommendations, action plans and documents supporting digital transformation. The European Skills Agenda (European Commission, 2020) supports digital skills for all by supporting the objectives of the Digital Education Action Plan (European Commission, 2021-2027) (EUR-Lex) and represents one of many indicators why HEI need to perceive a comprehensive

context to design a digital strategy as a shift to a new paradigm. Digital Compass and the European Pillar of Social Rights Action Plan (European Commission 2021) have set the ambitious policy targets of reaching a minimum of 80% of the population with basic digital skills and having 20 million ICT specialists by 2030. The Digital Education Plan sets out two strategic priorities and fourteen actions to support them. There are also EU priorities and action plans regarding the subject of this research i. e. Priority 1: **Fostering the development of a high-performing digital education ecosystem** there are several Action points relevant for this subject of research:

- Action 3: European Digital Education Content Framework
- Action 4: Connectivity and digital equipment for education and training
- Action 5: **Digital transformation plans for education and training institutions**
- Action 6: Ethical guidelines on the use of AI and data in teaching and learning for educators

and also, Priority 2: **Enhancing digital skills and competences for the digital transformation:**

- Action 7: Common guidelines for teachers and educators to foster digital literacy and tackle disinformation through education and training
- Action 8: Updating the European Digital Competence Framework to include AI and data-related skills
- Action 9: European Digital Skills Certificate (EDSC)
- Action 10: Proposal for a Council recommendation on improving the provision of digital skills in education and training
- Action 11: Cross-national collection of data and an EU-level target on student digital skills
- Action 12: Digital Opportunity Traineeships
- Action 13: Women's participation in STEM
- European Digital Education Hub

Digital Competences of Educators

The proposed objective of the DigCompEdu framework in the document European Framework for the Digital Competence of Educators (Redecker, C., 2017) was to reflect on existing instruments for educators' digital competence and to synthesize these into a coherent model that would allow educators at all levels of education to comprehensively assess and develop their pedagogical digital competence. The DigCompEdu framework distinguishes six different areas in which educators' Digital Competence is expressed with a total of 22 competences (Ibid. p. 16, 24):

Area 1: Professional Engagement: Using digital technologies for communication, collaboration and professional development.

1.1. **Organisational communication**. To use digital technologies to enhance organisational communication with learners, parents and third parties. To contribute to collaboratively developing and improving organisational communication strategies.
1.2. **Professional collaboration**. To use digital technologies to engage in collaboration with other educators, sharing and exchanging knowledge and experiences and collaboratively innovating pedagogic practices.
1.3. **Reflective practice**. To individually and collectively reflect on, critically assess and actively develop one's own digital pedagogical practice and that of one's educational community.

1.4. **Digital Continuous Professional Development (CPD)**. To use digital sources and resources for continuous professional development.

Area 2: Digital Resources: **Sourcing, creating and sharing digital resources.**

2.1. **Selecting digital resources.** To identify, assess and select digital resources for teaching and learning. To consider the specific learning objective, context, pedagogical approach, and learner group, when selecting digital resources and planning their use.

2.2. **Creating and modifying digital resources.** To modify and build on existing openly-licensed resources and other resources where this is permitted. To create or co-create new digital educational resources. To consider the specific learning objective, context, pedagogical approach, and learner group, when designing digital resources and planning their use.

2.3 **Managing, protecting and sharing digital resources.** To organise digital content and make it available to learners, parents and other educators. To effectively protect sensitive digital content. To respect and correctly apply privacy and copyright rules. To understand the use and creation of open licenses and open educational resources, including their proper attribution.

Area 3: Teaching and Learning: **Managing and orchestrating the use of digital technologies in teaching and learning.**

3.1 **Teaching**. To plan for and implement digital devices and resources in the teaching process, so as to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction.

3.2 **Guidance.** To use digital technologies and services to enhance the interaction with learners, individually and collectively, within and outside the learning session. To use digital technologies to offer timely and targeted guidance and assistance. To experiment with and develop new forms and formats for offering guidance and support.

3.3 **Collaborative learning.** To use digital technologies to foster and enhance learner collaboration. To enable learners to use digital technologies as part of collaborative assignments, as a means of enhancing communication, collaboration and collaborative knowledge creation.

3.4 **Self-regulated learning**. To use digital technologies to support self-regulated learning processes, i.e. to enable learners to plan, monitor and reflect on their own learning, provide evidence of progress, share insights and come up with creative solutions.

Area 4: Assessment: Using digital technologies and strategies to enhance assessment.

4.1 **Assessment strategies.** To use digital technologies for formative and summative assessment. To enhance the diversity and suitability of assessment formats and approaches.

4.2 **Analysing evidence.** To generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, in order to inform teaching and learning.

4.3 **Feedback and planning**. To use digital technologies to provide targeted and timely feedback to learners. To adapt teaching strategies and to provide targeted support, based on the evidence

generated by the digital technologies used. To enable learners and parents to understand the evidence provided by digital technologies and use it for decision-making.

Area 5: Empowering Learners: **Using digital technologies to enhance inclusion, personalisation and learners' active engagement.**

5.1 **Accessibility and inclusion**. To ensure accessibility to learning resources and activities, for all learners, including those with special needs. To consider and respond to learners' (digital) expectations, abilities, uses and misconceptions, as well as contextual, physical or cognitive constraints to their use of digital technologies.

5.2 **Differentiation and personalisation**. To use digital technologies to address learners' diverse learning needs, by allowing learners to advance at different levels and speeds, and to follow individual learning pathways and objectives.

5.3 **Actively engaging learners**. To use digital technologies to foster learners' active and creative engagement with a subject matter. To use digital technologies within pedagogic strategies that foster learners' transversal skills, deep thinking and creative expression. To open up learning to new, real-world contexts, which involve learners themselves in hands-on activities, scientific investigation or complex problem solving, or in other ways increase learners' active involvement in complex subject matters.

Area 6: Facilitating Learners' Digital Competence: Enabling learners to creatively and responsibly use digital technologies for information, communication, content creation, wellbeing and problem-solving.

6.1 **Information and media literacy**. To incorporate learning activities, assignments and assessments which require learners to articulate information needs; to find information and resources in digital environments; to organise, process, analyse and interpret information; and to compare and critically evaluate the credibility and reliability of information and its sources.

6.2 **Digital communication & collaboration.** To incorporate learning activities, assignments and assessments which require learners to effectively and responsibly use digital technologies for communication, collaboration and civic participation.

6.3 **Digital content creation.** To incorporate learning activities, assignments and assessments which require learners to express themselves through digital means, and to modify and create digital content in different formats. To teach learners how copyright and licenses apply to digital content, how to reference sources and attribute licenses.

6.4. **Responsible use**. To take measures to ensure learners' physical, psychological and social wellbeing while using digital technologies. To empower learners to manage risks and use digital technologies safely and responsibly.

6.5 **Digital problem solving**. To incorporate learning activities, assignments and assessments which require learners to identify and solve technical problems, or to transfer technological knowledge creatively to new situations.

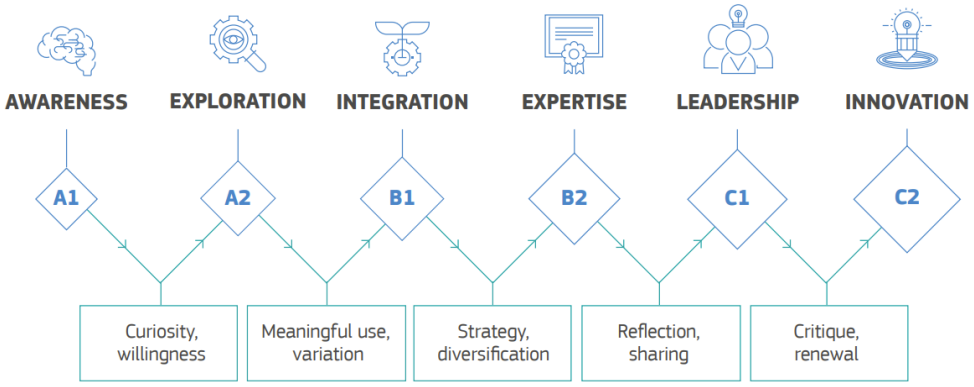

Figure 1: Educators' competence Progression model (DigCompEdu 2017, p. 29)

Progression model proposed in the DigCompEdu (Ibid., 28-29) has intention to help educators understand their personal strengths and weaknesses, by describing different stages (linked to the six proficiency levels used by the Common European Framework of Reference for Languages (CEFR), ranging from A1 to C2) or levels of digital competence development. It is necessary for HEI to perceive and measure the proficiency levels educators have (in all the fields, Ibid., p. 30 – 87) before considering setting out Digital strategy structure.

Digitally Competent Educational Organisations

According to interpretation of Jisc Digital Capability initiative, meaning of Digitally competent educational organisation refers to the effective use of digital technology by the educational organisation and its staff to provide a compelling student experience and to realise a good return on investment in digital technology. Digital technologies are being incorporated in exciting and promising ways at all levels of education and training systems. To consolidate progress and to ensure scale and sustainability, however, educational institutions need to review their organisational strategies and enhance their capacity for innovation and exploitation of the potential of new and emerging technologies and digital content (Kampylis, P. et al., 2015). As an answer to that particular challenge DigCompOrg may be used as a reference tool to compare existing frameworks and initiatives, in order to map which elements, sub-elements and descriptors are taken into account by a currently existing framework.

According to the same report (Kampylis, P. et al., 2015) DigCompOrg is a holistic conceptual meta-framework that provides a reference guide to existing framework initiatives and a model for self-evaluation by educational organisations of their integration and effective use of digital technologies. DigCompOrg has the potential to underpin transparency and comparability between related initiatives throughout Europe and in doing so can play a part in addressing fragmentation and uneven development between and within the Member States. The DigCompOrg is intended for educational organisations to self-reflect on their progress in integrating and effectively using digital learning technologies. Digital learning technologies are widely regarded by educational organisations as an enabler of their core mission and vision for quality education. From this perspective, the progressive integration and effective use of digital technologies can have the character of an educational innovation, and this implies a process of planning changes along three basic dimensions: pedagogical,

technological, and organisational (Ibid.). With 15 sub-elements placed outside of the circle framework and 75 areas inside of it with encompassing 74 descriptors (plus sector-specific element) represent solid starting point that can be used as indicators for HEI digital strategy content structure (Kampylis, P. et al., 2015: p. 18-20):

Leadership & Governance Practices

1) *Integration of Digital-age Learning is part of the overall mission, vision and strategy*
2) *Strategy for digital-age learning is supported by an implementation plan*
3) *A Management and Governance Model is in place*

Teaching and Learning Practices

4) *Digital Competence is promoted, benchmarked and assessed*
5) *A rethinking of roles and pedagogical approaches takes place*

Professional Development

Assessment practices

6) *Assessment Formats are engaging and motivating*
7) *Informal and Non-Formal Learning are recognised*
8) *Learning Design is Informed by Analytics*

Content and Curricula

9) *Digital Content and OER are widely promoted and used*
10) *Curricula are redesigned or re-interpreted to reflect the pedagogical possibilities afforded by digital technologies*

Collaboration and Networking

11) *Networking, sharing & collaboration is promoted*
12) *A strategic approach is taken to communication*
13) *Partnerships are developed*

Infrastructure

14) Physical and Virtual Learning Spaces are designed for digital-age learning
15) The digital infrastructure is planned and managed

Sector-specific element(s)

16) *Sector-specific sub-element(s)*

74 descriptors which are detailed in the following 15 sub-elements refer to the individual organisational segments according to which we can start HEI digital strategy development. For example, in the thematic element *Content and Curricula* under the sub-element 9) *Digital Content and OER are widely promoted and used* we can validate 5 descriptors (Ibid. p. 30):

- **Staff and students are creators of content:** The organisation encourages and supports staff and students to be creators as well as consumers of subject-specific and cross-curricular digital content, for use in both formal and informal curriculum areas.
- **Content repositories are widely and effectively used:** Staff and students develop proficiency in identifying and using content repositories relevant to their programmes of study and in adding community value to repositories through participatory annotation and comments.

- **Intellectual property and copyright are respected:** The organisation has policies and procedures in place to ensure that stakeholders are well-informed about intellectual property and copyright rules when sourcing, using, re-mixing or creating digital content.
- **Digital tools and content are licensed as required:** The organisation has policies and procedures in place in respect of licences for content (e.g., e-books, journals), software, apps, platforms and other educational resources sourced from commercial publishers/providers.
- **Open Educational Resources are promoted and used:** The organisation actively promotes the use/re-mix/creation of Open Educational Resources (OER) and Creative Commons licencing to support modernised curricula and to provide students with opportunities to develop their knowledge and skills and to achieve comprehensive learning outcomes.

Digital Transformation in Business

Digital transformation is not anymore a novel phenomenon nor is isolated to organizations and institutions. It became already a societal and economic common practice conditioned by digital paradigm shift. But business organizations are more exposed and use a variety of standardised frameworks and solutions to cope with it: improve their performance and keep up with the digital economy market demands. They continually invest huge and creative efforts to transform and improve their operational model, come up with new and innovative products, services, processes and business models, in order to sustain as either market challengers or leaders. Sometimes radical changes or solutions that companies create out of these efforts we call disruptive models or disruptive innovations (Ogrizek Biškupić, I. et al., 2022). There are as many examples of digital transformation in business as there are different approaches. Business context, experience and practice refers to the sector of education as well. Though educational model is institutionally inherent and regulated at large, with the focus on providing educational services and knowledge creation as main outputs, educational institutions also strive for excellence, recognition, and better positioning towards competition. Intensive digital transformation in business provide educational institutions with frameworks, application experiences and operational practices that may encourage and inspire their own digital transformation proactivity and creativity.

Conceptual Backgrounds

Many researchers seek out to define the complexity of the subject of digital transformation in business as a whole or some specific areas of it (Vial, 2019; Wessel et al., 2021). Spremić (2017), for example, notes that digital transformation is "a consciously driven transformation of the business with simultaneous strategic application of all available digital technologies with the aim of innovating the model of doing business". For Solis and Szymanski (2016), it is "realignment of investments into new technologies, business models and processes that will bring value for customers and employees, and compete more efficiently in an ever-changing digital economy". Berghaus and Beck (2016) define digital transformation as technology-induced change at many levels of the organization. Rouse (2005) explains that business transformation implies not only routine but fundamental changes that substantially change an organization's relationships with one or more stakeholders such as customers, employees, suppliers and investors. Matt *et al.* (2015) complement that the transformation of

companies based on digital technologies becomes a necessary and integral part of modern business while the business model, on which it is based, is exposed to constant change or can be replaced by a completely new model that meets the requirements of modern business. Tancini *et al.* (2012) explicates that digital transformation is an organizational change that is using digital technologies and business models with the aim of improving business results. Majority of those authors accomplish that digital transformation of the business is characterized by organizational changes made possible by and due to digital technology (Constantinides et al., 2018; Davenport, 2018).

To respond to the significant changes brought by the use of digital technologies to the dynamics and structure of the market, organizations must outline and design a new business strategy that meets the requirements of modern and more agile business (Matt et al., 2015). Such a strategy of digital transformation of business, Bharadway *et al.* (2013) define as an organizational strategy formulated and implemented using digital resources to achieve differential value. Scope of digital transformation of business encompasses the entire organization, therefore it must be coordinated with and cover all business segment strategies within the enterprise (Matt et al., 2015). Bharadway et al. (2013) stress that the ICT strategy and business strategy must be integrated into a single digital business strategy. Rogers (2016) concludes that digital transformation is an organizational change that includes strategy, processes, people and dynamic competitiveness. The very concept of modern business, which is predetermined by the development of digital technologies, requires technological awareness and strategic commitment of executive management for the digital transformation of its business (Sofronijević and Milićević, 2017). Management is a key factor in the success or failure of the digital business transformation because it requires commitment to this goal, clear guidelines of action, and a business *start-up* culture that supports constant changes. Kane *et al.* (2015) accomplish that "willingness for change and management's awareness that the digital transformation of the business is essential for the success of their business is the first step in creating a digital strategy". Digital strategy is as good as it has considered all these external and internal circumstances, correctly addressed the potential of digital technologies, put together desired but achievable objectives and translated them into a detailed development plan. With all that said in mind, Kane *et al.* (2015) would conclude: “it is strategy not technology that drives the digital transformation of the business”.

Digital transformation can be carried out according to various elaborated models, instructions and even rules but, independently of the industry sector, type of business or characteristics of business culture, this process is always unique and specific to every company. However, it is possible to single out some correlations in the process that allow comparisons and comparative analyses of the results they achieved. Although they define them and elaborate differently, one group of researchers (Berghaus et al., 2015; Geschke, 2017) suggest that all companies still have to go through the same transformation stages, even at different dynamics. In particular, they must consider that customers, i.e. their preferences and expectations, have to be constantly in the spotlight when it comes to the measurement of results achieved in the digital transformation. Customers who do not experience a seamless user experience in the digital world may quickly switch to other suppliers. Another possible approach to digital transformation comparisons could be through the elaboration and application of the digital maturity assessment methodologies. Chanias and Hess (2016) rate digital maturity from two different perspectives. From a technology perspective, an enterprise is digitally mature when it performs all procedures through IT and has all the information in digital form. From a management perspective, digital maturity is achieved when all strategic changes were implemented through the process of digital transformation. Spremić (2017) describes digital maturity as "the state in which the

company finds itself relative to the consciously guided digital business transformation while concurrently and strategically applies all available digital technologies with the aim of innovating the business model".

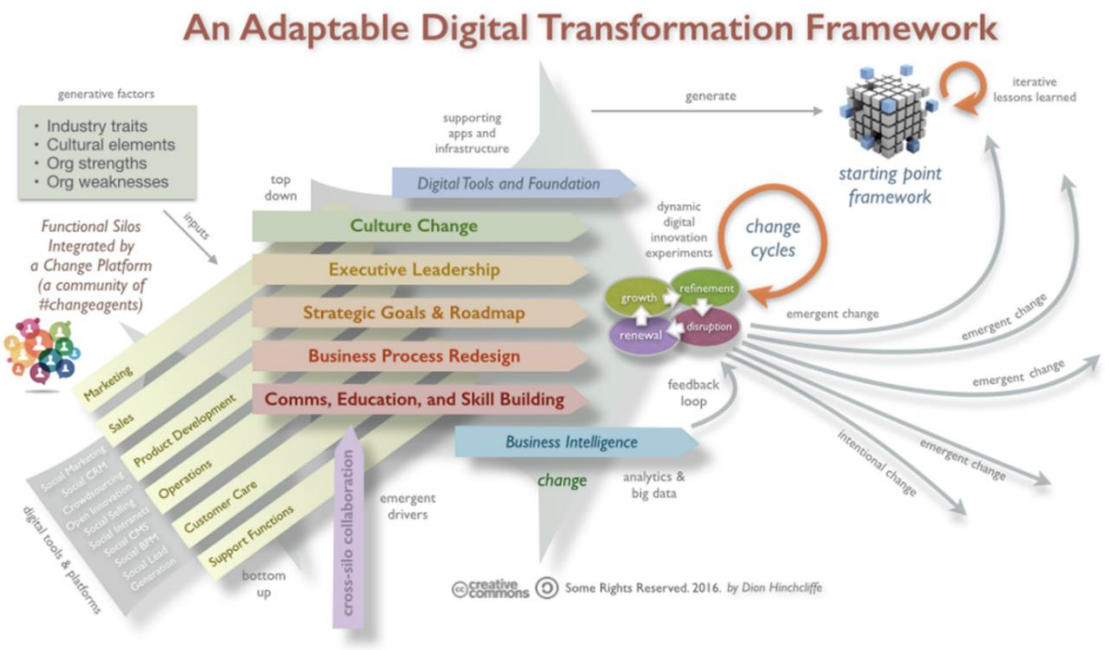

Figure 2: An adaptable digital transformation framework (Hinchcliffe, 2016)

The benefits that an enterprise may have by achieving digital maturity are potentially multifaceted: consolidated and improved business processes; transformed customer experience; optimized business strategy by use of analyzed data, transformed and educated employee experience, increased team agility; more competitive position in the workforce market; a corporate business culture that embraces change, etc. However, there are also a number of risks and potential obstacles in the implementation of the digital business transformation that management must continuously care about. Matt et al. (2015) believe that all these challenges should be dealt with and taken care by the new C-level managerial function of Chief Digital Officer (CDO), which will "permanently evaluate the expectations on which the digital transformation has embarked as well as the progress achieved along the way".

Kane (2017) believes that the process of digital transformation is better to start with immediately and then formulate the missing parts of the strategy along the way and during process development. Sydow, Schreyögg and Koch, (2020), meanwhile, stress that forcing rapid changes without adequate preparation can lead to a lack of recognition of potential deviations in the system, which potentially opens up existential risks for the businesses. Therefore, it is necessary to anticipate, understand and prevent potential obstacles that can slow down or impede the progress of the enterprise in a new business environment. Mehndirata (2018) is structuring and analyzing possible obstacles to the process of digital business transformation: integration of legacy and digital infrastructure, hesitation with digital change, failure to manage risks, and ignoring innovation. Valli (2019) recognizes the following obstacles: legacy approaches; lack of the right talent; lack of investment, conservatism and lack of vision. One of the obstacles very often mentioned in research is employee resistance, i.e. slow

acquisition of new knowledge and adaptation (Abraham and Junglas, 2011). Berghaus and Back (2016) also cite and employee resistance to commitment and change as one of the factors influencing the digital transformation.

Digital transformation of traditional business requires very new set of multidisciplinary management competencies. From top management who need to become digitally savvy, open and ready for change, to the line of business managers whose roles and responsibilities should be transformed to cope with the change, and finally to all front-end marketing and sales people who should open-up for the strategies and processes guided primarily by the user experience. Businesses are to be transformed due to the impact and development of digital technologies even in the sectors that were not significantly ICT induced so far: e.g. agriculture or mining. Digital transformation presents an organizational challenge on several levels, especially in business administration, data management, global logistics and integration of technological solutions in the process of the organizational transformation. "While it is important to monitor, collect and analyze data, technology should strive to integrate all functions and processes to secure a comprehensive approach, including digital literacy" (Sanchez, 2017). Digital transformation is also an extremely demanding business venture and often involves some new technologies and processes, such as digital marketing or predictive analytics, that require competences that have not yet been used in traditional business. Starting from the management (insufficient strategic capacity, competences, visions, indecision, etc.) and over to the employees (ignorance of customers, change resistance, unused talents, missing agility, etc.), human factor appears to be the main bottleneck for the efficient implementation of such a wide-ranging mission.

Digital Transformation Business Activities

Digital transformation (DT) transforms business and business activities by applying different digital technologies with an aim to accelerate, improve or even create new business processes and models (R. McGrath, R. McManus, 2020). **When dealing with DT we are not only rethinking the present shift and change that's feasible in current circumstances but also future target state**. Several global trends have influenced development and adoption of DT:

- population growth and increased consumption,
- urbanisation and globalisation,
- continues increase of customers' expectation,
- products and services' personalisation and customised services' delivery,
- customers moving to services (e. g. sharing platforms),
- 24x7 availability and service had become a standard expectation for many of the customers.

Customers and clients want to be able to reach companies that provide a service from anywhere, anytime and **they expect to be provided with the service that is consistent across all channels**. Additional expectation observed is related to continuous innovation and novelties in the products and services. This has put many industries under a pressure to develop their products and services (and go to market) much faster than they used to (similar to situation universities were faced with during the pandemic). Shorter products lifecycles require many changes in the organisations. **Design thinking, scrum, agile and other methods have become essential to digital transformation**. DT has been successfully applied in many industries in the last decade (e.g. media and entertainment, retail,

financial services, telecommunications, hospitality and travel, transportation, insurance, manufacturing, healthcare, education, utilities, wholesale, etc.). **The main reasons companies state as the reasons to grasp into DT are evolving customers' and employees' behaviour and preferences, competitive pressure** (particularly by companies that do engage in DT), **growth opportunities** (including those in new markets), **necessity to understand and start applying digital trends, decline in business performance that could be turned around with support of DT as one aspect of business transformation needed** (V. Scuotto, 2022).

To navigate through digital technologies, it is imperative for leaders to wisely choose which technology to use and how to apply in a way to improve their business. More important questions should be focused on business model and ever-changing business landscape (Ogrizek Biškupić, I. et al., 2022). **The technology should only be the outcome of desired business effect not the reason for implementation itself**. To seize the full potential of this structural shift, companies need to align with the new value-driven business logic while at the same time effectively managing complexity. Product, process, and organisational innovation alone are no longer sufficient for companies to stay competitive (Krčo, S., 2019). DT is not only carried out in different business areas and industries, but also in other organisations such as governments and public sector agencies. Governmental DT initiatives typically focus on full digitalisation of processes used by citizens (tax application, election and referendum voting, any kind of governmental certificates provided in digital form, health records digital access, issuing of documents like personal ID, driving licenses etc. through fully digitalised process, etc.) and integration of different governmental bodies and ministries into single process, driven by unified access and usage through the same entry point (portal), thus provided to citizens in easy to use manner.

Several technologies have become a standard in IT industry, particularly in the companies that are using digital technology: mobile, social media, cloud computing and big data and analytics. There are many other technologies **used to support DT**: Internet of Things (IoT), data analytics, artificial intelligence, augmented reality, virtual reality, robotics, digital twins, additive manufacturing and 3D printing, digital twins, blockchain, voice recognition...

DT bring process and model changes, but it is important to understand that those changes typically come from changing the perspective and approach to customers in a way that customers' needs and expectations become main drivers of the transformation. Executives in many industries have believed that changes in industries that are not directly related to their industry won't significantly affect them. Based on the aforementioned, there are two main directions for setting out digital strategy (Ogrizek Biškupić, I.; Banek Zorica, M., Šiber Makar, K., 2022):

1) **to provide digital optimisation** (better customer experience, improved productivity, improved products), and
2) **to provide digital business transformation through new product and services and new business models**.

Depending on the industry, DT in business has in focus digital strategy and scale of digital change anticipated in these segments:

- **Product Digitization** - focuses on turning physical products into digital customer experience platform
- **Process Digitization** - focuses on automation of existing manual and paper-based processes

- **Business Model Digitization** - focuses on digitization of existing business models that are now being digitalized
- **New Digital Business Models introduction** - focus on providing products or services that are new and based on digital technologies.

Concepts and Frameworks of Digital Transformation in Business

Concept 1: Digital Maturity Assessment

A digitally mature organisation is one that is making the best use of digital technology and its associated culture in everything it does. This means digital became part of the organisational DNA. But being digitally mature is different from only having digitised systems, processes, products and activities. How to find out how digitally mature an organization is? There are different methodologies, approaches and tools available that are designed to assist organizations in measuring the level and quality of their digital maturity.

These models often focus on measuring a couple of the most important business dimensions of any organization:

Customers: Assess the experience customers would have by viewing an organization as their digital partner in using preferred channels of interaction to govern their connected online and offline services. This may include experiential areas like customer engagement, service experience, customer insights, behaviour, trust and perception.

Strategy: Assess how a business organization transforms or operates in order to increase its competitive advantage through digital initiatives that are embedded in the overall business strategy. This may include areas like market and customers, portfolio, ideation and innovation, finance and investment, and brand, ecosystem, stakeholder and strategic management.

Technology: Assess the success of digital strategy in engaging technology to help it create, process, store, secure and exchange data to meet the needs of customers and lower the costs and overheads. This may include areas like software applications, connected things, data and analytics, delivery governance, networks, security and technology architecture.

Operations: Assess organizations in executing and evolving processes and tasks by utilizing digital technologies to drive strategic management and enhance business efficiency and effectiveness. This may include areas like real-time insights and analytics, standards and governance automation, agility of change, automated resources, integrated services, smart and adaptive process management.

Organization: Assess how an organization defines and develops organizational culture with governance and talent processes that support progress along the digital maturity curve, and the flexibly to achieve growth and innovation objectives. This may include areas like leadership and governance, organizational design and talent management, workforce and culture enablement, etc.

There are also some assessment models that provide for more detailed introspection and self-guided review of many organizational dimensions that are important for measuring digital maturity. Here is an example of digital maturity assessment framework (Figure 3).

DIGITAL MATURITY ASSESSMENT FRAMEWORK					
Digital maturity	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
Culture	**Sceptical** Staff are wary of digital and try to avoid it.	**Respectful** Staff are happy that specialists are dealing with digital.	**Participative** The organisation understands the value of digital and wants to learn more.	**Inclusive** Digital is seen as key to success and incorporated into everything.	**Evangelical** Digital is the principal way to engage supporters and achieve the mission.
Leadership	**Minimal** There's no clear digital leadership at any level.	**Restricted** The digital lead is confined to a mostly tactical role.	**Supported** The digital lead is encouraged to be strategic, when time allows.	**Elevated** A senior digital lead exists, and digital leadership is actively invested in.	**Intrinsic** Digital is an integral part of the overall strategy and digital leadership is present at all levels.
Budget	**Survival** The budget only covers the bare essentials, such as website hosting.	**Maintenance** The budget supports the current setup but doesn't allow for improvements.	**Experimenting** The budget allows for the testing of new ideas in priority areas.	**Growth** The budget supports increasingly digital ways of thinking and doing.	**Sustainable** A healthy budget for the ongoing evolution of digital operations increases impact.
Innovation	**Deprioritised** Innovation is not considered important, or is not happening at all.	**Ad hoc** Innovation occasionally happens as part of existing projects.	**Small-scale** There is innovative re-imagining of some aspects of products or services.	**Coordinated** Joined-up innovation is evolving the organisation.	**Embedded** A structured innovation programme is creating transformational change.
Capacity	**Responsibility** One person looks after the website and email. They may not have a digital background or skillset.	**Expertise** Basic digital functions are covered by people with specialist skills and experience.	**Team** There's a central team of digital specialists, with some digital delivery in other teams.	**Function** There's a senior digital lead and a team, with growing digital opportunities in other teams.	**Capability** Senior digital leadership exists across the organisation with effective delivery teams.
Recruitment	**Essential** There's a focus on technical skills for the role looking after the website.	**Specialist** Specialist digital skills are included in certain roles that support engagement.	**Generalist** Broad digital skills are required for jobs all around the organisation.	**Prevalent** Strategic digital skills are standardly included in job descriptions.	**Pervasive** New recruits are all digitally capable. All job descriptions include relevant digital skills.
Learning	**Skill-sharing** Digital experts teach others on an ad-hoc basis. The training budget is very small.	**Building** literacy There's a small budget for basic digital skills in digital expert roles.	**Centralised** Organisation-wide training is normalising digital skills.	**Multi-layered** Digital upskilling is a priority for all. Teams understand their role in the digital change.	**Cultural** Learning function leads on the development of digital skills and behaviours at all levels of the organisation.
Project management	**Inconsistent** Project management is done differently for different projects.	**Basic** Some common project management principles are used.	**Progressing** Projects are managed through a structured but often lengthy process.	**Developing** Agile project management principles and practice are used. There is a launch, test and improve approach.	**Impactful** Agile principles of digital project management are consistently used in all projects to improve efficiency and increase impact.
Technology	**Primitive**	**Outdated**	**Keeping up**	**Effective**	**Leading edge**

	Systems are limited in scope and aren't integrated. They may be insecure.	Systems aren't keeping up with the needs of the organisation.	Systems are stable and enable basic operations.	Tools and systems are delivering improvements in effectiveness.	Interconnected tools and systems provide a smooth, effective internal and external user experience.
Data	**Chaotic** Data in the organisation is scattered and largely about offline activity.	**Understood** Data is seen as important for the organisation. Quality and use is improving in some areas.	**Developing** There's a clear policy for data management. Data is integrated and analysed.	**Literate** Quality, integrated data is used across much of the organisation.	**Driven** Live data is used across the organisation to shape decisions and performance.
Reporting	**Sporadic** KPIs exist, but progress is measured in an ad-hoc way.	**Tactical** Relevant KPIs are set and reported against, but the lessons aren't always used.	**Aggregated** Performance data is collected and joined up, but is hard to access.	**Integrated** Holistic performance data is quickly and easily accessible.	**Real-time** Holistic performance data is always available and is used strategically.
Insight	**Gathering** Insights are gathered but are used inconsistently.	**Understanding** Insights from more than one source are combined to build understanding.	**Analysing** Knowledge about who people are is combined with behavioural insights.	**Acting on** Insights are used to shape planning and delivery.	**Learning from** All work is grounded in rich, up-to-date insight. Work is improved upon iteratively.
Communications	**Unspecific** Digital is used as a device to promote non-digital communications.	**Consultative** Digital advice is sought when judged it's needed.	**Inclusive** Digital is involved from the outset in communications planning.	**Strategic** Communications are designed to be digital by default.	**Transformational** Digital is used to create adaptable, integrated communications.
Service delivery	**Basic** Information is shared online. Traditional offline services are signposted from the website.	**Supplementary** There is some experimentation with service delivery using digital channels.	**Equal** Digital services are seen as being as important as traditional offline services.	**Insight-driven** The provision of online services is based on research and testing.	**Innovative** Online services are iterative and integrated. They are delivering previously untapped reach and impact.
Internal systems	**Inefficient** There is no will or budget to digitise systems or processes.	**Inconsistent** Some digital tools are available but their use is erratic.	**Discretional** Good digital tools are available, with onboarding and support on request.	**Effective** There is investment in digital tools that improve the working lives of staff.	**Efficient** A comprehensive suite of connected digital tools, with proactive support for staff is in use.

Figure 3: Digital Maturity Framework (adapted from Digital Maturity Framework)

Concept 2: Digital Customer Experience

Understanding customer experience and how customers directly or indirectly interact with business, is critically important for any business organization when it comes to improving satisfaction, add value, repeat business opportunities, and keep long-lasting and valuable relationships. Concept of tracing digital customer experience through their journey mapping is designed to help organizations better understand its customers. It is meant to facilitate for and create a communication strategy that will provide for a continuous dialogue with customers by mapping all their key organizational 'touchpoints' across many different digital platforms (multiplatform) and channels (multichannel), and design current and future 'customer journeys' through the services an organization is offering to its customers and users. Digital customer journey models very often offer opportunities for organizations to integrate and manage customer data through market research, customer experience analysis and

customer journey mapping in order to plan, manage and optimize their key customer touchpoints and achieve better marketing and business objectives.

When preparing to look at the proper digital journey situation, organizations may start from various touchpoint perspectives the customers have with their business. Different internal stakeholders may be actively involved and provide diverse viewpoints on how they interact with customers when it comes to, for example, customer services, e-commerce, fulfilment, etc. This could be expanded through customer segments and operational departments looking at e.g. marketing channels (email, postal, telephone, social networks, blogs, etc); order fulfilment (delivery, payment, returns, etc); and exploration channels (websites, consumer forums, sales stores, customer services, etc).

Figure 4: Digital customer journey mapping (adapted from [Digital customer journey])

The above map shows only direct contacts with customers, but that could be expanded to cover other indirect touchpoints like social sites, word of mouth, customer reviews, etc. to get a complete picture of various digital customer journey touchpoints. For each of those touchpoints customers would normally complete many dissimilar actions and activities, most likely different for each business sector or industry, but could be categorized into the several basic types:

- Awareness
- Discovering
- Purchasing
- Use of products of services
- Bonding with products

For example, this can be expanded to cover the key areas for an educational organization (e.g. enrolment and scholarship office, student office check-in, student career centre interactions, use of the altering student services, etc.). It is though best to keep it simple at the beginning and allow initial customer journeys to be easily mapped and additional activities exposed, notified and put in practice. Once the customer touchpoints and activities are mapped and completed, typical customer personas could be built to map their journey from initial awareness, through procurement and bonding to final

satisfaction survey and assessment. The key here is to understand the path and steps that each type of customer takes, using actual customer feedback and research if available.

With having built an understanding of digital customer experiences, an organization is in position to improve its customer satisfaction in many different ways: by minimizing negative customer experiences (through identification of key steps and decisions to ensure the correct information is available and accessible to all customer types), by improved customer retention (through understanding how they transition over each stage in the service lifecycle; through enabling relevant discussions with customers to assist them in moving towards a positive decision), by identification of communication gaps (overcoming conflicting messages and use of social media to address customer feedbacks), by understanding core customer journey paths (through additional development that will provide the biggest impact), and by understanding the required satisfaction metrics (through identifying customer progress, or providing opportunities for the return of customers).

Here is an example of the digital customer omnichannel journey model:

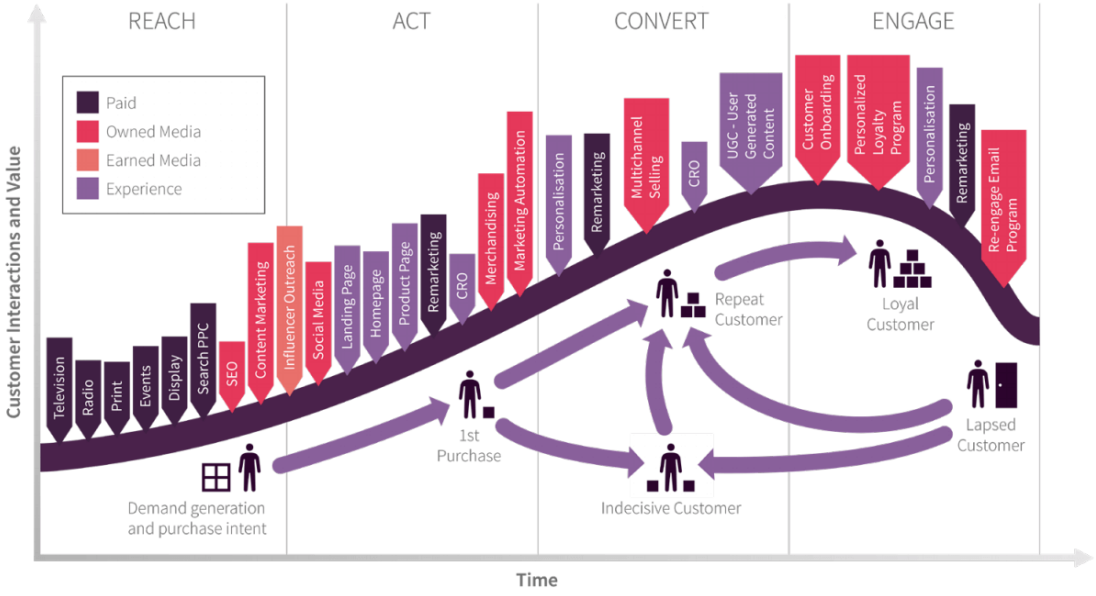

Figure 5: Digital customer omnichannel journey model ([E-commerce customer lifecycle)]

Concept 3: Digital Transformation Models and Frameworks

Digital transformation frameworks evolved from other business transformation concepts in late 1980s and over time were refined and designed to provide decision-makers with a starting point, offer checklists of what is to be done, and suggest sequence of activities in doing the transformation. At the same time, frameworks are not expected to be overly prescriptive and offer detailed instructions on the way of how to apply them. They tend to leave users to grasp the momentum, adopt to the framework logic and apply best of understanding of the particular circumstances of their organization. Digital transformation frameworks should also work well for people at different levels of organization in seeing their contribution clearly and collaborate well when working together to make digital change possible. In a way, they are also expected to offer the following:

- Help executives see the big picture

- Define a set of tasks and sequences
- Outline transformation of both front and back-office
- Make it customizable to suit circumstances

The best of frameworks should also help decision-makers see different perspectives and dimensions of transformation. For example, customers and users must be in the focus and reason for digital change. Also, many frameworks should address opportunities, but organizations of different size also face different constraints. Company culture is also an important dimension to consider. Modern, lean and flat organizations would be more flexible and dynamic while adapting to the change requirements. At the end, frameworks should be fairly simple and easy to apply. Therefore, it should not come as surprise when recognizing that the most convincing digital transformation frameworks are designed and offered by the best global business and technology consulting companies and institutions.

Table 1 Evolution of digital transformation models and frameworks in business

EVOLUTION OF DIGITAL TRANSFORMATION MODELS AND FRAMEWORKS IN BUSINESS			
Name	**Proprietor**	**Year**	**Scope**
Customer Journey Map	Oxford SM	1998	Diagram depicting the stages and 'touch points' customers go through when interacting with an organization
Business Model Canvas	Osterwalder & Pigneur	2005	Strategic management template used for developing new business models and documenting existing ones
Design Thinking Framework	Stanford University	2010	Human-centered, creative problem-solving process of discovery, ideation and experimentation in transformation
Digital Transformation Framework	Capgemini	2011	Highlights nine critical elements that should be addressed through a digital transformation process
Nonstop Customer Experience Model	Accenture	2012	Driven by new technology, the customer journey as dynamic, accessible and continuous process
Four Levels of Digital Maturity	MIT Capgemini	2012	Evaluates opportunities based on 'Digital Intensity' and 'Transformation Management Intensity'
Finding Your Digital Sweet Spot	McKinsey	2013	Enhanced connectivity, automation of manual tasks, improved decision making, and product innovation
The Strategy Palette	BCG	2015	Five different approaches when dealing with environmental changes in the digital age
Digital Industrial Transformation Framework	Deloitte	2016	Strategy in redesigning talent models, transforming processes and retooling technology

Digital Business Strategy Framework	Accenture	2016	Issues, decisions, actions and investments required in creating a digital business
Digital Industry Transformation Framework	PwC	2016	Industry 4.0 as the heart of digital change, incorporates data and analytics as the core capability
Digital Government Policy Framework	OECD	2016	Several governance dimensions when analyzing and supporting national efforts in public sector digitalization
Digital Reinvention Framework	McKinsey	2017	'4Ds of Digital Transformation', consisting of the Discovery, Design, Deliver and De-risk phases
A Roadmap for Digital Transformation	McKinsey	2017	Provides guidance to organizations in defining value, launch and acceleration, and scaling up
Technology Digital Transformation Framework	DXC	2017	Digital transformation built around Digital Experience, Digital Platforms and Digital Solutions
Digital Transformation Framework	Cognizant	2018	Four common elements applying to most companies making digital change in B2C and B2B market segments
The Five Building Blocks of Digital Transformation	MIT	2018	Company accountability organized around components, not functions, product lines, or geographies
Digital Transformation Framework	Ionolgy	2019	Technology not as a building block but as the means by which all processes are supported and delivered
Roadmap for Digital Business Transformation	Gartner	2020	Enabling CIOs and other business leaders to build a successful digital enterprise

Here is an overview and comments of the seven selected transformation models and frameworks that may be considered as useful approaches to digital transformation in education institutions as well.

PricewaterhouseCoopers (**PwC**) is the second-largest international professional services network in the world and is considered as one of the Big Four[3] accounting firms. PwC Framework is suggesting that digital transformation should be rooted in the 'Industry 4.0' (4IR, The Fourth Industrial Revolution). The outer circle of the PwC framework (Figure 6) is labelling data and analytics as core capability of an organization. This framework provides accurate intelligence for business leaders to make decisions in stages (1-3). Digitisation of product and service offerings is expected to come in stage 2. But at the same time, Capgemini's framework (Figure 10) encourages organizations to go

[3] *Big Four accounting firms - Wikipedia*. (n.d.). Retrieved November 1, 2022, from https://en.wikipedia.org/wiki/Big_Four_accounting_firms

beyond digital packaging of the traditional products, and instead build the new type of products that are digitally native.

Figure 6: Building the digital enterprise (PwC, 2016)

PwC positions 4IR in the heart of their digital transformation framework but makes no reference of customers and users in this process. However, it is referencing different type of technologies, from smart sensors and 3D printing to IoT platforms, though technology changes very often and may become redundant. The framework does not make any reference on company culture. It also recognizes organizational opportunities but has no mention of limitations.

Cognizant is a multinational information technology services and consulting company from USA. Cognizant digital transformation framework (Figure 7) identifies four elements that commonly apply to most companies going through digital alteration (products and services, operations, organization and customer experience). Where PwC (Figure 6) made only a vague reference on customers, Cognizant is devoting an entire segment of its framework to digitizing customer experiences. It also includes customer insights, an important aspect integrated by MIT into its Five Building Blocks (Figure 11) of digital transformation. Cognizant framework also recognizes that new pricing and business models are important for digital transformation. This framework is proved to be relatively easy to use.

Unfortunately, 'customers' in this framework are only seen as objects of digital marketing. Strictly speaking, digital marketing is not an element of digital transformation and is not aiming at helping customers. It should also be noted that digitization of the organization section in this framework does not include an element of organization culture, just a fraction of partner ecosystems.

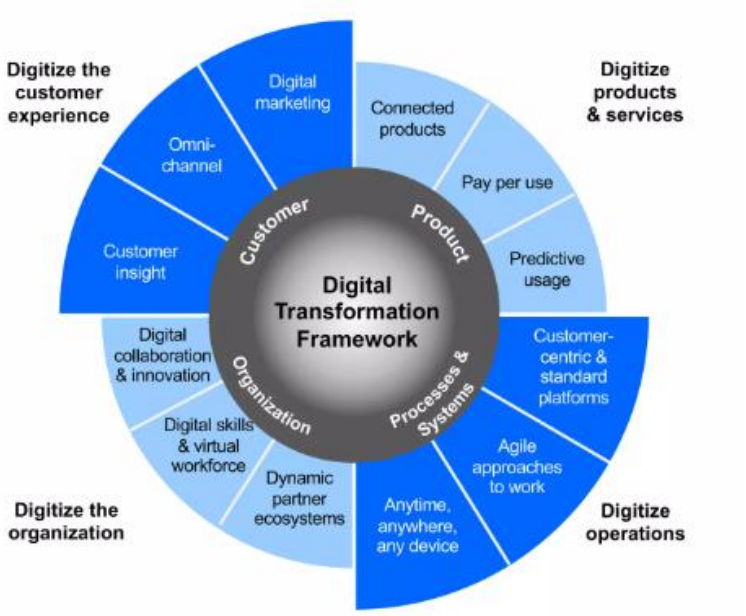

Figure 7: Cognizant's Digital Transformation Framework (Cognizant, 2014)

Gartner is a global technological research and consulting firm that conducts research on technology. Gartner has designed a six-step digital transformation framework (Figure 8) aiming at assisting ICT and other business leaders to build a successful digital enterprise. Having a 'right mindset' and 'shared understanding' for Gartner is the first step organizations will have to go through. Second step of the Gartner digital transformation framework is about putting the right leadership in place. These two initial steps are validated by various research that found out skill gaps are often key reason for digital transformation underperformance or failures.

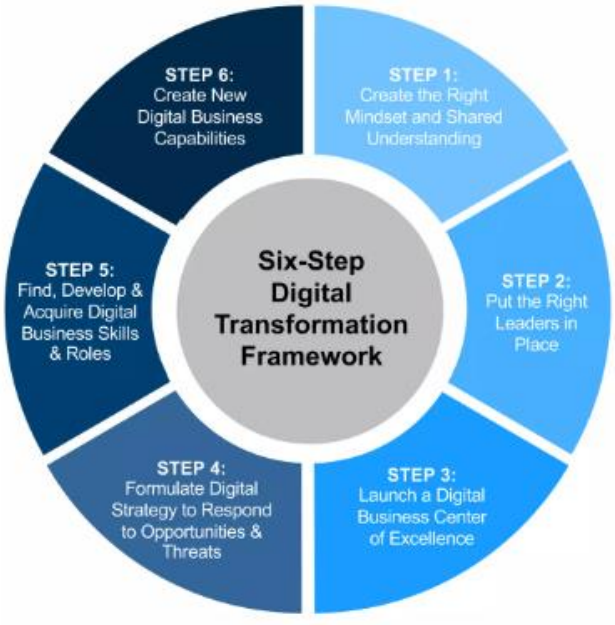

Figure 8: Gartner's Digital Transformation Framework

Technology transformation is useless without people who understand and share the same vision about why digital make sense. While some other frameworks also touch upon shared beliefs and culture, Gartner framework goes beyond in suggesting that organizations have to be supported by a digital excellence team of coaches and mentors. However, just like some other frameworks, Gartner framework is also not very much concerned with the participation of customers, and is more focused on leadership as a change maker.

McKinsey is a global management consulting firm that has developed and practice a proprietary digital transformation framework they call '4Ds' (Figure 9), after its Discovery, Design, Deliver, and De-risk activity phases. In this framework customers are really put first: e.g. in the Discovery phase they look at customer behaviour trends. The next phase (Design) is all about designing and building customer journeys as an important driver of customer experience. Customer journeys also form one of the six building blocks for creating a high performing digital enterprise. The last phase encourages the organization to reinvest profits made from quick wins to de-risk the business against change fatigue. There are similar solutions in other frameworks as well: PwC (Figure 6) encourages organizations to create a budget for pilot projects and then scale up funding, while DXC framework (Figure 12) uses customer journeys to identify new opportunities.

As a downside, McKinsey digital transformation framework expects from an organization to act and behave with a start-up agility, which is mostly not realistic and sometimes is even contradictory and opposite.

Figure 9: McKinsey 4Ds Digital Transformation Framework (McKinsey Quarterly, 2017)

Capgemini is a French multinational information technology services and consulting company. Its framework (Figure 10) digitally transforms three key pillars of an organization: customer experience, operational processes, and business models. Within each of the three pillars, three different elements (altogether nine) are transformed and they represent the building blocks of digital transformation. For

example, pillar one is about understanding the customer and thinking about new kinds of customer journeys: starting with the customer experience, getting some quick wins and moving on to more complex issues. Capgemini assumes digital technology is rather providing support than leading transformation. Pillar one is about front-office, while pillar two is about back-office, and these operational switches are required to bring value propositions. This framework is not the only one that is addressing value propositions, you may find them also in other frameworks, while they are named 'offers' in the MIT framework (Figure 11).

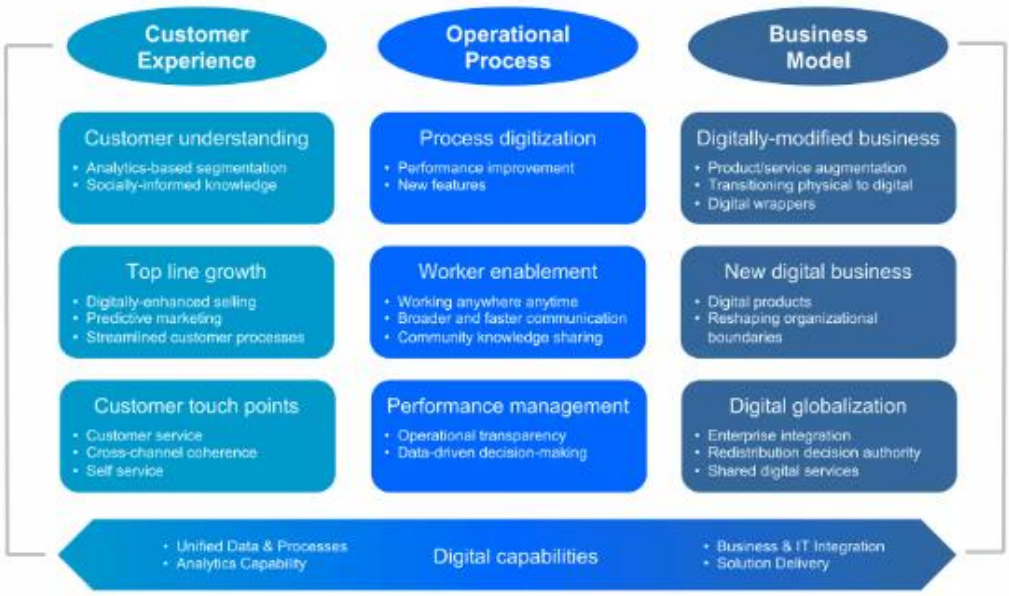

Figure 10: Capgemini DT Framework (CG & MIT Centre for Digital Business, 2011)

Massachusetts Institute of Technology (MIT) is a private USA research university with global impact on development of modern technology and science. Unlike other frameworks in this review who look more like flow charts, MIT Five Building Blocks to digital transformation framework (Figure 11) look more like real construction blocks with a lot of emphasis on customers. Just like PwC Data and Analytics core competency ring (Figure 6), MIT points organizations to develop their 'reservoir of intelligence' about both customer problems and solutions. The accountability block tries to break down organizational barriers as means of transformation. Start-up culture is welcomed wherever it is possible to make mistakes and still succeed. Organizations are invited to adopt and establish new framework of accountability around components rather than around functions, product lines, or geographies, and align the entire business around the customer.

However, MIT Five Building Blocks to digital transformation framework (Figure 11) begins with operations, and not customers. One block is devoted to the 'external developer platform', or a digital marketplace. The idea here is of outsourcing production externally, not building everything internally, while focusing on core competencies. In the digital world, according to DXC, the consumer is in charge and will define next move. Asymmetric competition from mostly unexpected sources will be the norm. Winners maintain control while they minimize their benefits.

Figure 11: MIT Five Building Blocks digital transformation framework (2018)

DXC Technology (**DXC**) is a multinational information technology services and consulting company from USA. **DXC** digital transformation framework (Figure 12) puts customers first, just like MIT and CapGemini frameworks, but their Digital Customer Experience section is very comprehensive. They touch upon customer journeys and take it a step further by claiming these journeys need to be 'Intelligent', 'Digital-first' and 'Omni-channel'. Their Business Model Innovation section actually anticipates asymmetric competition (like Apple start offering Apple Pay, and then launches its own digital bank).

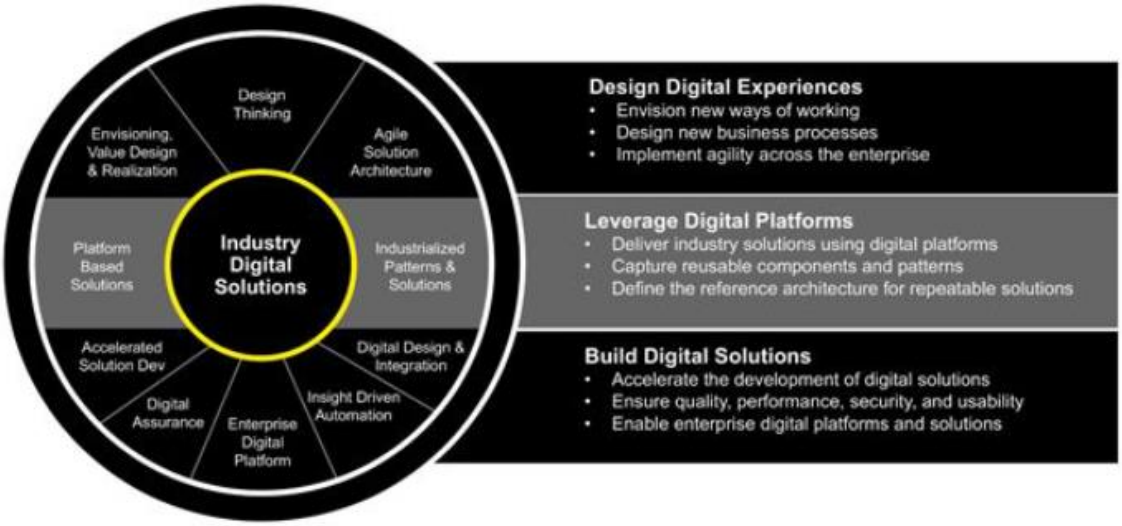

Figure 12: DXC's Digital Transformation Framework (DXC, 2017)

Just like MIT and Cognizant, this DXC framework advises organizations to keep what they manage to a minimum and to focus on their core competency, while outsourcing the rest.

Digital Transformation in Education

COVID-19 pandemics forced HEI (Higher Education Institution) to immediately transform their teaching and organisational activities in a digital environment. Nowadays, the major challenge is on how to keep the transformed processes and continue with further development in the context of DT digital transformation. Existing research mainly focus on digital learning environments and studies that are usually divided in 3 different perspectives: technical (Gafurov, I. R. et al., 2020) pedagogical and organisational (Jackson, N.C., 2019).

One of the possible approaches to DT of HEI is to learn from enterprises that already experienced DT and tested different solutions. Research (Rof, A. et al., 2020) shows usage of business model concepts oriented towards innovation and entrepreneurial activities, primarily designed for private sector and implemented in the HEI environment.

Some other research focuses on the competences or phases of digitization, i. e. by exploring the digital transformation of higher education at University of Oslo authors (Bygstad, B. et al., 2022) identified tree different phases and concluded that rapid development during 2020/21 has created lasting and transformational changes with increased attention moving from dual digitalisation to digital learning spaces and that the potential for transformation significantly increases. Hence, their key recommendations are (Ibid.):

- Universities should adopt a learning-centric approach to digital transformation, i.e., establish a shared learning space, integrating technologies, pedagogies and organisational measures.
- Professors and lecturers need to redefine their role, moving from lecturing to orchestrating digital resources.
- Students should enhance their capacity to work in complex hybrid settings where different forms of digitalisation take place.

Another issue that needs to be clarified is the usage of the term's digitization, digitalization and digital transformation. The terms have been used synonymously and interchangeably but there is a clear distinction between them (Alenezi, M., 2021). Digitization and digitalization in their broad context concentrates on modifying analogue into digital world while digital transformation DT refers to „disruptive and holistic changes in the organisation with the incorporation of digital technologies." Therefore, in order to have a successful DT digital abilities and competencies are a prerequisite.

The goal of the EU Action Plan for Digital Education 2021-2027 (European Commission, 2020) is to adapt education and training to the digital age. Therefore, digital education at all levels of education and training must be a strategic priority. The other priority of any HEI strategy should be focused on the community in which it operates, on improving the digital skills and competencies of the population, which includes lifelong learning programs as a part of continuity of professional development. Through the strategic documents, where the general goals are defined, two goals are specifically determined and related to the digital transformation of the HEI (Kučina Softić, S. et al., 2021):

1) Better usage of digital technology for teaching and learning.
2) Developing relevant digital competencies and skills for digital transformation.

According to the Learning and Teaching strategies research (N: 303 HEI) in EUA document Trends 2018 Learning and teaching in the European Higher Education Area 86 % of the surveyed institutions (Gaebel, M., 2018) have an institutional strategy or policy for learning and teaching, mostly at the central level (46%), or at both the central and faculty level (38%). This confirms that learning and teaching stands as a priority. Overall, only 3% of institutions indicated that they have no learning and teaching strategy in place, and do not plan to develop one. Main points of the research were:

- Learning and teaching has become an institutional priority, generating dedicated strategies and structures, such as learning and teaching centres.
- Institutional strategies tend to focus on (a) international exchange and cooperation as a means for learning and teaching enhancement; (b) academic staff development; (c) other measures to improve teaching.
- National strategies, where existent, seem to give impetus and serve as a driver for institutions, although they do not stand out as the first source of inspiration for institutional learning and teaching strategies. Overall, institutions that have a learning and teaching strategy seem more influenced by university alliances at the national, regional, or international level.
- Many institutions have developed capacity for research on their own teaching, through a variety of channels (faculty or department of education, learning and teaching centre as a coordination point, etc.).

From a university perspective, digital transformation strategies aim to (a) increase the total revenue (b) enhance productivity (c) generate value through innovative practices and (d) develop a brand reputation and novelty (Mohamed A., et al. 2021), (Matt C. et al., 2015), (Shaughnessy H., 2018). Meaning, they need to formulate agile, realistic and scalable digital transformation strategies that assist as the centric philosophy that integrates the entire university's function (Mohamed A., et al. 2021). These requires comprehensive and different institutional approach to planning, implementation and monitoring e. g. strategic planning with concrete action plans.

Approaches and Practices in Setting a Digital Strategy

Most of the development strategies of European universities either do not mention the segment that includes digital context or conceptually integrate digital into their general institutional strategies as partial segment.

Separate strategy concepts focused on digitization or digital transformation that would be integrally positioned in the comprehensive university's digital strategy, which contemplates the integrity of the system with all its constituent parts with the aim of achieving disruptiveness, are absent in most European universities. Digital strategy has been one of the relevant indicators on how HEI's approached the process of digital transformation and which segments they've integrated into it. The intellectual output 3/activity 4 will go deeper in the analyse of concrete segments and this R3 A1 report contains only short in-site overview on some currently available concept based on the summary resented in previous chapters.

The subject of the analysis is only the recognition of strategy elements that would indicate digital transformation without analysing other segments of the strategy itself. For this purpose, 15 European university strategy documents and strategic plans were analysed concerning a strategic approach to

digital transformation regarding the broad context of its impact in all the segments of the university community and all its external stakeholders. This doesn't mean that these institutions haven't been working on the context of digital transformation or already implemented it but only reflection on the current available documents. None of the analysed strategies haven't had comprehensive approach to digitalisation leading to digital transformation (i. e. digital strategy as separate document outside the general institutional strategy).

Searching for the examples of good practice leading to the information of HEI's digital transformation concepts, and in addition to everything that should be a subject of interest in the process of developing digital (transformation) strategy we can here find few international examples of universities that already developed a digital (transformation) strategy with all the segments integrated comprehensively. The following table contains a list of universities with links on their publicly available strategy documents (Table 2).

Table 2 Selection of digital (transformation) university strategy documents

DIGITAL (TRANSFORMATION) UNIVERSITY STRATEGIES		
University	**Country**	**Documents**
Université de Genève	Switzerland	Digital strategy; Digital strategy Action Plan
Durham University	UK	Digital Strategy 2020-2027
University of Wolverhampton	UK	Digital Strategy to 2025
University of Nottingham	UK, China, Malaysia	Digital Strategy Delivery Plan
University of St Andrews	UK	Digital Enabling Strategy 2019-2023
Dalhousie University	Canada	Dalhousie's Digital Strategy: Report
Ulster University	Ireland	Digital Strategy 2020-2023
University of Oxford	UK	Digital Strategy
University Sorbonne	France	Strategic Plan (2019 – 2023)

By looking at the content of these digital strategies, and putting aside their specifics and very individual nature of transformation momentum achieved, they were all aiming at strengthening transformation and innovation segments within their educational model. These examples could be further analysed and used as a checking point for outlining a possible proposal for digital strategy content model and blueprint structure for digital transformation in education.

Digital Strategy Outline

Examining the afore mentioned sample of digital (transformation) university strategy documents, we may find out they tend to follow very similar and comparable pattern in outlining their content model and structure.

1. **Digital technology for teaching and research**
   1.1. Students first
   1.2. Creation of innovative types of teaching and knowledge assessment based on digital technologies
   1.3. Enhancing digital skills and engagement
   1.4. Skills and knowledge for economic and social transformation
   1.5. Strengthening digital values and confidence
   1.6. Measuring KPI's
2. **Digital solutions for open, connected science**
   2.1. Researcher oriented digital environment
   2.2. Innovation and achievements of the research goals
   2.3. Collaboration with external partners on scientific projects
   2.4. Promoting open science
3. **Digital expertise in the service of society**
   3.1. Social responsibility
   3.2. Diversity and inclusivity
   3.3. Promoting digital innovation and creativity
   3.4. Promoting lifelong learning
4. **Digital tools for the University community**
   4.1. Collaborations on digital issues with academic and non-academic external partners
   4.2. Responsible use of digital technology by the university community
   4.3. Digital platforms integration
5. **Governance for the digital transformation of the University**
   5.1. Strategic priorities
   5.2. Information, cyber security and privacy
   5.3. Challenges
   5.4. Financial implication
   5.5. Governance
   5.6. Risk mitigation and management
   5.7. Implementation

This extracted sample of structure may serve as a solid starting point in elaborating and outlining a typical blueprint for design of digital strategy documents in other educational institutions that are yet to start developing their own.

Conclusion

Scholars argue (Mohamed, A. et al., 2021; Matt, C. et al., 2015; Shaughnessy, H., 2018) that the underlying composition of digital transformation strategy is described by:

a) increasing use of technology
b) ability to create value
c) supporting structural changes, and
d) economic gains.

Analysed examples and issues described by the experts in the field of education who are working on digital transformation indicate that when planning and considering a comprehensive approach to this topic we should not only consider one segment itself regarding e-learning, platforms or digitalisation of documentation and teaching materials. Digitization and transformation are comprehensive and include the broad environment in which educational organizations operate as well as community liaison and many external stakeholders.

In not so many publicly available Digital Strategies of universities (which only indicates the need for more attention to this topic) several key strategic areas are treated in a more or less similar way. One of them is shared values like inclusiveness, equity, diversity, accessibility, seamlessness, integration, lifelong learning, transparency, sustainability, privacy, security, digital literacy, and community focus. Furthermore, integration (well-integrated and supported systems and platforms will enable all users to thrive), shared data as an institutional asset, communications and training and user-oriented areas.

To develop a comprehensive digital strategy for educational institutions as a blueprint requires further discussion with all-inclusive approach to digital transformation in education. This report represents only the first step in further research activities leading to this project final analysis and proposal of the blueprint (R3/A4).

Exploring the Institutional Approach to Digital Strategy

Author: Lidija Kralj, Algebra University College

During 2022, project partners have mapped the digital readiness and resilience of HE/VET institutions in response to the COVID crisis in the context of governance and enabling services, teaching and learning practices, and infrastructure in Bulgaria, Croatia, Germany, Italy and EU. Project partners also collected information about concepts and frameworks, examined case studies and best practices, and were outlining a blueprint for the strategical approach to digitalisation while exploring the institutional approach to digital strategy.

The records revealed that pre and post-COVID digitalization efforts in HE/VET institutions have been a complex issue. In both periods, digitalization has been high on national policymakers' agenda, with obvious more prominence given in the post-COVID period. The accent on digitalization in the pre-COVID was driven more by the need for innovation (digitalization has been perceived as inextricably linked with innovation, either as a vehicle or an end by itself), while during COVID and in the post-COVID period digitalization was more driven by needs (during pandemics digital modes of delivery was the only way to continue with education process and services).

Though there was vocal commitment by government, the implementation has been exacerbated by different issues, such as underfunding, scepticism in academia, lack of competent or trained staff, and lack of institutional execution capacity (among others).

Institutions have made an amazing effort for moving all their educational activities online, despite the existing technical constraints (i.e. schools were not equipped with digital learning platforms, not all students had appropriate and required devices, connectivity was an issue in some residential areas, etc.) and unprepared staff and educators (i.e. appropriate teaching methods, ICT skills, etc.).

During the pandemic, schools and universities have shown great response capacity and resilience, and they have held it up during the COVID emergency. At the same time, distance teaching instead of being taken as an opportunity to leap forward, from the pedagogical perspective have rather represented a step back, since educators were widely sticking to traditional frontal teaching, albeit online.

However, digitalisation of HEIs could also be assessed in the context of the Bologna Process in the European Higher Education Area and the Digital Agenda for Europe of the European Union (EU). Moreover, it is strongly associated with the development of distance education that has had strong historical roots in the higher education and received a new impetus in the early 21st century when personal computer and internet technology were introduced as a new means of education. By that time many HEIs started developing and introducing their own e-learning platforms. This process got a particular momentum when significant budgets were invested in support to the development of electronic systems for distance education.

The challenges of digital transformation can be categorized and associated with five groups of issues: learning styles and cultures, digital pedagogy, technology, technical training, and time management challenges. On the other hand, enablers of digital transformation are educators, and their passion for and innovations in distance teaching and learning is crucial. Institutions are challenged more in their

capacity and capability to adapt by enhancing the quality of teaching while providing for the de-bureaucratization of processes and freeing up resources required for innovative approaches to education, curricula design and research networks.

Digital transformation is one of the key dimensions of modern social, economic, and organizational development in adapting to the increased internal and external use of digital technologies and ascending digital society and economy. In order to successfully initiate and implement transformation, educational and all other organizations need to be able to answer a number of related questions: how to manage processes and communicate digitally, which social networks to use, how to optimize online operations, how to dynamically manage costs, should physical libraries be kept? These are just some of the questions that need to be answered in order to prepare the appropriate plan, harmonize procedures and master changes that will affect all activities of the organization. Digital transformation also implies making changes in the strategy, operational model, procedures, as well as in the organization's culture. Digital transformation brings an opportunity for reinterpretation and fundamental change in almost all aspects and segments of living and doing work. But digital transformation also bears many transitional risks when it comes to understanding and grasping its complexity, formulating appropriate digital alternatives, implementing, and transforming processes, coping with transformation obstacles and barriers, and achieving expected added value gains out of transformation.

Due to the experience in digitalisation gained by educational institutions before, during and after the pandemic, they have now accomplished preconditions for setting up a more comprehensive approach to the process of digitalisation: through strategic planning and regular assessment of the results achieved. The Council of EU, in its *Council Recommendation on blended learning approaches for high-quality and inclusive primary and secondary education*[4]*,* has recommended developing longer-term strategic approaches to blended learning and building on successful innovations introduced or tested during the pandemic to share and scale good practices.

In an OECD research document (Reimers et al., 2022), on how the COVID pandemic was disrupting and changing education, the authors discuss opportunity to rethink how to create a business culture for innovation in education, since they found out that for most of institutions it appeared easier to buy new tools and systems than to invest in redesign of all its processes. In that context, policymakers and institutions' management will need to become much better at building agenda for innovation, resilience and change, and support for digital transformation.

The education systems are large and complex, and process of digital transformation will be extremely difficult venture. In addition, it is necessary to consider all its multidimensional segments integrally if aiming to achieve essential, planned for and comprehensive transformation. EU is making great effort in providing development resources, supporting research and designing varied frameworks for digital knowledge and skills, hoping European educational institutions would be moving on and catching-up.

[4] The Recommendation was adopted at the Council meeting on 29-30 November, 2021 (Official Journal of the European Union, 14.12.2021, p. 5, no. 1).

Institutional Contexts

During 2022, project partners have mapped the digital readiness and resilience of HE/VET institutions in response to the COVID crisis in the context of governance and enabling services, teaching and learning practices, and infrastructure in Bulgaria, Croatia, Germany, Italy and EU. Country reports were submitted encompassing many information about different concepts and frameworks used, identified case studies and best practices, and efforts to design both institutional and pedagogical strategical approach to digitalisation. Not surprisingly, that mapping has showed many similarities, but also many differences in the momentum, approaches and outcomes in the digital readiness and resilience response of HEI/VET to the COVID crisis.

Pre-COVID State of Digitalisation

Before COVID pandemic, all project partner countries were adhering to the EU frameworks and programmes in the field of education and its digitalisation in particular, such as the Digital Agenda for Europe, the Digital Education Action Plan 2021-2027, the European Skills Agenda for sustainable competitiveness, social fairness and resilience, the European Education Area by 2025, etc. In all project countries digitalization of education was simultaneously supported for and limited by regulations and policies on all government levels: national, regional and county or municipality, up to the university and educational institutions' authorities.

Many different policies, activities, projects and programmes focusing on digitalization were designed, developed and implemented in all partner countries at all levels of formal and informal education, including HEI and VET, albeit with the varied success. In all these countries, strategic plans aiming at implementing information technology in education were developed, initially at university and later at the pre-tertiary institutional level.

Despite all the programs, funding, and actions for speeding up the digitalization of education system before the pandemic, institutional practice was still holding back. Different constraints were indicated that were preventing more dynamic digital transformation: from lack of high-speed connections and proper infrastructure, to non-preparedness and cultural resistance of educators and administrators toward new, digitally enabled teaching, learning and management practices.

The drivers and motivators referenced in most of the countries were:

- Prepare people better for the demands of 21st century and digital professions
- Strengthen digital literacy in the digital era
- Include more citizens in education
- Flexible form of higher education
- Motivation of teachers to integrate new technologies into the educational process.

The barriers and obstacles referenced in most of the countries were:

- Distance education supressed vs. on-site formats
- Lack of strategic commitment, clear vision and good strategy from the top
- Deficient communication and collaboration among different stakeholders

- Attitude of the administration on fixing things with ‘new techno’
- Lack of continued and structural support and guiding for students and staff
- Resistance to change
- Marginalised and vulnerable students in the gap of digital services
- Concerns about data protection, privacy and data austerity

During and Post-COVID State of Digitalisation

Although the impact of COVID pandemic on education institutions was stressful, since in most cases they had no contingency plans ready, education systems in general responded with solidarity and acted with bare uniformity: teaching was continued by use of pedagogical modalities that did not require physical presence. Since institutions were not ready and had no time to prepare, and they were forced to close on-site and move overnight to online operations, participants (both educators and students) sought their own delivery paths and eventually relied on creativity and innovation when were accelerated into this new form of teaching and learning.

Most of the governments have developed some sort of guidance documents to support educational institutions in the fast adaptation to new circumstances and conditions caused by the pandemic. Those documents were typically structured around:

- **Governance**:
    - How in-presence and online teaching and learning should be organized in terms of timing schedule and blending of synchronous and asynchronous activities
    - Which communication tools should be available for both students and families
    - Platforms and tools in use for digital learning
- **Teaching methods**:
    - Importance of using teaching methods appropriate for digital learning
- **Assessment methods and tools**:
    - Use of both summative and formative assessments, with the aim to assess and stimulate several dimensions, including the quality of the processes activated
    - Willingness to learn and to work in groups, the autonomy, personal and social responsibility, and the process of self-evaluation
- **Training for educators**:
    - For example, Italian guidelines required schools to appoint a digital animator with the responsibility to develop a school action plan and oversee its implementation
    - Plan had to start from the Digital School contents and provide its delivery indicators
    - Digital animator had to identify purposes, objectives, and actions within the areas of internal training
    - Involvement of the school community and creation of innovative solutions were expected

Identified drivers, motivators, enablers and driving forces behind digitalization of different aspects of education during and after COVID pandemic were:

- Connectivity services and devices
- E-learning and communication & videoconference platforms

- Digital content, simulations, augmented/virtual reality emulation of physical environment, and artificial intelligence
- Trainings for educators
- Tutoring and assistance services for students
- Internationalization without travel
- Assessments and examinations done online
- Provision of more flexibility
- Different innovative tools fostering better pedagogy
- Online administrative processes enabling smooth functioning of the educational system
- Fostering partnerships between institutions
- Carrying out apprenticeships and on-the-job delivery online
- Establishing several communication channels
- Equipment for students with lower socio-economic backgrounds
- Instructions for the age-appropriate use of the pre-prepared content
- Monitoring and support
- Educators motivation and training
- Helpdesk services for educators encountering problems with e-learning technologies
- Students prefer to continue studying online (online education was found to be more flexible and convenient for students, especially the more mature ones)
- Both students and lecturers saw their digital skills improved after the pandemic

Barriers, obstacles and pitfalls that have been observed in the context of education during and after the COVID pandemic could be sorted out into the four categories of issues:

- **Technological**
    - Lack of appropriate digital infrastructure (stable connection and bandwidth) to carry out effective education process
    - Internet connection and connectivity problems, system failures, devices not compatible or working properly
    - Remote areas without adequate infrastructure for digital learning and teaching
    - Unsustainable funding models for digitalization
- **Privacy**
    - Data privacy and protection regulation
    - Academic authorities exercising greater control and reducing the teaching autonomy
    - Teaching materials used and disseminated improperly
    - Proctoring and supervision
- **Well-being and logistics**
    - Exercising of joint and practical activities
    - Disruption of work-life balance, increased workload for both students and staff
    - Digital exhaustion and lack of focus, particularly after the long hours in front of the screen
    - Increased digital divide for students from disadvantaged social backgrounds
    - Distractive elements such as parallel social media communication, other family members in the same space, or a growing sense of isolation due to the lack of human contact

- **Didactics and other competencies**
    - Lack of competencies and skills of staff implementing digital content
    - Lack of time and motivation of teaching staff to create attractive and engaging digital educational content
    - Lack of pedagogical skills to manage work in a virtual environment
    - Lack of student engagement (attentive following of online lectures; difficult learning in online; organization of time; mental concentration, social contact, etc.)
    - Inclusion (some students without appropriate computer skills, devices and other equipment for a successful and positive online learning experience)
    - Lack of comprehensive competencies required for successful methodology and approach for effective conversion of non-digital into digital content

In all project participating countries sources emphasized that the pandemic led to a more structured approach to digital transformation, better analysis of the enabling services and infrastructure already available in the institutions and among students, and to the creation of plans and preparedness for future crises of any kind.

Outlook and Opportunities

Looking into the evolution of digitalization offerings from time before and after the COVID pandemic, acceleration of efforts in HEI/VET is more than evident. Some transformation efforts have been made prior to the onset of COVID, but governments have made quite a push on it through and after the outbreak of pandemic. Though they used pandemic as an opportunity to accomplish education system reform and modernization agenda, implementation momentum was often sluggish and sporadic. As for the education institutions, the pandemic has been widely acknowledged as an accelerator for digital transformation, however it came along with a range of difficulties and obstacles.

The COVID pandemic accelerated the process of digitalization in education, but also disclosed many remaining legacy issues that were hampering proper and comprehensive educational reforms before its outbreak, including leveraging of digital potential. Underfunding is often seen as a major problem, but the state of mindset, resistance to change and inadaptability for new skills acquisition were also identified as barriers to an uptake. In addition, digitalization also raises complex policy and regulatory issues such as ethics, privacy, and social justice.

In an abrupt and forced shift to online mode of delivery for all, it appears that some institutions who were offering distance education and use of the online e-learning platforms before, managed to go through the pandemic transition without significant process disruptions and compromised quality. Others have struggled and experienced serious omissions in the educational process. This can be explained by the fact that institutions providing distance education are very often technologically and methodologically better equipped and prepared, both in terms of hardware, software, and digital content, as well as in availability of lecturers trained and prepared for delivery of distance or online education.

Looking forward, probably the most important opportunity for digital transformation in education will be the range of programmes and courses that were developed, or are in the process of development, to help train and re-train teachers to deliver digital education in terms of new pedagogy, content, and methods of assessment. This refers not only to digital skills *per se* but also to cultural, interpersonal

and communication abilities. There is also an extensive discussion at the national, European, and international levels about how to narrow the digital gap and ensure inclusive digital education.

One more positive aspect of learnings coming out of COVID transition is realisation of need for strategy in digital education, to help guide institutions through the process of preparing delivery of high-quality digital education and institutional digitalisation. Today, every educational institution needs to develop a digital strategy and have a clearly defined execution plan, including a contingency response in case of crisis situations. Strategy has to encompass digital education program contents but also elaborated requirements for the professional development of educators, like new methods and ways of assessing and evaluating acquired knowledge and skills of students. It is especially important that the digital strategy is linked to other strategies at the institutional level and directions of development.

Digitalisation has been clearly a thorny path in all project countries, but it certainly has no alternative for the future. Irrespective of how the COVID pandemic affected institutions, digitalization is here to stay and propagate through all levels, kinds and forms of education.

Digital Strategy Approaches

In order to approach to designing a strategy for the digital transformation blueprint within the project DigiTransformEdu, we are combining exploration and analysis done in R1, findings about not only barriers, obstacles and pitfalls, but also drivers and motivators, enablers and driving forces behind digitalization of different aspects of education in Bulgaria, Croatia, Germany, Italy and EU with the presentation of the selected best practices in HE/VET institutions.

Digital transformation is not anymore a novel phenomenon nor is isolated to organizations and institutions. It became already a societal and economic common practice conditioned by digital paradigm shift. But business organizations are more exposed and use a variety of standardised frameworks and solutions to cope with it: improve their performance and keep up with the digital economy market demands. They continually invest huge and creative efforts to transform and improve their operational model, come up with new and innovative products, services, processes and business models, in order to sustain as either market challengers or leaders. This business context, experience and practice refers to HE/VET educational institutions as well. Though educational model is institutionally inherent and regulated at large, with the focus on providing educational services and knowledge creation as main outputs, educational institutions also strive for excellence, recognition, and better positioning towards competition. Intensive digital transformation in business provide educational institutions with frameworks, application experiences and operational practices that may encourage and inspire their own digital transformation proactivity and creativity.

In his working paper: *Digital strategies in education across OECD countries: Exploring education policies on digital technologies*, van der Vlies (2020) reports that many OECD countries have adopted a specific strategy on digital education or integrated this topic into a generic strategy on digital innovation as such. There is a high awareness among OECD countries of the benefits of digitalisation,

and the role of government to support digital innovation in education. This paper covers more than fifty digital education strategies published between 2015 and 2019[5].

From a HEI specific perspective (Mohamed et al., 2021; Matt et al., 2015; Shaughnessy, 2018), digital transformation strategies aim to:

a) increase the total revenue
b) enhance productivity
c) generate value through innovative practices and
d) develop a brand reputation and novelty.

Meaning, they need to formulate agile, realistic and scalable digital transformation strategies that assist the centric philosophy that integrates the entire university's function (Mohamed et al. 2021). These require a comprehensive and different institutional approach to planning, implementation and monitoring, e. g. strategic planning with real action plans.

The joint ILO-UNESCO report: *The Digitization of TVET and Skills Systems*[6] provides a global, high-level overview of how digitalization is affecting technical and vocational education and training (TVET) and skills systems (i.e. lifelong learning systems). The fundamentals of TVET digitalization are in the three-way collaboration between employers, students (or employees) and educational institutions with the support of the government as policymaker. This process is also accelerating hybridization of tertiary education.

As stated in this ILO-UNESCO report, very few countries have a coherent strategy of TVET and skills systems digitalization. From policy perspective, TVET and skills strategies tend to focus on digital adaptation, with varying degrees of emphasis on:

- Modernizing TVET and skills development, so that it teaches 'new skills' (both technical and transversal) required by the labour market
- Increasing the responsiveness of TVET and skills development to the labour market, notably by improving labour-market intelligence and the timeliness of programme responses
- Equipping students better for the labour market
- To a lesser extent, equipping students with entrepreneurial skills to find or create jobs themselves.

A corollary to the lack of policy focus on digital TVET and skills development is that much digital innovation is taking place at the institutional level. Such innovation tends to iterate and improve existing processes through the use of technology. Essential prerequisites for such grassroot innovation may include:

- Institutional management that keeps abreast of technological developments and is open to change
- Availability of basic infrastructure, such as electricity, broadband and equipment
- Sufficient institutional autonomy to invest in technology

[5] *OECD Education Working Papers No 226,* 50 digital education strategies (p 24).

[6] *The Digitization of TVET and Skills Systems*. (n.d.). Retrieved January 18, 2023, from https://www.ilo.org/skills/areas/skills-policies-and-systems/WCMS_752213/lang--en/index.htm

- Ability to create a culture of innovation encompassing all institutional staff
- Close connection with students and industry to respond to demands for digitization.

The team of the Erasmus+ Powerhead project (POWERHEAD, 2022)[7] found out essential preconditions for the digital transformation of HEI, which are very similar to the findings of our DigiTransformEdu project:

- Modernising the infrastructure
- Adequate funding Professionalisation of teaching staff
- Developing students' digital competencies
- Importance of support functions in and outside institutions
- Developing and conveying a vision in higher education institutions
- Embedding in quality assurance and Health aspects.

Leading the Way

Looking for the institutional best practices in approaches to digital educational strategy we identified a couple of notable 'leading the way' examples.

Durham University Digital Strategy[8] pursues to an institution-wide strategy, very much focused on delivering benefits, not just technology, and experience-based, agile, flexible and grounded. This is an example of the organisational strategy, not a strategy of the IT department. It seeks to unite the entire organisation behind a single digital vision, with a clear roadmap that is setting out when the new functionality will be delivered (Durham University, 2020). It has envisioned a comprehensive approach to its development in four critical stages (Figure 1).

[7] Powerhead is an EU Erasmus+ project coordinated by the Flemish Department of Education and Training, and implemented in cooperation with the Flemish Education Council and the Ministry of Education and Science in Latvia in 2020-2022. Retrieved January 18, 2023, from https://www.vlor.be/powerheadproject

[8] *Digital Strategy - Durham University*. (n.d.). Retrieved January 18, 2023, from https://www.durham.ac.uk/about-us/professional-services/computing-information-services/strategy/digital-strategy/

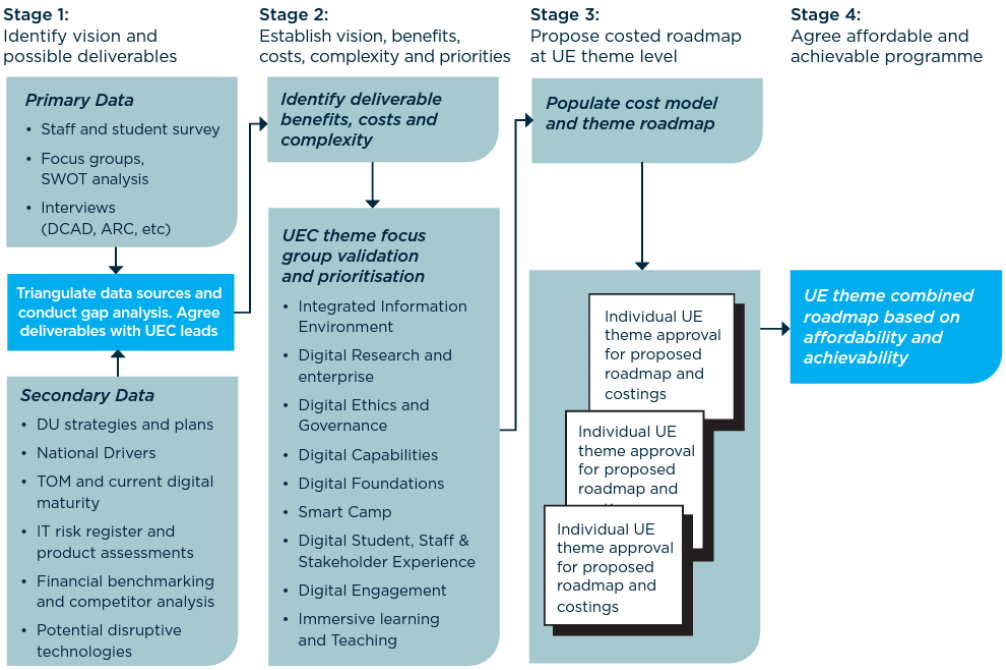

Figure 13: Digital strategy approach (Durham University, 2020)

These stages are structured around the following set of internal and external activities:

> Stage 1: Identify vision and possible deliverables. The goal in this stage is to review available secondary data and undertake a digital staff satisfaction survey of IT services. Interpretation of the survey results were conducted through three focus groups with representation from across the organisation. This evidence served as the baseline position for identification of potential projects and corresponding costs.
>
> Stage 2: Establish vision, benefits, costs, complexity and priorities. The goal is to categorise potential projects into themes and refine them with theme leads. Thereafter undertake theme workshops in order to identify any gaps, add further project detail and prioritise into a roadmap. Individual project details are to be added by working with project sponsors to a defined template. External partner to undertake interviews with IT providers to support the identification of an agreed University operating model.
>
> Stage 3. Propose a costed roadmap at the theme level. The goal is to publish a draft strategy for consultation and input from various stakeholders and committees, including the strategy Council. Concurrently populate a cost model and propose an affordable and achievable portfolio in line with organisational priorities and benefits. Present to individual theme leads and refine.
>
> Stage 4. Agree on an affordable and achievable programme. The ultimate goal is to agree on a finalised strategy and roadmap, and disseminate through the University governance structures. Transition into implementation.

Jisc, a UK digital, data and technology not-for-profit agency focused on tertiary education, envisages that education and research improves lives and that technology improves education and research. In

the guide *How to shape your digital strategy*[9] they explain 'how to create a broad, organisationally focused digital strategy that develops digital capabilities and harnesses the potential of digital devices and services' (Thomas and Ayton, 2021).

They suggest starting with a digital vision in which an institution will share and communicate what the digital experience looks like, help stakeholders to stay connected to the values that inform digital practice, support new members' integration into the way they do things and act as a call to action. Once a vision for the institution's digital future has been agreed, there is a need to identify the strategic goals for achieving the vision. The selected strategic goals should be created through the collection of evidence and analysis of trends, using external and internal analysis methods (i.e. PESTLE or/and Porter's Five Forces, SWOT or/and SOAR analysis, etc.).

ILO-UNESCO (ILO-UNESCO, 2020) proposed a set of recommendations[10] which they grouped under the following two headlines:

1) Programmes to improve the evidence base informing digital transformation
2) Strategies for digital transformation.

In practice, the recommendations are interlinked and need to be addressed integrally, holistically and as a composite. This segmented approach to policymaking and implementation creates multifaceted pressure for TVET to modernize in response to a changing world, industry sectors and labour market, reflecting TVETs role as a service provider.

Notwithstanding, the fragmented and complex nature of skills systems do not necessarily work in favour of integrated policy approaches.

Powerhead project (POWERHEAD, 2022) have delivered a number of quality outcomes and within, prepared a set of digitalisation policy guidelines[11] for the national authorities and higher education institutions, including the action items recommended in areas such as:

- Vision
- Policy and Quality Assurance
- Skills and Digital Readiness
- Funding and Infrastructure
- Students
- Course & Curriculum Design
- Cooperation and Stakeholders.

[9] *How to shape your digital strategy | Jisc*. (n.d.). Retrieved January 18, 2023, from https://www.jisc.ac.uk/guides/how-to-shape-your-digital-strategy#
[10] *The Digitization of TVET and Skills Systems*. (p. 77-79). Retrieved January 18, 2023, from https://www.ilo.org/skills/areas/skills-policies-and-systems/WCMS_752213/lang--en/index.htm
[11] *Outcomes | Vlor*. (n.d.). Retrieved January 18, 2023, from https://www.vlor.be/powerheadoutcomes

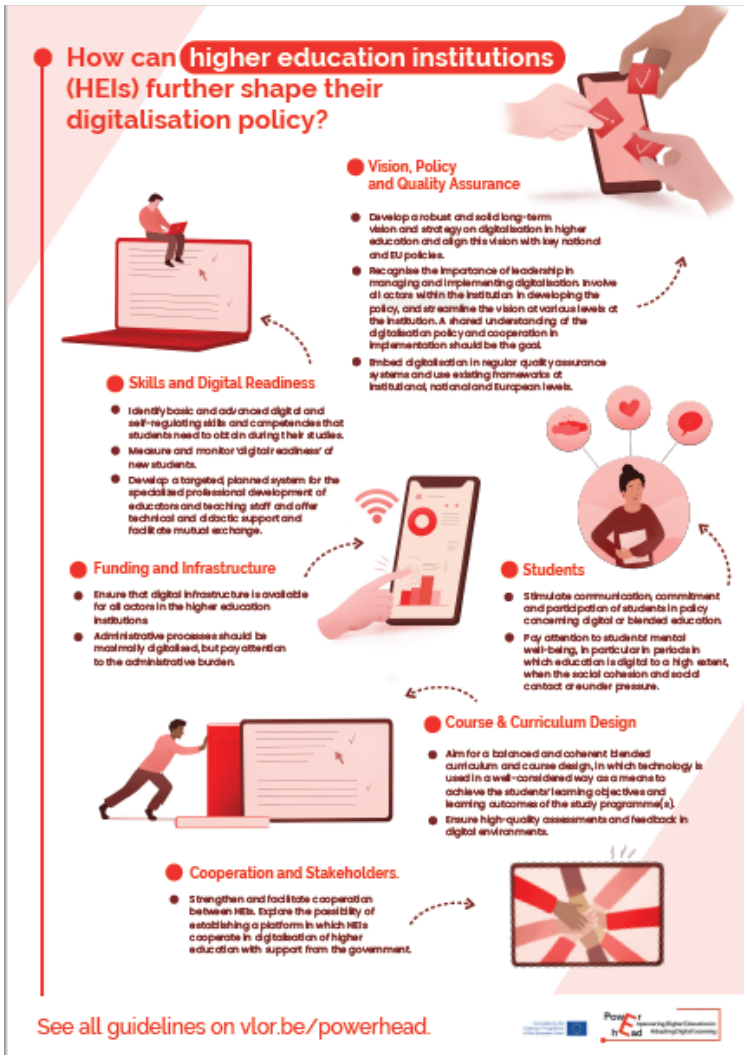

Figure 14: A summary of guidelines for shaping digitalisation policy in HEIs (POWERHEAD, 2022)

Involving All Stakeholders

Aforementioned examples, as well as elements defined by the experts who are working on digital transformation strategy in education, indicate that comprehensive approach to it is inevitable. When planning for and approaching to this topic we should not considering one segment and disregarding others, like e-learning, teaching platforms and tools, digitalisation of documentation or teaching materials. Likewise, digitization and transformation should be not only comprehensive but also well thought through and integrated, like reformed program content and redesigned curricula. That requires including the broad social, economic and political exterior environment in which HEI operates, and many individual and institutional external stakeholders.

In *A guide to creating a digital strategy in education* (NetSupport, 2021), the authors Kingsley and Anderson[12] are providing a brief overview and mapping of all the interlocking stakeholders who need

[12] *A Guide to Creating a Digital Strategy in Education - Version 2 - out now! - NetSupport*. (n.d.). Retrieved January 18, 2023, from https://www.netsupportsoftware.com/20210114a-guide-to-creating-a-digital-strategy-in-education-version-2-out-now/

to take part in delivering a successful digital strategy for a school, district, local authority, or any other education institution.

Figure 15: A stakeholder map to creating a digital strategy in education (NetSupport, 2021)

Besides other typical segments of a strategic document, this guide is also putting some attention on public regulation in areas like Special Education, Data Privacy and Online Safety, supported in EU through the Digital Service Act[13], GDPR[14] and soon-to-be-published AI Act[15].

An important step in the strategy creation process is to identify, understand, empower and include all relevant stakeholders (Thomas & Ayton, 2021), that could be achieved by the following steps:

- Assemble the views of your key stakeholders
- Map the stakeholder views to organisational aims, objectives and policies
- Assign objective owners to build and implement objectives for their areas.

The stakeholder consultation process was a very important part of development of the new *Ireland Digital Strategy for Schools to 2027* (Department of Education Ireland, 2022). The development of this

[13] *The Digital Services Act package | Shaping Europe's digital future*. (n.d.). Retrieved January 18, 2023, from https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package
[14] *General Data Protection Regulation (GDPR) – Official Legal Text*. (n.d.). Retrieved January 18, 2023, from https://gdpr-info.eu/
[15] *The Artificial Intelligence Act |*. (n.d.). Retrieved January 18, 2023, from https://artificialintelligenceact.eu/

Digital Strategy has been informed by a wide-ranging and extensive consultation process to ensure that all voices were given an opportunity to contribute and inform its development. The consultation process consisted of:

- Online questionnaires for teachers, principals, parents, and students
- Open call for submissions for interested stakeholders, including management bodies, teacher unions, industry representatives, individual businesses, teachers, principals, and parents
- Focus Groups: Following an analysis of the findings from the questionnaires and open call, themes were developed for discussion in more detail
- Consultative Group: This was a key group comprising representatives from the education partners, parents and students' groups and an overarching industry representative
- Bilateral discussion with Denmark, Estonia and Finland's education authority.

Figure 16: Ireland Digital Strategy for Schools to 2027 consultation process map (DEI, 2022)

Through 2021 and 2022 Oxford University have been developing a new *Digital Education Strategy*[16] which aimed at shaping the future of its digital education (University of Oxford, 2022). During the consultation between staff and students, an inventive step in the process was organized and conducted: student writing competition to help inform the new Digital Education Strategy for Oxford University. Students were invited to write about:

- Inclusion and digital education: *How could digital technologies make learning spaces more inclusive at Oxford?*
- Innovation and digital education: *How could digital technologies engender educational innovation at Oxford?*

[16] *Shaping the future of digital education at Oxford | Centre for Teaching and Learning*. (n.d.). Retrieved January 18, 2023, from https://www.ctl.ox.ac.uk/digital-education-strategy

- Openness, global reach and digital education: *How could digital technologies enhance Oxford's capacity for openness and ability to reach wider audiences (e.g. open access, knowledge exchange and outreach)?*

As with any strategy, the success is based on the time taken to cooperate and co-produce, with all stakeholder voices well heard, and then ensuring it is sufficiently embedded into the execution plan, so that it will remain effective and deliver impact over time.

Beyond Devices and Technology

Digital transformation in education is leveraging digital technologies to enable major educational improvements, enhance learner and educator experiences, and create new instructional modalities through policies, planning, partnerships, and support (Martin and Xie, 2022).

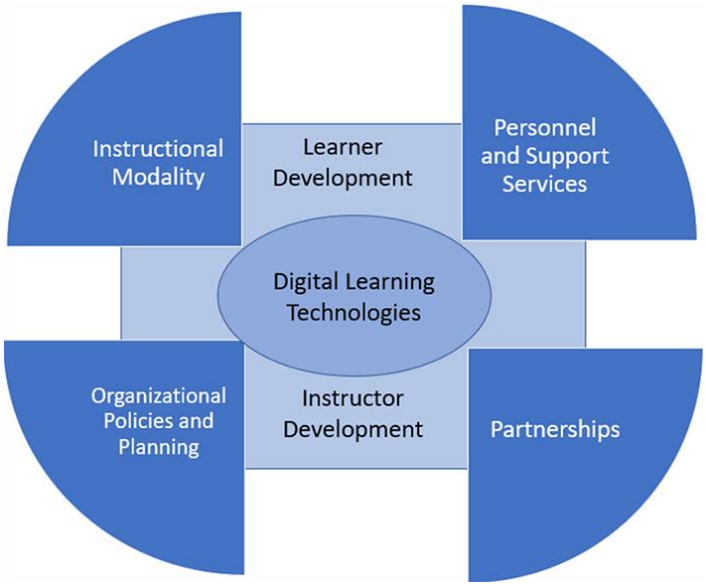

Figure 17: Digital learning matrix in Higher Education (Martin and Xie, 2022)

As for the **Instructional Modality,** besides already often used on-site technology enhanced learning, blended, asynchronous and synchronous online learning and teaching, Marin and Xie are suggesting that learning can also be facilitated through additional instructional modalities like:

- **Bichronous online**: blends asynchronous and synchronous online teaching and learning. Students participate in the asynchronous classes at the time and location of their choice, and they participate in the synchronous classes in real-time
- **HyFlex**: offers the most flexibility. It combines in-person and online students in the same classroom. HyFlex learning is similar to hybrid or blended learning, but it allows students to choose their modality based on their needs and daily circumstances.

In the area of **Organizational Policies and Planning**, Marin and Xie are pointing out that institutional policies and standards need to be set up for digital teaching and learning: digital transformation must be part of the strategic planning, examining funding models for different modalities and ensuring

equitable learning opportunities for all students. They also emphasize the importance of **Partnerships and collaboration** with other universities, professional organizations, and industries.

However, the Department of Education Ireland (2022) recommends a three-pillar approach to the transformation strategizing:

- Supporting the embedding of digital technologies in teaching, learning and assessment
- Digital technology infrastructure
- Looking to the future: policy, research and digital leadership.

This approach follows the strategic objectives of the EU Digital Education Action Plan[17] and includes developing a "high-performing digital education ecosystem" and "enhancing digital competences for digital transformation". To this end, Ireland *Digital Strategy* will continue to support school leaders and educators through effective initial education and ongoing professional learning. Aim is in supporting educators to develop essential skills and empowering them to gain the maximum advantage from digital technology in every classroom, for the benefit of all learners.

Ireland Digital Strategy points that it is created with the learner in the centre, ensuring that:

- All learners will be supported to reach their full potential
- All learners will be supported to have appropriate and equal access to digital technologies, in particular individuals at risk of educational disadvantage and those with additional learning needs
- Use of digital technology becomes as much a core part of the education journey as basic literacy and numeracy skills are, with a deliberate and increased use of digital technology in teaching, learning and assessment
- All teachers are supported to further embed the use of digital technologies in their classrooms to support all learners in a safe, responsible, and ethical way.

The digitization of TVET was not identified as a separate area of government strategy: in the countries surveyed in the ILO-UNESCO report[18], no single ministry or body was found responsible for taking ownership of the strategy implementation or any underlying programmes. Digitization of TVET and skills systems hosts different policies and regulatory frameworks (ILO-UNESCO, 2020), thus:

- Core infrastructure required for TVET provision, including provision of (mobile) broadband, is typically covered by telecoms policies and regulators
- Industrial and economic policies typically set the pace of digitization across the whole economy, often with a country picking certain sectors. TVET and skills systems then typically react to these decisions, by teaching the applied skills required to meet these demands
- Regulation of specific education and training institutions, including the approval of new digitally enabled pedagogies and decisions on funding for digitization of VET institutions, are typically handled at the level of the education or labour ministries, or related agencies

[17] *Digital Education Action Plan (2021-2027) | European Education Area*. (n.d.). Retrieved January 18, 2023, from https://education.ec.europa.eu/focus-topics/digital-education/action-plan
[18] *The Digitization of TVET and Skills Systems*. (n.d.). Retrieved January 19, 2023, from https://www.ilo.org/skills/areas/skills-policies-and-systems/WCMS_752213/lang--en/index.htm

- Policies on digital-skill development are often shared competencies between 'digital ministries', together with education and training strategists
- Opportunities for work-based learning will also involve job agencies and employment ministries.

ILO-UNESCO (2020) report states that *just-in-time learning* is gaining increasing value. This also has implications for TVET institutions: rather than offering monolithic programmes for pre-set professions, they need to apply a 'plug-and-play' approach, whereby different skills units are bundled in different configurations for different stakeholders and different purposes. That would enable microlearning modules, teaching a discrete skill at any time. Thus, when individuals need specific skills for their job, they can quickly undergo the training. These lifelong education and training pathways also require innovation in digital credentials and e-portfolios, aiming to ensure that competencies and skills are presented concisely, with the verification and visibility of the full lifelong learning standards.

One of the elements in VET digital transformation is *digitally enabled guidance pathways* which typically involve: self-assessment tools, personal skills profiles, and recommender engines, which can suggest suitable employment opportunities based on a certain skills profile or appropriate learning. An example of digitally enabled guidance pathways could be found in the *Singapore Skills Framework*[19] co-created by employers, industry associations, education institutions, unions and the government, for the Singapore workforce. It aims to create a common skills language for individuals, employers and training providers, further facilitating skills recognition and supporting the design of training programmes for skills and career development.

Creation and provision of digital transformation plans for VET require involvement of a broad range of professionals, especially when it comes to advanced skills. It is up to industry and manufacturers of the live systems to create and provide training or simulation. Some of the professionals mentioned in the research are also instructional designers, media creators, assessment and specific skills experts (ILO-UNESCO, 2020).

ILO-UNESCO report also highlights *virtual apprenticeships and internships* as a mean of work-based learning from home. 'Virtual apprenticeships' or 'virtual internships' are conducted remotely, with learners and mentors interacting and collaborating with the rest of the company teams through digital communication tools. Typically, these arrangements lend themselves to jobs which can be performed in this manner, e.g. programming, digital marketing, journalism and media production, but also to the jobs that are supported by simulation technologies, like welding, customer service or specific industrial control systems (ILO-UNESCO, 2020).

Apprenticeships and internships at the VET/HE level provide students with smart opportunities to build up new skills and knowledge, both on and off the job, while providing companies with a reliable way to evaluate and shape potential future hires. The *Apprentice Track* project[20] researched and created a roadmap supported by the *Tool-Prototype for Management of Apprenticeships* to assist in matching the learning outcomes of students with the needs of specific employers.

[19] *SSG | Skills Framework for Training and Adult Education*. (n.d.). Retrieved January 19, 2023, from https://www.skillsfuture.gov.sg/skills-framework/tae

[20] *Welcome - Apprenticetrack*. (n.d.). Retrieved January 19, 2023, from https://apprenticetrack.eu/

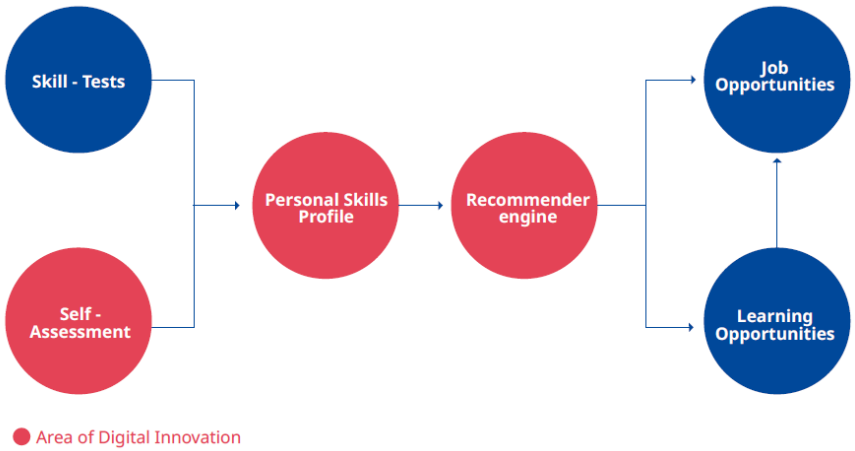

Figure 18: Digitally enabled guidance pathways (ILO-UNESCO, 2020)

ILO-UNESCO (2020) report stress that the *ethical implications of digitization* are receiving insufficient attention. Missing from this conversation include: ethics of introducing various technologies, digital TVET reinforcing or addressing digital divides, the pitfalls of algorithmic bias in AI, reinforcing social stereotypes, implications of competence-based learning for professional values, academic autonomy and digital performance surveillance tensions, power dynamics between employers, competition between public and private educational providers, and technology enabled students. Developing a digital strategy should also bear in mind EU *data privacy* and *online safety* policy recommendations like the Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators[21]. These aspects that should be part of any future HE/VET institutional digital strategy.

Conclusion

During 2022, project partners have mapped the digital transformation readiness and resilience of institutions in response to the COVID crisis in the context of governance and enabling services, teaching and learning practices, and infrastructure in Bulgaria, Croatia, Italy, Germany, and EU. The mapping showed many similarities and differences exist across the HEI/VET digital readiness and resilience in response to the COVID.

Although the impact of the pandemic on education institutions was stressful and, in most cases, there were no contingency plans, education systems as a whole responded in solidarity and acted uniformly: teaching continued using pedagogical modalities that did not require physical presence. As there was no time to prepare for the online environment when the university and schools closed, educators and students sought their own paths by showing creativity and innovation that accelerated the new era of

[21] *Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators | European Education Area*. (n.d.). Retrieved January 19, 2023, from https://education.ec.europa.eu/news/ethical-guidelines-on-the-use-of-artificial-intelligence-and-data-in-teaching-and-learning-for-educators

teaching and learning. All country participants emphasized that the pandemic led to a more structured approach, analysis of the enabling services and infrastructure, and plans for creation digital strategies and readiness for the future crises.

Comparing state of affairs before and after the COVID pandemic, acceleration in digitalization offerings and efforts in HEI/VET is evident. Though some efforts have been put in place prior to the onset of COVID, and governments have been making a push in reforming and modernizing education, implementation was often sluggish and sporadic. The pandemic has been widely acknowledged as an accelerator for education institutions digital transformation, though it came along with a range of new difficulties and obstacles.

All the project partner countries adhere to the EU frameworks and programmes in education and its digitalisation in particular, such as the *Digital Agenda for Europe*, the *Digital Education Action Plan 2021-2027*, the *European Skills Agenda for sustainable competitiveness, social fairness and resilience*, the *European Education Area by 2025*, etc. In all countries digitalization of education is supported and framed by regulations and policies on several government levels: from state, regional and county to university and educational institution authorities.

Digital transformation brings an opportunity for reinterpretation and fundamental change in almost all aspects and segments of living, doing work and education. Digital transformation also bears many transitional risks when it comes to understanding and grasping its complexity, formulating appropriate digital alternatives, implementing, and transforming processes, coping with transformation obstacles and barriers, and achieving expected added value gains out of transformation.

Digital transformation strategies for HEI/VET aim to increase the total institutional input and output, enhance productivity, generate value through innovative practices, develop brand reputation and novelty while facilitating collaboration between all stakeholders: employers, students (or employees) and educational institutions with the support of government as the policymaker.

Digital strategy is usually a process and developed through several stages including: identifying vision and deliverables, benefits, costs, complexity and priorities, proposing a roadmap, publishing a draft strategy for consultation and input from various stakeholders, agreeing on an affordable and achievable programme. The selection of strategic goals should be achieved through the collection of evidence and analysis of trends, using external and internal analysis methods in consultation with different stakeholders and partners.

Digital strategy should support embedding of digital technologies in all aspects of teaching, learning and assessment, digital infrastructure and future outlook. It should also encompass policy, research and digital leadership objectives of EU in developing high-performing digital education ecosystem and enhancing digital competences for digital transformation. It should not be covering only devices and technology, but also enable the development of new instructional modalities and student support processes, like *HyFlex* and *Just-in-Time* learning, digitally enabled guidance pathways, digital credentials and e-portfolios, virtual apprenticeships or internships, and remain agile and flexible in opening possibilities for learning innovations.

When developing a digital strategy, one should also have in mind ethical implications, data privacy and online safety in accordance with different EU policies and recommendations, like the *Ethical*

guidelines on the use of artificial intelligence and data in teaching and learning for educators, *Digital Service Act*, *GDPR* and *AI Act*.

As with any strategy, its success is based on the time taken to co-produce, with all stakeholder voices heard, and then ensuring it is sufficiently embedded into the smart delivery plan with objectives turned into a roadmap, so to remain effective and deliver impact over time. Digital transformation in education is leveraging digital technologies to enable major educational improvements and should be an iterative process concerning the continuous enablement of digital society and economy.

Blueprint for Digital Transformation Strategy in Education

Authors: Lidija Kralj and Goran Radman, Algebra University College

During 2022 and 2023, project partners have mapped the digital readiness and resilience of HE/VET institutions in response to the COVID crisis in the context of governance and enabling services, teaching and learning practices, and infrastructure in Bulgaria, Croatia, Germany, Italy, and EU. Project partners also collected information about concepts and frameworks, examined case studies and best practices, and outlined a blueprint for the strategic approach to digitalisation while exploring the institutional approach to digital strategy.

The challenges of digital transformation can be categorised and associated with different issues: i.e. learning styles and cultures, digital pedagogy, technology, technical training, and time management challenges. On the other hand, enablers of digital transformation are educators, and their passion for and innovations in distance teaching and learning are crucial. Institutions are challenged more in their capacity and capability to adapt by enhancing the quality of teaching while providing for the de-bureaucratization of processes and freeing up resources required for innovative approaches to education, curricula design, and research networks.

Digital transformation is one of the key dimensions of modern social, economic, and organisational development in adapting to the increased internal and external use of digital technologies and ascending digital society and economy. To successfully initiate and implement transformation, educational and all other organisations need to be able to answer a number of related questions: how to manage processes and communicate digitally, which social networks to use, how to optimise online operations, how to manage costs dynamically, should physical libraries be kept? These are just some of the questions that need to be answered to prepare the appropriate plan, harmonise procedures, and master changes that will affect all activities of the organisation.

Digital transformation also implies making changes in the strategy, operational model, procedures, and the organisation's culture. Digital transformation brings an opportunity for reinterpretation and fundamental change in almost all aspects and segments of living and doing work. But digital transformation also bears many transitional risks when it comes to understanding and grasping its complexity, formulating appropriate digital alternatives, implementing and transforming processes, coping with transformation obstacles and barriers, and achieving expected added value gains.

Due to the experience in digitalisation gained by educational institutions before, during, and after the pandemic, they have now accomplished preconditions for setting up a more comprehensive approach to the process of digitalisation: through strategic planning and regular assessment of the results achieved. The Council of EU, in its *Council Recommendation on blended learning approaches for high-quality and inclusive primary and secondary education*[22], has recommended developing longer-term strategic approaches to blended learning and building on successful innovations introduced or tested during the pandemic to share and scale good practices.

[22] Adopted at the Council of EU meeting on 29-30 November, 2021 (Official Journal of the European Union, 14.12.2021, p. 5, no. 1).

In a research document (Reimers et al., 2022) on how the COVID-19 pandemic was disrupting and changing education, the authors discuss the opportunity to rethink how to create a business culture for innovation in education since they found out that for most institutions, it appeared easier to buy new tools and systems than to invest in redesign of all its processes. In that context, policymakers and institutions' management will need to improve at building an agenda for innovation, resilience and change, and support for digital transformation. Digital technologies are being incorporated in exciting and promising ways at all levels of education. To consolidate progress and ensure scale and sustainability, education institutions need to review their organisational strategies to enhance their capacity for innovation and exploit the full potential of digital technologies and content.

This Blueprint document builds upon different frameworks and self-assessment tools used in European countries and their educational institutions. Specifically, it continues on the systemic approach that has been done in designing the *European Framework for Digitally-Competent Educational Organisations* (DigCompOrg)[23]. This framework facilitated transparency and comparability between related initiatives and played a role in addressing fragmentation and uneven development across Europe. Therefore, this Blueprint can be used by any educational organisation (i.e., elementary, secondary, and VET schools, as well as higher education institutions) to navigate through a process of self-assessment on progress toward comprehensive integration and effective deployment of digital transformation approaches and learning methods, frameworks, tools, and technologies. The Blueprint can also be used as a strategic planning tool for institutional management and policymakers willing to promote comprehensive initiatives to effectively accept digital learning technologies by educational organisations at regional, national, and European levels.

DigiTransformEdu Blueprint is designed to complement rather than supersede other frameworks and tools already in use in this area: e.g., to develop relevant aspects of students' digital competence. The primary purposes of the Blueprint therefore are to:

- Encourage self-reflection and self-assessment within educational organisations as they progressively deepen their engagement with digital learning and pedagogies;
- Enable education management to design, implement and appraise programmes, projects and policy interventions for the integration of digital learning technologies in the education and training organisations.

This Blueprint is also designed to focus mainly on the institutional and organisational aspects supporting teaching, learning, assessment and related activities undertaken by a given educational organisation. As such, it is not intended to address the full range of administrative and management information systems that may be in use within the organisation. It includes components, sub-components and descriptors that may be regarded as linked to 'organisational responsibilities' (e.g., Infrastructure) or to 'individual responsibilities' (e.g., Teaching and Learning practices). This reflects the fact that a digitally-competent educational organisation needs a balanced combination of strong leadership and governance (for vision and top-down strategies) as well as internal staff and external stakeholders capable of taking personal responsibility (for self-initiated actions and bottom-up efforts and initiatives).

[23] *DigCompOrg Framework*. (n.d.). Retrieved October 1, 2023, from DigCompOrg Framework (europa.eu)

The education systems are large and complex, and the digital transformation process will be an extremely difficult venture. In addition, it is necessary to consider all its multidimensional segments integrally if aiming to achieve essential, planned, and comprehensive transformation. EU is making great efforts in providing development resources, supporting research, and designing varied frameworks for digital knowledge and skills, hoping European educational institutions will be moving on and catching up. This blueprint document aims to add value to all those efforts.

Institutional Prerequisites and Requirements

Digital technologies are enablers of change and transformation in institutional approach to learning and teaching practices. However, they do not guarantee it. Change that is both sustainable and at scale requires a multi-faceted systemic approach, including investment in infrastructure and in management professional development, programme and curriculum change, rethinking students' assessment and teachers' advance and appraisal, making the right decisions about curriculum-related content, promoting collaboration and open content and practices, and integrating all these within an environment that ensures good governance and oversight of quality.

Successive European and national initiatives and policies provide support for the modernisation and innovation of education and training. This is to be found out through a comprehensive review of academic and research literature, analysis of existing methodologies and frameworks, as well as through individual self-assessment reports and documents promoting the integration of digital technologies in education and training systems, including the expert and stakeholder consultation. This Blueprint conceptual outline may guide different trajectories of integration and effective use of different elements and building-blocks for digital transformation of learning institutions and stimulate further research in the field, contributing to the momentum for modernising education and training organisations across Europe.

Here, we will focus on some of the most critical prerequisites and requirements educational organisations have to consider providing before and when approaching to design, elaboration and implementation of their digital strategies. These prerequisites and requirements are descriptive, not prescriptive, and will be further explained in the following chapters: Leadership and Governance, Collaboration and Networking, and Infrastructure.

Leadership and Governance

This prerequisite refers to the role of leadership in the organisation-wide integration and effective use of digital technologies concerning its teaching/learning mission and activities. The organisation’s strategic planning process should encompass digital learning technologies, and these in turn should be a cornerstone of a well-defined and well-communicated long-term educational vision. This vision should be visibly supported through leadership and governance and articulated in short- and medium-term strategic plans. Leadership and Governance may also be explained further by the following components.

Digital-age Learning Set by the Vision, Mission and Strategy. Factors that foster effective learning including the integration and organisation-wide use of digital learning technologies, are clearly embedded in statements of the mission, vision and strategy of the organisation. The organisation's strategic/planning processes and documentation include a vision and mission that clearly articulates the potential of digital learning technologies to modernise educational practices geared towards more comprehensive learning outcomes. The organisation has appropriate processes in place for communicating internally and externally the vision for and the benefits to be gained from the integration of digital learning technologies.

The organisation's strategic plan is evidence–based and informed by ongoing research on the educational use of digital technologies and includes specific goals and objectives in relation to embedding digital-age learning on a sustainable organisation-wide basis with associated performance indicators. The public engagement aspect of the organisation's strategy includes commitments to open education practices such as open courses, open lectures and open access to digital resources and publications.

Digital Strategy Reinforced by an Implementation Plan. The organisation has a well-defined and realistic digital capacity implementation plan, with clear priorities and measurable targets for the effective organisation-wide deployment of digital learning technologies, in the context of an overarching policy/strategic plan for teaching, learning and assessment. The digital capacity implementation plan is contextualised and builds on enablers/facilitators of digital learning technology integration while addressing possible barriers. The digital capacity implementation plan affords internal stakeholders a degree of autonomy in the implementation of digital learning technologies in the context of an overarching policy for teaching and learning and/or the requirements of a curriculum.

The digital capacity implementation plan identifies opportunities, incentives and rewards for staff who actively engage in the process of building digital capacity and modernisation of learning environments. The digital capacity implementation plan is aligned with broader priorities, including equal opportunities and widening participation in order to mitigate social disadvantage and reduce the risk of inadequately addressing the needs of particular groups such as gifted students, migrants, and early school leavers. The digital capacity implementation plan includes not only providing digital learning technologies to modernise existing educational provision but also offering new opportunities for formal, non-formal and informal learning.

Digital Management and Governance Model in Place. A management and governance model is in place to coordinate and oversee the implementation plan for digital-age learning and digital capacity, including the effective use of human and other resources and orchestrating the integration and effective use of digital learning technologies. The leadership team has a shared understanding of why and how the organisation seeks to integrate digital learning technologies, and commitment to the implementation plan is evident. Management responsibility has been clearly assigned for the delivery and monitoring of the digital capacity implementation plan. Staffing and budgetary resources required to underpin the digital capacity implementation plan are clearly identified and optimised in the context of organisational budgets and staffing plans.

A process is in place to periodically review and report the outcomes, quality and impact of the digital capacity implementation plan and to update it to take account of the evolving needs of the

organisation and emerging technological trends and pedagogical developments. Appropriate processes are in place for the evaluation of specific initiatives or pilots that might be undertaken by the organisation as part of its digital capacity implementation plan. A process is in place to externally benchmark the organisation's digital capacity with respect to similar organisations, regionally, nationally or internationally. Boards of management or other governing authorities engage with questions of policy and direction in relation to digital-age learning.

Collaboration and Networking

This prerequisite refers to an organisation supporting a culture of collaboration and communication and having processes and policies in place to enable staff and students to engage with internal and external stakeholders, share experiences and learn effectively within and beyond the organisational boundaries. The Collaboration and Networking prerequisite may also be explained further by the following components.

Networking, Sharing and Collaboration Promoted. Digital-age learning relies extensively on multidimensional communication, networking and sharing with the internal and external knowledge ecosystem. The organisation offers the necessary tools, infrastructure and support systems to develop a culture of connected learning that extends beyond the institutional walls and promotes the kind of anytime, anywhere learning necessary for digital learning environments to thrive. The organisation actively promotes and expects staff engagement with networks, portals and professional/discipline-based communities of practice that promote excellence, quality and accessibility of educational content and knowledge about the deployment of digital learning technologies in different contexts. Through such engagement, staff can also access and contribute to the research and evidence base and the wider learning ecosystem.

Networking, knowledge exchange and collaboration activities, including those mediated by online platforms, are recognised as professionally relevant learning outcomes. Students are encouraged to engage with relevant social/professional networks and communities of interest/practice to connect with ideas, interests and people. Digital technologies and social/professional media platforms are used extensively on an organisation-wide basis for effective networking, interaction, and collaboration and to create a more challenging learning environment by opening up and broadening perspectives in this way. The organisation encourages, facilitates and expects staff and students to organise and/or take part in knowledge-exchange activities and events (face-to-face, online, or in combination) for cross-fertilisation of learning experiences with players in the external knowledge ecosystem. The organisation has processes in place, supported by relevant digital tools and platforms, for bringing internal stakeholders together (staff and students) to build synergies, exploit internal knowledge and resources, and share action-research and effective practice through cross-functional and cross-disciplinary structures and teams.

Strategic Approach is Communicated. The organisation's communication strategies are underpinned by a dynamic digital presence characterised by open communication processes and sharing of experiences. Digital technologies and social/professional media platforms which ensure communication with stakeholders and the wider learning community are deployed and used. These complement other means of communication (e.g., face-to-face) and enable safe and effective two-way communication within and beyond the organisation. The organisation has in place an explicit

communication strategy, which identifies and uses appropriate communication channels/systems for different purposes and target groups, including a website, social media presence and a learning platform. The organisation has a dynamic digital presence (websites, social networks), which is updated regularly and used by all stakeholders as a hub to support and open up online collaboration, sharing, communication and learning.

Partnerships are Developed. Engagement and collaboration with the external knowledge ecosystem and its stakeholders can open up new relationships and generate a valuable resource in terms of opportunities for developing expertise and organisation-wide learning experiences. In this context, the learning organisation develops and maintains contacts and relationships with local, regional, national and international partners geared towards collaborative working and sharing of resources and expertise, thereby more fully exploiting the potential of digital learning technologies. The organisation is committed to collaboration and knowledge exchange through partnerships with other learning organisations, private and public sector organisations (including those in the technology/digital media sectors) and the wider community. The organisation encourages and supports staff and students to actively take part in partnerships with external organisations, facilitated and sustained as appropriate through the use of digital tools and platforms.

Infrastructure

This prerequisite refers to the crucial role of infrastructure in enabling and facilitating innovative practices and in extending the boundaries of learning spaces (physical and virtual) in a way that encompasses some or all of the multiple dimensions of openness and flexibility (any individual/group learning anywhere, anytime, using any device, with mentoring provided by anyone). Whole-organisation approaches to the innovative design, adaptation and/or reorganisation of virtual and physical learning spaces reflect the organisation's vision to modernise practices for achieving more comprehensive learning outcomes. Underpinning such developments is the backbone of digital services, which must be reliable, secure and scalable. The Infrastructure prerequisite may also be explained further by the following components.

Physical and Virtual Learning Spaces. The way in which physical and virtual learning spaces are designed can deliver an unspoken message about the dominant teaching and learning paradigm and can also shape and influence the teaching and/or learning practices that take place. Therefore, the learning organisation ensures that due attention is paid to the design and organisation of learning spaces so that their utility is aligned with intended teaching and learning activities. Physical learning spaces have been designed/re-arranged and furnished to harness and optimise the affordances of digital learning technologies, giving access to a wide range of relevant digital tools, content and services in learning settings that can be flexibly configured. The design (or customisation) of virtual learning spaces (VLEs and learning platforms) adequately reflects the intended pedagogic paradigm and affords a staff/student experience that complements and is consistent with that experienced in face-to-face settings. Virtual learning spaces are also designed (or customised) to optimise usability, accessibility and user experience.

Digital Infrastructure is Planned for and Managed. The organisation has in place the necessary expertise and processes to ensure the effective identification, selection and organisation-wide deployment of a range of digital learning technologies appropriate to its scale and needs. Front-facing

services must operate seamlessly as far as staff and students are concerned. For this to happen, core ICT backbone and services (networks, portals, Wi-Fi, cloud) must be omnipresent. The use of digital technologies, content, platforms and services by staff and students is regulated by an Acceptable Usage Policy formally adopted by the organisation and clearly communicated to all users.

The organisation has access to pedagogical and technical expertise (internally and/or externally) to support planning and decision making about investment in technologies, resources and services. The organisation has in place a range of digital learning technologies, tools, applications, content and services and takes appropriate steps to ensure that these can be accessed by staff and students anywhere/anytime (e.g., in both formal and informal settings and/or including one-to-one deployment). Staff and students may use their own devices and may connect these to services provided by the organisation. A Bring Your Own Device (BYOD) policy defines the parameters for own device usage.

As digital devices and connectivity proliferate, the organisation is sensitive to the risk of exacerbating inequalities experienced by socio-economically disadvantaged students, and takes steps to ensure that special measures are in place to provide for the needs of these students. Technical and user support is planned and integrated in digital infrastructure to ensure reliable performance, maintenance and interoperability, and to provide students and staff with seamless access to the digital technologies, content and services they require.

A Service Level Agreement (SLA) may be used to define the scope of the services and supports that can be provided (internally or by external service providers). Assistive technologies and appropriate digital content are used organisation-wide to address the special needs of students requiring additional or differentiated learning support. The organisation has appropriate policies, procedures and safeguards in place to ensure the protection of individual privacy, confidentiality and the safe use of digital learning technologies and data. These include legal obligations relating to Data Protection and Licences, policies for Learning Analytics and formal guidelines for staff and students on privacy, confidentiality and safety in online environments.

Procurement planning considers general as well as specialist requirements (e.g., discipline-specific or professional software, or specialist/high-end workstations) and makes appropriate provision, including, for example, flexibility through desktop virtualisation. Whole of life costing models inform decisions about procurement of networks, equipment and software. The organisation has in place a viable operational plan for the procurement, maintenance, interoperability and security of core ICT backbone and services appropriate to its scale and needs.

Importance of Effective Digital Education

Digital learning technologies constitute a key enabler for educational organisations, which can support their efforts to achieve their particular vision and mission for quality education. Distinct from superficial, deep integration of digital technologies requires significant educational innovation and implies a process of planning for change in all educational dimensions: pedagogical, technological and organisational. This DigiTransformEdu Blueprint provides a comprehensive and generic conceptual framework that reflects primarily organisational aspects of the process of systematically integrating

digital learning in educational organisations. It is adaptable to the particular institutional context within which educational organisations, intermediaries or project managers operate, including the sector-specific approaches.

Supporting Educators and Students

The implementation of effective digital education facilitates the accessibility of education to a wider and more diversified array of learners, encompassing those with impairments, working professionals, and those residing in geographically isolated regions. The implementation of inclusive education aims to guarantee that educational practises are designed to accommodate the diverse requirements of all students. The efficacy of digital education is enhanced by the utilisation of interactive technologies, multimedia resources, and collaborative platforms, which effectively foster active student engagement. The implementation of this active learning methodology has the potential to improve both comprehension and retention.

The implementation of digital education facilitates the customisation of learning experiences, hence enhancing their effectiveness. For example, adaptive learning systems provide the capability to tailor educational content according to the specific needs of individual students, hence offering a personalised pathway for education.

The importance of lifelong learning cannot be overstated, particularly in the context of a dynamic and evolving employment market. Digital education facilitates the acquisition of novel skills and knowledge by individuals, hence cultivating a societal ethos that promotes continuous learning across the course of one's professional trajectory. The utilisation of effective digital education can provide learners with the necessary skills and credentials required to progress in their careers, improve their prospects for employment or facilitate access to a wider range of work prospects.

Flexibility and Creativity

Flexibility and innovation are key advantages of digital education, since they allow students the opportunity to learn at their own pace and in a location of their choosing. This holds significant value for individuals who are classified as adult learners, employed professionals, and those who have familial or other obligations. Students have the ability to conveniently access course materials, enhancing the adaptability of education to their individual circumstances.

The significance of digital education in ensuring educational continuation amid crises was underscored by the COVID-19 pandemic. Online education offers an alternative solution in circumstances where actual educational institutions may be unattainable. The utilisation of digital education fosters an environment that promotes the exploration of creative pedagogical approaches and technological advancements by educators. This facilitates the opportunity for conducting experiments and incorporating current trends in pedagogical practises.

Scalability and Global Reach

The scalability of digital education surpasses that of traditional classroom-based education. Institutions have the capacity to accommodate a greater number of students without being limited by the physical limits of classroom space. This is particularly pertinent in the realm of higher education, where there is a pressing need to address the increasing demands for enrolment. The environmental sustainability of online education surpasses that of traditional in-person education as a result of diminished travel requirements and reduced resource usage. This is in accordance with the objectives of sustainability and contributes to the mitigation of the carbon emissions related with educational activities.

Digital education enables global collaboration by fostering communication and cooperation among students and educators across different geographical locations. It facilitates the cultivation of cross-cultural comprehension and the dissemination of ideas on a worldwide level. Digital education platforms provide substantial quantities of data that can be examined globally to acquire valuable information regarding all aspects of the educational process, including the student performance and engagement. Educators have the ability to utilise this data in order to make educated decisions regarding course design and the provision of support to students.

Online education frequently leads to a reduction in the overall expenses associated with education. Students have the opportunity to reduce their expenses in terms of transportation, accommodation, and educational resources. Furthermore, educational institutions have the potential to save expenses related to operational overhead by eliminating the need for physical premises. Online education has the capacity to overcome geographical limitations, enabling educational institutions to attract students from around the world. The promotion of cross-cultural relationships and the inclusion of varied perspectives serve to enhance the overall learning experience.

In summary, the implementation of efficient digital education has the potential to bring about significant changes and advancements in both higher education and vocational education. This phenomenon caters to the changing requirements of individuals seeking knowledge, grants educational opportunities to various demographics, and presents advantages in terms of adaptability, financial effectiveness, and expandability. The ongoing progression of technology will assume a more pivotal role in determining the future of education.

Approaches to Digital Education Design

Traditional Approaches to Digital Education Design

Traditional approaches to digital education design in higher education or vocational education often rely on established methods and principles that have been adapted to the online or digital learning environment. These approaches prioritize structured content delivery, engagement, and assessment while leveraging technology to enhance the learning experience. We are mentioning some of the key elements of traditional approaches to digital education design bellow.

The adherence to pedagogical principles is a common practice in the design of traditional digital education. This approach generally incorporates well-established principles, such as Bloom's

taxonomy of learning objectives[24], to guarantee that the organisation of course content facilitates profound learning and the development of critical thinking skills.

Learning Management Systems (LMS) are commonly employed in conventional digital educational programs to facilitate the organisation of course materials, assignments, and communication. They offer a centralised platform that enables instructors to effectively manage instructional content while also providing students with convenient access to educational resources. The structure of courses often consists of modules or units, which encompass specific learning objectives, assigned readings, multimedia resources, and various assignments. The implementation of a structured method facilitates the systematic progression of students throughout the course.

In the realm of traditional digital education, it is common to observe the integration of both synchronous or real-time and asynchronous or self-paced learning activities. Synchronous sessions encompass various interactive activities such as real-time lectures, webinars, and collaborative discussions, whereas asynchronous components allow students the flexibility to access course materials and fulfil assignments at their individual speed.

Interaction and communication are facilitated by various digital platforms such as discussion forums, chat rooms, and direct messaging, enabling students and teachers to engage in meaningful exchanges. These educational resources facilitate cooperative learning and enable students to seek assistance as required. The involvement of instructors is of paramount importance in the context of traditional digital education, as they assume a prominent role in offering advice, feedback, and support to students. Academic instructors often allocate designated office time slots, during which they are available to engage with students on a one-on-one basis. Additionally, they may offer written feedback on projects to facilitate students' learning and growth. Furthermore, instructors actively participate in online conversations, fostering an interactive and collaborative learning environment.

While traditional approaches to digital education have been effective for many learners, they are evolving in response to advances in technology and changes in pedagogical understanding. Contemporary approaches often incorporate elements of active learning, personalized learning, and data-driven decision-making to enhance the educational experience further.

Innovative Approaches and Emerging Trends

Innovative approaches and emerging trends in digital education design for higher education and vocational education are continuously evolving to meet the changing needs and preferences of learners. These approaches leverage cutting-edge technology and pedagogical insights to create engaging and effective learning experiences. Here, we are referring to some of the most innovative approaches and emerging trends.

Personalised and Adaptive Learning Systems employ algorithms and data analytics to tailor the educational experience to the individual needs of each learner. The content and exams are customised according to the unique strengths and limitations of each individual. Collaborative and social learning platforms foster opportunities for peer engagement, collaborative efforts, and the exchange of

[24] *Bloom's taxonomy* (n.d.). Retrieved October 3, 2023, from Bloom's taxonomy - Wikipedia

knowledge. Group projects, online forums, and collaborative technologies contribute to the development of a strong feeling of community within the realm of digital education.

The integration of **gamification** components, such as points, badges, and leaderboards, into the design of educational courses serves to enhance learner motivation and engagement. Serious games are commonly utilised in vocational education and simulations to facilitate the development of practical skills. **Microlearning** is a pedagogical approach that involves the division of educational content into small, manageable parts that can be easily comprehended and assimilated within brief periods of time. This aligns with the contemporary learner's inclination for concise and targeted educational encounters. **Mobile applications** and microlearning platforms are specifically developed to provide convenient access to concise lectures and tests.

Globalisation and internationalisation have resulted in the growing accessibility of online education to individuals worldwide. This phenomenon has contributed to the inclusion of a wider range of perspectives and enhanced cultural knowledge within course content. Many educational institutions are now providing courses in various languages and modifying their material to suit diverse cultural situations. These innovative approaches and emerging trends in digital education design are driven by advances in technology, research on effective pedagogy, and a commitment to providing high-quality, flexible, and inclusive learning opportunities for students in higher education and vocational training.

Immersive technologies, such as **Virtual Reality** (VR) and **Augmented Reality** (AR), provide students with the opportunity to engage in immersive learning experiences. These technologies enable students to navigate and comprehend intricate topics inside a three-dimensional environment. Vocational training in sectors such as healthcare, engineering, and architecture greatly benefits from their specific utility. **Mixed Reality** (MR) encompasses features from both VR and AR. This amalgamation offers a range of possibilities for interactive educational experiences, simulations, and the enhancement of various skill sets.

AI-Powered Chatbots and **Virtual Assistants** offer immediate assistance to learners by addressing inquiries, providing direction, and aiding in course navigation. They are capable of assisting with administrative duties, including enrolment, scheduling, and grading.

Blockchain technology is employed for the purpose of safeguarding and validating digital credentials, such as academic degrees and certifications. The utilisation of digital badges has become increasingly prevalent as a means for learners to demonstrate their proficiency in specific skills and accomplishments, hence ensuring the credibility of their achievements.

Ethical considerations and data privacy have become increasingly important in the realm of digital education. With the collection of extensive data, there is a heightened emphasis on safeguarding the privacy and security of student information. Additionally, educational institutions are actively grappling with ethical concerns pertaining to **artificial intelligence** (AI) and algorithmic bias inside educational systems.

Designing Inclusive and Accessible Digital Education

Designing inclusive and accessible digital education for higher or vocational education is essential to ensure that all learners, regardless of their abilities or backgrounds, can access and benefit from educational content and resources.

Universal Design for Learning (UDL)[25] is a pedagogical framework that advocates for the creation of educational resources and environments that are accessible and efficacious for a wide array of learners. By adopting a UDL approach, educators may ensure that their instructional practises accommodate the various needs and abilities of all students. The UDL framework places emphasis on the provision of diverse opportunities for representation, interaction, and expression.

It is important to become acquainted with accessibility standards and rules, such as the Web Content Accessibility Guidelines (WCAG)[26]. The aforementioned guidelines establish explicit criteria for ensuring the accessibility of digital material to those with impairments. Institution should develop a coherent and meticulously structured framework for digital course materials.

To ensure accessibility, alt text should be used for photos and graphics, accurately describing the visual content. This helps users who cannot see the images understand the message. Captions for videos and transcripts for audio content can be helpful. Descriptive and meaningful hyperlink language should be used for keyboard navigation. Ensuring interactive features can be effectively operated using keyboard input.

Testing and assessments can be enhanced by providing different formats to accommodate diverse learning styles and abilities. For instance, in addition to traditional tests, offering text-based assignments can be a valuable option. Performing usability testing with individuals who have disabilities could obtain input and discern accessibility concerns. It is imperative to verify that the digital platform and materials are compatible with a diverse range of devices and assistive technologies, including but not limited to screen readers, voice recognition software, and braille displays.

It is recommended to provide the option of longer time or flexible scheduling for assessments, if necessary and offer alternative formats for assessments. It is essential to foster a culture of feedback among students, wherein they are encouraged to share their experiences on any accessibility barriers they may find over the duration of the course.

In order to foster an inclusive learning environment, it is imperative to implement a multifaceted approach that addresses various aspects of accessibility and inclusivity. One pivotal facet of this approach involves providing comprehensive training and resources for faculty members. By equipping instructors with the knowledge and tools necessary to create accessible content and effectively utilize accessible technology, universities can empower them to design courses that cater to the diverse needs of their student body. Moreover, it is essential to cultivate awareness among educators regarding the significance of accessibility in education, instilling a collective commitment to inclusivity.

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[25] *Universal Design for Learning*. (n.d.). Retrieved October 7, 2023, from Universal Design for Learning - Wikipedia

[26] *Web Content Accessibility Guidelines (n.d.)*. Retrieved October 7, 2023, from WCAG 2 Overview | Web Accessibility Initiative (WAI) | W3C

In tandem with faculty training, the adoption of inclusive pedagogical practices plays a pivotal role in accommodating diverse learning styles and preferences. Encouraging instructors to embrace inclusive teaching methods not only enhances the learning experience for students with disabilities, but also benefits the entire student population. By creating an environment that supports varied learning approaches, universities can foster a culture that celebrates diversity, promotes engagement, and empowers all learners.

The pursuit of inclusivity does not conclude with the implementation of initial measures; rather, it necessitates a commitment to continuous improvement. This entails the regular review and update of course materials and digital resources to ensure their ongoing accessibility as technology evolves. By remaining vigilant in monitoring advancements in digital accessibility, educational institutions can adapt their materials and tools, accordingly, guaranteeing that students with disabilities continue to have equal access to educational content.

Furthermore, establishing a robust support system for students with disabilities is paramount. Universities should offer dedicated accessibility services and resources to assist these students in navigating the academic landscape. This support network not only provides practical assistance but also fosters a sense of belonging and inclusion within the larger learning community. By addressing the unique needs of students with disabilities, universities send a clear message that everyone's contributions are valued and that barriers to learning are actively dismantled.

In summary, the path to a truly inclusive learning environment necessitates a holistic approach that encompasses faculty training, inclusive pedagogy, continuous improvement, and a supportive community. By providing educators with the tools to create accessible content and fostering an inclusive classroom culture, universities lay the foundation for an educational experience that benefits all students. Additionally, the commitment to ongoing improvement and the establishment of robust support systems demonstrates a dedication to inclusivity that reverberates throughout the entire learning community.

Digital Teaching and Examination

Digital technology has emerged as a powerful force in reshaping both teaching and examination in contemporary academia. As universities and educational institutions increasingly integrate digital tools and platforms into their academic and pedagogical practices, a fundamental shift towards a technology-driven academic landscape has taken place. This transformation extends to the design of innovative teaching methodologies, knowledge assessment techniques, the development of digital skills, and the enhancement of digital values and confidence among students, all with the overarching goal of preparing them for economic and social transformation in an increasingly digitized world.

The integration of digital technology in teaching and research represents a transformative shift in higher education, placing students at the forefront of this evolution. With a focus on students first, educational institutions are increasingly adopting innovative teaching and knowledge assessment methods underpinned by digital technologies. This approach not only enhances students' digital skills and engagement but also equips them with the essential knowledge and competencies required for economic and social transformation in a rapidly evolving digital landscape. Furthermore, it emphasizes

the importance of strengthening digital values and confidence among students, promoting responsible and ethical digital citizenship. To gauge the effectiveness of these initiatives, measuring key performance indicators (KPIs) is essential, allowing institutions to assess their progress in achieving digital education goals and ensuring that students are well-prepared for the digital age.

Students First

In the digital age, placing students at the forefront of educational strategies is paramount. Digital technologies facilitate personalized learning experiences tailored to individual needs and preferences. Through adaptive learning platforms and online resources, students gain agency in their education, allowing them to pace their learning and explore content that aligns with their interests. This student-centric approach is essential in cultivating critical thinking, problem-solving, and self-directed learning skills that are invaluable in navigating a rapidly evolving digital landscape.

Innovative Teaching and Knowledge Assessment

Digital technologies enable the creation of innovative teaching methods and knowledge assessment techniques that go beyond traditional classroom boundaries. Virtual reality, augmented reality, and interactive simulations provide immersive learning experiences that bridge the gap between theory and practice. Additionally, digital assessment tools offer immediate feedback, promoting continuous improvement and adaptive learning strategies that enhance students' understanding and retention of course material.

Enhancing Digital Skills and Engagement

As digital technology becomes increasingly integrated into education, the acquisition of digital skills becomes essential for students. Educational institutions must prioritize digital literacy, ensuring students are proficient in areas such as information literacy, digital communication, and data analysis. Furthermore, digital tools have the potential to increase student engagement through gamification, interactive content, and collaborative platforms, making learning more dynamic and participatory.

Strengthening Digital Values and Confidence

In tandem with digital skills, the cultivation of digital values and confidence is essential. Ethical and responsible use of technology, respect for privacy, and the ability to critically evaluate digital information are integral components of digital citizenship. Strengthening these values ensures that students become responsible and informed digital citizens who can navigate the digital landscape with confidence and integrity.

Measuring Key Performance Indicators

In the pursuit of effective digital education, it is imperative to establish and measure key performance indicators (KPIs). These metrics provide valuable insights into the impact and efficacy of digital initiatives. KPIs may encompass student engagement, course completion rates, learning outcomes, and the successful integration of digital tools. Regularly monitoring and evaluating these KPIs enables educational institutions to make data-informed decisions, refine their digital strategies, and continually improve the quality of education.

In summary, the integration of digital technology in teaching and research is not merely a technological shift but a fundamental transformation that places students at the centre of educational innovation. It involves the creation of innovative teaching and assessment methods, the enhancement of digital skills, and the development of values necessary for success in an increasingly digitalized world. By measuring KPIs, institutions can adapt and refine their approaches, ultimately preparing students for the economic and social transformations driven by the digital age.

Inventory of Approaches to Digital Education Design and Delivery

Designing and delivering digital education in higher education requires careful planning and consideration of various approaches to create effective and engaging learning experiences. Here are some key approaches for the design and delivery of digital education in higher education:

Blended Learning combines traditional in-person instruction with online components. It allows students to access course materials and engage in activities online while still benefiting from face-to-face interactions with instructors and peers.

Fully Online courses are delivered entirely through digital platforms. They provide flexibility for both students and instructors and can reach a global audience.

Hybrid or HyFlex courses give students the option to choose between attending classes in-person or participating online. This flexibility accommodates varying learning preferences and circumstances.

In a **Flipped Classroom** model, traditional in-person lectures are replaced with online video lectures or readings that students review before attending class. Class time is then used for interactive discussions, group work, and application of concepts.

Synchronous vs. Asynchronous Learning: Synchronous learning occurs in real time, with students and instructors meeting online simultaneously through video conferencing or live chats. Asynchronous learning allows students to access course materials and complete assignments at their own pace.

Project-Based Learning involves students working on real-world projects, often in collaboration with peers, to apply their knowledge and skills. Digital tools facilitate project management, research, and collaboration.

Competency-Based Education focuses on mastery of specific competencies or skills rather than traditional semester-based courses. Students are progressing as they demonstrate mastery, often through assessments and practical application.

Gamification incorporates game elements, such as points, badges, and leaderboards, into the learning process to increase engagement and motivation. Game-based learning involves using educational games to teach specific concepts or skills.

Microlearning breaks down learning content into small, easily digestible units, often delivered in the form of short videos, quizzes, or infographics. It is designed to meet specific learning objectives quickly.

Peer Teaching and Peer Assessment encourage students to take on the role of teachers by having them create and deliver presentations or facilitate discussions. Peer assessment involves students evaluating and providing feedback on each other's work.

Social Learning may foster creation of the online communities where students can discuss course topics, share resources, and collaborate on projects.

Use of technology may create **Personalized Learning Paths** based on individual student progress and needs, offering targeted resources and assessments. Complemented by employment of learning analytics to track student performance and engagement, this may enable timely interventions and support for struggling students.

Connecting digital education with **Real-world Experiences** may support more effective internships, cooperative education programs, and fieldwork opportunities.

Blockchain technology may effectuate secure and verifiable credentialing, allowing students to store and share their academic achievements and certifications.

Ethical and Digital Citizenship Education integrate discussions on digital ethics, online etiquette, and responsible use of technology into the curriculum.

Digital materials and platforms should be made accessible to students with disabilities adhering to **Accessibility Standards**.

Students may be encouraged to collaborate with peers from diverse cultural backgrounds on projects and assignments fostering **Global Perspectives**.

Environmentally Sustainable Practices could be promoted in digital education to reduce the carbon footprint associated with online learning.

Continuous Assess of the effectiveness of digital education approaches could make iterative improvements based on feedback and data.

These approaches can be combined or adapted to meet specific educational goals, disciplines, and student populations. The choice of approach should align with learning objectives and the unique needs of higher education institutions and their students.

Inventory of Tools for Digital Education Design and Delivery

Designing and delivering digital education involves a wide range of approaches and tools to create engaging and effective learning experiences. Here is an inventory of some key approaches and tools used in digital education:

Learning Management Systems (LMS): Moodle, Blackboard, Canvas, Sakai, Brightspace, Google Classroom, edX.

Content Creation and Management: Articulate Storyline, Adobe Captivate, H5P (HTML5 content authoring tool), Pressbooks (for open educational resources), WordPress (for building course websites).

Virtual Learning Environments: Second Life (3D virtual world), OpenSimulator (open-source virtual world platform), Unity (for creating 3D interactive environments), AltspaceVR (social virtual reality platform).

Video and Multimedia Tools: Adobe Premiere Pro (video editing), Camtasia (screen recording and video editing), Kaltura (video hosting and streaming), YouTube (for hosting and sharing videos), Vimeo (video hosting and sharing).

Interactive Elements: H5P (interactive content creation), Kahoot! (game-based learning), Poll Everywhere (live audience engagement), Mentimeter (interactive presentations and polls), Padlet (collaborative digital whiteboard).

Assessment and Quiz Tools: Quizlet (flashcards and quizzes), QuizMaker (online quiz creation), ProProfs Quiz Maker, Poll Everywhere (for quizzes and polls), Google Forms (for surveys and quizzes).

Collaboration and Communication Tools: Zoom (video conferencing and webinars), Microsoft Teams (collaboration and communication), Slack (team communication), Discord (voice and text communication), Remind (communication with students).

Social Media and Online Communities: Twitter, now called X (for professional networking and sharing resources), LinkedIn (professional networking), Reddit (discussion and community engagement), Facebook Groups (community building), Discord (for creating online communities).

eBooks and Digital Publishing: Adobe InDesign (digital publishing), iBooks Author (eBook creation), Pressbooks (for open textbook publishing), Kindle Direct Publishing (self-publishing eBooks), Apple Books (for distributing eBooks)

Augmented (AR), **Virtual** (VR) and **Mixed Reality** (XR): Unity (for creating AR and VR experiences), A-Frame (web-based VR framework), Merge EDU (AR and VR tools for education), CoSpaces Edu (virtual reality platform for education), ClassVR, Umety.

Accessibility and Inclusivity: Ally by Blackboard (accessibility checker), ReadSpeaker (text-to-speech software), VoiceOver (screen reader for macOS), JAWS (screen reader for Windows), Braille displays (assistive technology for visually impaired)

Data Analytics and Learning Analytics: Tableau (data visualization and analytics), Google Analytics (website and app analytics), Learning Locker (open-source learning analytics), EdSurge Data (education technology trends and data)

Digital Credentialing and Badging: Open Badges (standard for digital credentials), Credly (digital badge platform), BadgeList (badge management and issuance)

Collaborative Document Editing: Google Workspace (Google Docs, Sheets, Slides), Microsoft Office 365 (Word, Excel, PowerPoint), Overleaf (collaborative LaTeX editor), Zoho Office Suite, Cloud Storage and File Sharing: Google Drive, Dropbox, OneDrive, Box

AI-Powered Tools: IBM Watson (for creating AI-powered chatbots), Grammarly (AI-powered writing assistance), ScribeSense (automatic transcription), ChatGPT (AI-powered chatbot), Real Fast Reports (school reports), gotFeedback (generating feedback), Curipod (generate lesson plans), Magic Schools AI (49+ generators for teachers), EduaideAI (content creation, assessment, feedback), Nolej (turn static learning materials into microlearning activities), Gamma (generate presentations, documents, websites), ElevenLabs (convert text into audio), Coqui (clone and design voice), Soundraw (generate music and songs), Plazma Punk (generate music and videos), Synthesia (create videos), Fliki (turn text into videos with AI voices), Pictory.AI (create short videos from long content), MovieBot (create 3D animations), Micrososft Designer (create designs from prompts), MonicAI (generate assessments)

Blockchain and Credentialing: Blockchain-based digital credentialing platforms (e.g., Learning Machine, Blockcerts), Sovrin (decentralized identity and credentialing)

Open Source and Free Tools: OBS Studio (open-source video recording and streaming), Audacity (open-source audio editing), GIMP (open-source image editing), Moodle (open-source LMS).

These approaches and tools can be used in various combinations and adapted to different educational contexts to design and deliver effective digital education experiences. The choice of tools should align with specific learning objectives, audience needs, and instructional strategies.

Digital Solutions for Open and Connected Science

In the contemporary landscape of scientific research, digital solutions have emerged as a transformative force, reshaping the way researchers engage with their work and with one another. The advent of researcher-oriented digital environments has provided scientists with unprecedented tools and resources to accelerate their investigations, leading to innovation and the achievement of research goals. These digital environments foster collaboration, not only within the confines of individual laboratories or institutions but also through partnerships with external stakeholders, thereby promoting the principles of open science and enabling the sharing of knowledge and data.

Researcher-Oriented Digital Environment

A pivotal element in the evolution of scientific practice is the emergence of researcher-oriented digital environments. These environments encompass a wide array of digital tools, platforms, and resources designed to facilitate every stage of the research process, from data collection and analysis to publication and dissemination. Researchers can access data repositories, simulation tools, and collaborative platforms that empower them to work efficiently, share findings with colleagues, and engage in interdisciplinary discussions. As a result, the research landscape becomes more inclusive, collaborative, and adaptive, ultimately enhancing the quality and impact of scientific endeavours.

Innovation and Research Goals Achievements

The innovative potential of digital solutions in science cannot be overstated. Researchers now have the means to leverage cutting-edge technologies, such as artificial intelligence and high-performance computing, to tackle complex problems and accelerate the achievement of their research goals. These digital tools enable the automation of repetitive tasks, the analysis of vast datasets, and the discovery of novel insights. Consequently, scientific discoveries that once took years to materialize can now be expedited, leading to advancements in fields ranging from healthcare and materials science to environmental conservation and astrophysics.

Collaboration with External Partners on Scientific Projects

Digital solutions not only empower researchers within their academic institutions but also facilitate collaboration with external partners on scientific projects. Interdisciplinary collaboration and the sharing of expertise across institutional boundaries have become increasingly feasible through digital platforms. This interconnectedness promotes a more holistic approach to complex research challenges and allows for the pooling of resources and knowledge from diverse sources. These collaborations often result in innovative solutions that have a broader impact on society and industry.

Promoting Open Science

One of the notable outcomes of the digital revolution in science is the promotion of open science principles. Digital platforms provide the infrastructure for transparent and accessible sharing of research outputs, including datasets, methodologies, and publications. Open science fosters reproducibility, accountability, and inclusivity, as it encourages peer review and the engagement of a global scientific community in the evaluation of research findings. Through open science practices, the boundaries of knowledge dissemination are expanded, and the public's trust in scientific research is reinforced.

In conclusion, the integration of digital solutions into the scientific research ecosystem is revolutionizing the way researchers conduct their work. These solutions empower scientists with tools for innovation, collaboration, and the pursuit of open science practices, ultimately advancing the frontiers of human knowledge and addressing complex global challenges.

Digital Tools for the Education Community

In the contemporary education landscape, digital tools have become integral to the operations and interactions of the school and university community. These tools encompass a diverse range of technologies, including learning management systems, collaboration platforms, data analytics tools, and administrative systems. They serve as a cornerstone of modern pedagogy, enabling faculty to deliver content, students to engage with coursework, and staff to manage administrative tasks

efficiently. Moreover, digital tools facilitate communication and knowledge exchange within the university community, fostering a dynamic and connected learning environment.

Digital Collaborations with Academic and Non-Academic Partners

Effective engagement with digital issues extends beyond the university's boundaries, requiring collaborations with academic and non-academic external partners. Academic partnerships can foster interdisciplinary research, knowledge exchange, and innovation, enabling the university to address complex digital challenges. Collaborations with non-academic entities, such as industry, government, and civil society organisations, can lead to the development of solutions that are both academically rigorous and practically applicable. These partnerships emphasize the importance of a collective approach to addressing digital issues that transcend disciplinary boundaries.

Responsible Use of Digital Technology

While digital technology provides numerous benefits to the university community, it also necessitates a commitment to responsible use. Universities have a duty to instil in their community members a sense of digital ethics, cybersecurity, and privacy protection. Faculty, students, and staff should be informed about best practices for secure data handling, ethical use of technology, and digital citizenship. Encouraging responsible use not only safeguards the university's digital assets but also cultivates a culture of digital responsibility that extends beyond campus boundaries.

Digital Platforms Integration

The integration of digital platforms is a strategic imperative for universities seeking to streamline operations, enhance pedagogical outcomes, and improve the overall university experience. The convergence of administrative and academic digital platforms allows for seamless data sharing, ensuring that student information, academic resources, and research data are readily accessible to authorized stakeholders. This integration also promotes data-driven decision-making, as it provides institutions with the tools to collect, analyse, and interpret data from various aspects of university life, ultimately improving the effectiveness and efficiency of university operations.

Digital Education Delivery Tools

Learning Management Systems (LMS) and platforms for higher education are digital tools designed to support the administration, delivery, tracking, and management of educational courses and content. These systems have become essential in modern higher education settings, enabling institutions to offer online and blended learning experiences, streamline administrative processes, and enhance the overall educational experience. Here are key components and features of LMS and platforms in higher education: course management, content delivery, communication and collaboration, assessment and grading, enrolment and registration, analytics and reporting, mobile accessibility, integration and compatibility, customization and branding, accessibility and inclusivity, security and privacy, support and training.

The choice of an LMS or platform often depends on the specific needs and goals of an institution, as well as budget considerations. Many institutions also opt for cloud-based solutions to reduce the burden of infrastructure management.

Multimedia and interactive tools are essential components of engaging learners in higher education. These tools leverage various forms of media, interactivity, and technology to enhance the learning experience, making it more dynamic, immersive, and effective. Some multimedia and interactive tools commonly used to engage learners in higher education are: video lectures and webinars, podcasts and audio resources, interactive simulations and virtual labs, e-books and digital textbooks, infographics and visualizations, interactive quizzes and polls, discussion forums and online communities, interactive whiteboards and annotation tools, gamification and serious games, augmented reality and virtual reality, collaborative document editing and cloud-based tools, digital storytelling, online learning communities, artificial intelligence tutors and chatbots.

Assessment and feedback tools play a crucial role in higher education for monitoring student progress and evaluating learning outcomes. These tools help instructors gauge how well students are grasping course material and provide valuable feedback for improvement. Here are some assessment and feedback tools commonly used in higher education: quizzes and exams, rubrics, peer assessment, e-portfolios, discussion boards and online forums, plagiarism detection tools, learning analytics platforms, surveys, self-assessment tools, video and audio feedback, gamified assessments, adaptive learning platforms.

Assessing digital education in higher education is crucial to determine the effectiveness of online courses and ensure that students are meeting learning objectives. Various assessment approaches can be applied to evaluate both the course design and student performance. We are mentioning some approaches for assessing digital education in higher education.

Administer course **Evaluation Surveys** at the end of each course to gather feedback from students. These surveys can assess various aspects of the course, including content, instructor effectiveness, and the online learning environment.

Utilize **Learning Analytics** to collect and analyse data on student engagement, participation, and performance. Learning management systems and other educational technology tools often provide data that can help identify at-risk students and areas for improvement.

Develop clear and detailed rubrics and **Assessment Criteria** for assignments, projects, and assessments. These rubrics help ensure consistency and objectivity in grading.

Incorporate **Peer Assessment**, where students evaluate and provide feedback on their peers' work. Peer assessment encourages critical thinking and peer learning.

Have students create **Electronic Portfolios** (ePortfolios) to showcase their work, reflect on their learning experiences, and demonstrate their skills and achievements.

Assess students' participation in **online discussions, forums, and group activities**. Consider criteria such as the quality of contributions, frequency of participation, and engagement with peers.

Use **online Quizzes and Exams** to assess students' knowledge and understanding of course material. Employ various question types to evaluate different cognitive skills.

Encourage students to provide **constructive feedback** to their peers and reflect on their own learning experiences. This can be done through structured peer review activities.

Design assessments that mirror real-world tasks and challenges related to the course content. **Authentic Assessments** can include case studies, simulations, or problem-solving exercises.

Implement **Capstone Projects** at the end of a program or major course to evaluate students' comprehensive understanding of the subject matter and their ability to apply knowledge and skills.

Administer **Self-assessment Surveys** to students to encourage them to reflect on their learning progress, strengths, and areas for improvement.

Use **Pre-assessment Quizzes or Surveys** to gauge students' prior knowledge before a course begins. Follow up with post-assessments to measure knowledge gain.

Assign **video presentations** or demonstrations as assessments to evaluate students' ability to communicate and present information effectively.

Create assessments that require students to solve **complex, real-world problems**. Assess their problem-solving skills, critical thinking, and decision-making abilities.

Evaluate the online portion of blended courses or hybrid courses separately from the in-person components. Assess the effectiveness of the digital learning environment and resources.

Conduct surveys that specifically ask students about their experiences with the digital aspects of the course, such as the user-friendliness of the online platform and the quality of multimedia materials.

Assess the accessibility and inclusivity of course materials and digital tools to ensure they meet the needs of all students, including those with disabilities.

Encourage **peer observations and reviews** of online courses among faculty members to provide constructive feedback and share best practices.

Compare the performance of students in digital courses with those in traditional face-to-face courses, when applicable, to assess the effectiveness of the online format.

Effective assessment in digital education should be ongoing, authentic, and aligned with learning objectives. It should provide valuable insights for course improvement and help students achieve their educational goals in the online environment.

In summary, digital tools play a vital role in shaping the university community's interactions, collaborations, and operations. Collaborations with external partners, a commitment to responsible use, and the integration of digital platforms are all essential components of a forward-thinking approach to digital technology within higher education. As universities navigate the digital age, these considerations are pivotal in maintaining academic excellence and serving the needs of a diverse and interconnected university community.

Digital Expertise in the Service of Society

Digital expertise is a valuable resource that can significantly contribute to the betterment of society. It encompasses a wide range of skills and knowledge related to digital technologies, data analytics, and information systems. Individuals and organisations possessing digital expertise have a social responsibility to utilize their knowledge for the benefit of communities, addressing societal challenges, and driving positive change. By applying their digital acumen, experts can contribute to advancements in healthcare, education, sustainability, and various other domains, ultimately enhancing the quality of life for individuals and communities.

Social Responsibility

With the increasing prevalence of digital technologies in all aspects of modern life, individuals and institutions must recognize their social responsibility in the digital age. This responsibility extends to safeguarding digital privacy, fostering digital literacy, and promoting ethical use of technology. Digital experts in particular, bear a significant responsibility in ensuring that their actions and innovations align with ethical standards and contribute positively to the well-being of society.

Diversity and Inclusivity

Promoting diversity and inclusivity in the digital sphere is essential for building a more equitable and just society. Digital expertise can play a pivotal role in dismantling barriers and biases that exist within technology and digital platforms. By actively seeking to include underrepresented voices and perspectives in the design and development of digital solutions, experts can contribute to creating technologies that are accessible and beneficial to all, irrespective of race, gender, or background.

Digital Innovation and Creativity

Digital expertise is a driving force behind innovation and creativity in the digital realm. Professionals with digital skills can pioneer novel solutions, invent new technologies, and contribute to the growth of digital ecosystems. By fostering an environment that encourages experimentation and creative thinking, individuals and organisations can harness digital expertise to address complex challenges, enhance user experiences, and stimulate economic growth.

Lifelong Learning

In the dynamic and rapidly evolving field of digital technology, the concept of lifelong learning is crucial. Digital experts must commit to continuous skill development and education to stay current in their fields. Moreover, they can play a vital role in promoting lifelong learning among individuals of all ages, empowering them to adapt to technological changes, acquire digital literacy, and participate fully in the digital society. This commitment to ongoing education fosters a culture of growth, adaptation, and innovation.

In conclusion, digital expertise carries significant social responsibilities that encompass promoting ethical use of technology, advancing diversity and inclusivity, driving innovation, and fostering lifelong learning. By recognizing these responsibilities and actively working to fulfil them, individuals and institutions can harness the power of digital expertise to serve society in meaningful and transformative ways, ensuring that the benefits of the digital age are accessible to all.

Governance for the Digital Transformation in Education

The digital transformation of education represents a complex and multifaceted process that requires effective governance structures to ensure successful outcomes. Governance in this context involves the strategic planning, decision-making, and oversight mechanisms that guide the integration of digital technologies and practices into all aspects of university operations. Universities must establish clear governance frameworks that align with their strategic priorities, address information security and privacy concerns, anticipate challenges, assess financial implications, manage risks, and implement digital initiatives effectively.

Strategic Priorities

Governance for the digital transformation of education organisations begins with the identification of strategic priorities. Institutions must articulate clear goals and objectives for their digital initiatives, aligning them with their mission and vision. This strategic alignment serves as the foundation for all subsequent decisions regarding technology adoption, infrastructure development, and resource allocation.

Assessing Digital Education Organisations

Assessing digital education systems in higher and VET education involves evaluating the overall effectiveness, efficiency, and quality of the technological infrastructure, instructional design, and support services that support online learning. Some of the approaches for assessing digital education systems:

- Evaluate the technical infrastructure, including servers, networks, and software systems, to ensure they can handle the demands of online education. Assess the reliability, scalability, and security of the technology stack.
- Conduct usability testing and user experience assessments to determine the ease of navigation and user-friendliness of the digital education platforms and tools. Collect feedback from students, faculty, and staff regarding their experiences.
- Implement course quality rubrics or checklists to evaluate the design of online courses. Assess the alignment with best practices in online pedagogy, content organisation, and multimedia use.

- Conduct accessibility audits to ensure that all digital content and platforms adhere to accessibility standards and provide equal access to students with disabilities.
- Regularly review the effectiveness of the LMS, considering factors such as user satisfaction, feature utilization, and integration capabilities with other systems.
- Analyse data on student engagement, progress, and performance to identify trends, patterns, and areas for improvement. Use learning analytics to track student success and identify at-risk students.
- Establish quality assurance frameworks and protocols for online education that include regular reviews and assessments of course materials and digital tools.
- Evaluate the effectiveness of faculty development programs for online teaching, ensuring instructors have the necessary skills and support to deliver high-quality online courses.
- Assess the quality and effectiveness of digital educational resources, such as multimedia materials, e-textbooks, and interactive tools.
- Measure the efficiency and effectiveness of technical support services provided to students and faculty, including response times and problem-resolution rates.
- Evaluate the availability and effectiveness of student support services in the online learning environment, such as academic advising, counselling, and career services.
- Receive continuous feedback from key stakeholders, including students, faculty, and staff, through surveys, focus groups, and interviews to identify areas of improvement.
- Benchmarking and Comparative Analysis - Compare the digital education systems with those of peer institutions or industry standards to identify strengths and weaknesses.
- Strategic Alignment Assessment: Ensure that digital education systems align with the institution's strategic goals and objectives. Evaluate the return on investment (ROI) for digital education initiatives.
- Conduct regular security assessments and privacy audits to safeguard sensitive student and institutional data.
- Assess the environmental impact of digital education systems and identify ways to reduce carbon footprints associated with online learning.
- Ensure that digital education systems comply with relevant laws and regulations, including copyright, data protection, and educational accreditation standards.
- Foster a culture of continuous improvement by regularly reviewing assessment results and implementing necessary changes and enhancements.

Assessing digital education systems is an ongoing process that requires collaboration among various stakeholders, including IT professionals, instructional designers, faculty, administrators, and students. The goal is to optimize the online learning environment to provide high-quality education and support services in higher education.

Cybersecurity and Privacy

In an era marked by increasing digitalization, education faces heightened concerns related to information access through cybersecurity and privacy. Effective governance entails the establishment of robust policies, procedures, and safeguards to protect sensitive data and ensure compliance with privacy regulations. Institutions must remain vigilant in safeguarding their digital assets, fostering a culture of cybersecurity awareness and best practices among faculty, staff, and students.

Financial Implications

Digital transformation efforts often come with significant financial implications. Governance structures must include mechanisms for assessing the financial resources required for technology adoption, infrastructure upgrades, and ongoing maintenance. Universities must allocate resources strategically to maximize the return on investment and ensure the sustainability of digital initiatives.

Risk Mitigation Management

Effective governance entails risk mitigation and management strategies that identify potential risks associated with digital transformation and develop plans to address them. These strategies include contingency planning, disaster recovery, and crisis response measures. Governance frameworks should also outline roles and responsibilities for managing risks, as well as mechanisms for ongoing risk assessment and adjustment.

Implementation

Implementation is a critical phase in the digital transformation process, and effective governance is essential for its success. Governance structures must define decision-making processes, project management protocols, and accountability mechanisms. Clear lines of communication and collaboration between academic and administrative units are necessary to ensure that digital initiatives align with the institution's strategic priorities and educational mission.

In conclusion, governance for the digital transformation of universities is a multifaceted endeavour that requires careful planning, proactive risk management, and strategic resource allocation. Effective governance structures enable universities to navigate the complex challenges and opportunities presented by the digital age while safeguarding their digital assets, ensuring compliance, and aligning digital initiatives with their core mission and strategic priorities.

Challenges and Considerations

The digital transformation of education does not come without its specific challenges. Governance frameworks must consider, acknowledge and address issues such as digital inequality, faculty

resistance to technology adoption, the evolving nature of cyber threats, and many others. Managing these challenges requires proactive strategies, ongoing evaluation, and adaptability to changing circumstances.

Technical and Infrastructure Challenges

Designing and delivering digital education comes with various technical challenges and infrastructure requirements. These challenges must be addressed to ensure a smooth and effective learning experience for students.

The issue of **reliable internet connectivity** poses a significant challenge for numerous students, particularly those residing in remote or underserved regions, as they often encounter poor or restricted access to the internet. Ensuring ubiquitous and dependable internet connectivity is of paramount importance. This may entail allocating resources towards the development of internet infrastructure, establishment of Wi-Fi hotspots, or forging collaborations with regional service providers.

Access to Devices. It should be noted that not all students own the requisite technological devices, such as laptops, tablets, or smartphones, which are essential for engaging in digital learning. In order to ensure equitable access to course materials, educational institutions may consider the provision of loaner equipment or subsidies for students.

To effectively meet the demands of fluctuating usage, educational institutions must establish a **scalable infrastructure**. This is particularly crucial during peak periods. A cloud-based infrastructure that is scalable has the capability to effectively manage variations in user numbers, hence guaranteeing the responsiveness and availability of platforms. The concept of load balancing refers to the distribution of workload among multiple computing resources in order to optimise performance and prevent any one resource from overloading. The presence of imbalanced workloads on servers and network infrastructure might result in deceleration or disruptions in service provision.

Efficient **content delivery systems** are essential for the effective transmission of large multimedia files, such as films and simulations, to mitigate buffering and minimise loading delays. The material delivery networks, or local servers can effectively facilitate the distribution of material and mitigate latency. A comprehensive Content Management System (CMS) is essential for properly organising and delivering digital information. The use of a CMS specifically designed for educational purposes has the potential to streamline the processes of content generation, management, and delivery.

Users, including students and instructors, may experience technical difficulties related to software, hardware, or connectivity. Educational institutions should provide **technical support services**, such as help desks, troubleshooting guides, and online resources, to aid users in rapidly resolving these issues.

Digital literacy abilities are sometimes deficient among certain students and educators, hence impeding their ability to proficiently traverse online platforms. The implementation of digital literacy training programmes has the potential to enhance users' proficiency in utilising digital tools and platforms.

Achieving **accessibility compliance** for digital content, which warrants the inclusion of those with impairments, can present significant difficulties. It is crucial to incorporate accessibility considerations into content design and utilise authoring tools that adhere to accessibility standards.

The implementation of **data analytics systems** within educational institutions can facilitate the extraction of valuable insights from student data, hence enhancing the quality of courses and support services.

Data security and privacy are key considerations when it comes to safeguarding student information and ensuring confidentiality. It is imperative to incorporate resilient data security protocols, such as encryption, secure authentication, and adherence to data protection rules, in order to ensure comprehensive safeguarding of data.

Compatibility and interoperability can pose challenges when using various devices, browsers, and software versions. To promote compatibility and interoperability, institutions need to guarantee that digital tools and platforms are capable of functioning seamlessly across a diverse range of devices and adhere to widely accepted standards.

The occurrence of system failures, data breaches, or natural disasters has the potential to disrupt the continuity of digital education. The implementation of **disaster recovery** strategies and redundant systems can effectively mitigate the occurrence of downtime and data loss.

The utilisation of **outdated software** might potentially expose systems to security vulnerabilities and result in compatibility challenges. Regular software upgrades and maintenance are crucial in ensuring the security and functionality of systems.

Addressing these technical challenges and infrastructure requirements is vital for the successful design and delivery of digital education. Institutions must invest in the necessary infrastructure, provide technical support, and continually adapt to evolving technology trends to meet the needs of both students and instructors.

Educational Services Considerations

Considerations in supporting academic and instruction services are fundamental for effective designing and delivering digital education and online teaching. The quality of the educational experience in the online environment depends not only on the technology but also on how pedagogical principles are applied.

Structured content involves the organisation of course material into coherent sections or modules, hence facilitating students' ease of navigation through the course. It is essential to provide clear guidelines and a comprehensive curriculum that delineates the course timetable and anticipated requirements. Begin the course with clearly articulated learning objectives that outline the knowledge or skills that students should possess or be capable of demonstrating at its completion**. Synchronous and asynchronous** learning methods should be effectively balanced to suit individuals with varying schedules and residing in different time zones. Utilise synchronous sessions as a means of engaging in discussions, facilitating question and answer sessions, and promoting collaborative activities.

Multimodal content delivery involves employing many media and formats, such as text, videos, audio, graphics, and interactive simulations, to effectively communicate information. Foster active learning by integrating instructional activities that involve students in the process of problem-solving, critical thinking, and reflection. As a way to promote engagement and active involvement, many methods such as discussion boards, group projects, case studies, and simulations can be employed. **Engagement and interactivity** are crucial elements in educational settings. It is important to establish platforms that facilitate interaction not only between students and teachers, but also among students themselves.

Feedback and evaluation should be delivered in a timely manner and should be constructive in nature, aiming to provide valuable insights and guidance on assignments and assessments. It is advisable to incorporate a diverse range of assessment modalities, encompassing quizzes, essays, projects, and peer evaluations. Consistently evaluate the extent to which students are achieving the intended learning objectives. The promotion of **metacognition** can be facilitated by encouraging students to engage in **reflection** over their learning process and the tactics they employ. Reflective journals or dialogues might be employed as effective tools to support this process.

Encouraging **accessibility and inclusivity** by implementing measures to guarantee that all course materials and activities are readily accessible to students with disabilities. Implement effective communication channels to facilitate students' access to assistance or clarification. Encourage the building of a sense of community among students by facilitating introductions, engaging in icebreaker exercises, and promoting collaborative activities.

Adaptation and flexibility are critical aspects of effective teaching. It is imperative for educators to be prepared to modify their instructional strategies in response to the unique requirements and feedback of their students. Embrace a growth mindset and willingness to experiment with new instructional methods.

Cultural differences among students and cultural contexts may impact learning. Create an inclusive environment that values diverse perspectives. Address issues related to academic integrity, plagiarism, and copyright and other ethical considerations. Foster an environment that promotes the cultivation of continuous learning.

Equity and Accessibility Issues

Addressing equity and accessibility issues in designing and delivering digital education is essential to ensure that all learners, regardless of their backgrounds, abilities, or circumstances, have equal access to educational opportunities. However, several challenges and considerations must be considered to achieve this goal.

Challenges:

- Digital Divide: The digital divide refers to disparities in access to technology and the internet. Many students lack access to reliable devices and high-speed internet connections, making it challenging for them to participate fully in digital education.

- Access to Assistive Technology: Students with disabilities may require assistive technologies such as screen readers, voice recognition software, or adaptive input devices. Ensuring that these tools are available and supported can be a challenge.
- Content Accessibility: Creating digital content that is accessible to individuals with disabilities, including those with visual or hearing impairments, can be complex and requires adherence to accessibility standards.
- Language and Cultural Barriers: Online courses may be offered in languages that are not the first language of some students. Cultural differences can also impact how content is understood and received.
- Financial Barriers: The cost of technology, software, and internet access can be a barrier for some students. This includes both the initial purchase of devices and ongoing expenses.
- Time and Schedule Constraints: Students may have work, family, or other responsibilities that make it challenging to engage in synchronous online activities or meet strict deadlines.

Considerations:

- Universal Design for Learning: Implement UDL principles in course design to provide multiple means of representation, engagement, and expression. This approach benefits all students and promotes accessibility.
- Accessibility Standards: Ensure that all digital content, including documents, videos, and learning management systems, complies with accessibility standards. Provide alternative formats when needed.
- Accessible Technology: Select and recommend technology tools and platforms that are accessible and compatible with assistive technologies. Offer guidance on how to use these tools effectively.
- Tech Support and Training: Provide technical support for students who encounter accessibility issues or have technology-related questions. Offer training on the use of assistive technology when necessary.
- Financial aid and Loaner Devices: Institutions can provide subsidies for internet access or loaner devices to students who cannot afford them. Offer financial aid, scholarships, or grants to support students in covering the costs of technology and internet access.
- Flexible Scheduling: Offer asynchronous learning options, flexible deadlines, and alternative assessment methods to accommodate students with diverse schedules and time constraints.
- Language Support: Provide language resources, translation services, and multilingual support to help non-native speakers navigate course materials.
- Cultural Sensitivity: Be aware of cultural differences in communication and learning styles. Encourage a respectful and inclusive learning environment that values diverse perspectives.
- Equity-Minded Pedagogy: Instructors can adopt equity-minded pedagogical approaches that actively address disparities and promote inclusive learning environments.
- Regular Feedback and Iteration: Continuously seek feedback from students about their experiences with digital education and make iterative improvements to address equity and accessibility concerns.
- Advocacy and Policy: Advocate for policies and practices at the institutional and governmental levels that promote equity and accessibility in digital education.
- Collaboration: Collaborate with experts in accessibility, diversity, and inclusion to inform course design and make improvements.

Addressing equity and accessibility in digital education requires a concerted effort from educational institutions, instructors, and policymakers. It involves proactive planning, resource allocation, and ongoing commitment to ensure that all learners have an equitable opportunity to succeed in digital learning environments.

Selected Case Studies of Best Practices

Complementary to the Blueprint structure, DigiTransformEdu project has facilitated search for and identification, description of a template structure, development and presentation of the selected best practices in the institutional strategic approach to digital transformation. The aim was to provide at least one best practice selected per every project participating country, but the task was not limited to this goal. The direct output of this effort is delivered in the form of a collection of the selected case studies, constituting a separate document adjacent to the DigiTransformEdu Blueprint. Here is the summary of those case study findings.

Bulgaria

The **University of Ruse (RU)** in Bulgaria is implementing a policy for modernisation and digital transformation, focusing on adapting the educational system to the digital generation. The Centre for Innovative Educational Technologies, established in 2002, has developed an e-learning platform for easy online course development and a virtual course library for students. The Centre also organizes national seminars and international conferences on digital education, attracting representatives from Bulgarian higher education institutions, the Bulgarian Academy of Science, and international organisations. RU plans to introduce distance education for most bachelor and master programs, with eight master and four bachelor programs already accredited for distance education. Online courses are also introduced for continuing and tertiary vocational education. An information system, developed by the university students' union and funded by the university research fund, is used to communicate the benefits of digital learning technologies.

The Strategic Plan of RU focuses on the development of a university of the future that uses innovative educational technologies and digitalization for growth and achievement. The university's mission is to deliver knowledge, conduct research, and implement innovation to support the development of highly qualified professionals and the stable growth of the region and the country. The quality assurance strategy and other strategic documents reflect the concept of adapting the educational system to the digital generation. The implementation plan builds on enablers while addressing barriers, including online education, which was developed with EU projects and initiatives. Internal stakeholders have a degree of autonomy, and in Bulgaria, distance education can provide additional qualifications to professionals with diplomas in other domains. Opportunities, incentives, and rewards for staff acquiring digital competence and creating digital content are identified. The university has developed e-Learning Shell, a university e-learning platform, and has collaborated with the Ministry of Education, Youth, and Science to train teachers in using ICT in education.

RU has implemented a digital management and governance model to promote digital education in Bulgaria. The university has introduced incentives for publications, staff participation in projects, and

the identification of sponsors. The Centre for Innovative Educational Technologies has received numerous awards for their participation in the National program to create a virtual educational space. The university aims to modernize existing educational provision and offer new digital opportunities. The Distance Learning Centre, established in 2005, secures the distance form of education, trains teachers, and monitors resource development. The Centre for Innovative Educational Technologies supports digital pedagogy and collaborates with the Distance Learning Centre and the Centre for Technology and Intellectual Property Transfer. The University Computing and Information Services Centre develops and maintains digital infrastructure, while the Continuing Education Centre oversees online continuing and vocational training. The implementation plan's outcomes, quality, and impact are reviewed through performance indicators, participation in key national and international projects, and external evaluations. The Development Policy of RU is regularly assessed by the Ministry of Education and Science.

The University of Ruse (RU) has been recognized as a Research University by the Council of Ministers as of 26 October 2022. The university aims to transition its main buildings into smart buildings by 2030, providing digital education, social networks, and communication for collaboration. It also promotes networking and collaboration among staff, with regular updates on project funding opportunities and funding instruments.

The Transnational Interdisciplinary Studies Centre in the Area of Social Sciences (TISCASS) was established in 2009, promoting knowledge exchange efforts between science and practice. The university also organizes annual scientific sessions and events for students, with their works awarded with the Best paper Crystal Prize. Students are considered partners in university management through the Student Union and assigned various jobs and tasks.

RU plans to develop the Centre for Innovative Educational Technologies through national and international projects, establish a research institute in technology and innovation, and maintain a dynamic online presence. The university has an explicit communication strategy in place, maintaining a dynamic online presence and ensuring wide access to the internet.

The Centre for Technology and Intellectual Property Transfer identifies opportunities for development and problems of potential customers, stimulating the formation of teams involving RU professors and business representatives, establishment of strategic partnerships with leading European research centres, participation in international and transnational research networks, programs, alliances, forums, and projects. Staff and students are incentivized to be actively involved in partnerships.

RU's infrastructure includes physical and virtual learning spaces, with over 50 classrooms equipped with interactive presentation systems and synchronous online teaching. Virtual and augmented reality are used in courses when applicable.

The University of Ruse (RU) has implemented a comprehensive digital infrastructure, including the e-Learning Shell (eLSe-02), Moodle, BigBlueButton, and other learning technologies. The university has also promoted Bring Your Own Device (BYOD) approaches, addressed risks related to inequality and digital inclusion, and provided technical and user support.

The university has also developed an application that converts Bulgarian text into Braille, and plans to procure specific technical devices and automated places in the library for students and staff with

special needs. Measures to protect privacy, confidentiality, and safety are well established, and the university has a strategy for transparency and effectiveness.

The university is planning to improve and expand the digital education systems, extend and improve the functionalities of the e-Student system, maintain and update university websites, develop the university publishing centre into a digital centre, take advantage of technologies and increase computer-based and digital resources, develop digital training materials, and improve the website of the Continuing Education Centre.

The university aims to turn the university campus by 2030 into an integrated, digitally connected university city that can be used as a living lab to test innovations and technologies for smart cities. It will further develop the university intranet and foster its utilization by all teachers and students by linking it to the Centre of Excellence and the Scientific Research Complex.

The university also ensures broad access to the Internet and utilizes specialized software to improve the quality of education for students and research for professors and doctoral students. Additionally, the university maintains active links of the library website with library digital funds and digital catalogues of other national and international libraries.

The **New Bulgarian University (NBU)** is a leading institution in Bulgaria that has been implementing digital education since 1991. The university introduced the Radio University, a new type of distance education based on the Open University model, which used films, radio lectures, and sending textbooks by post. The Radio University gained popularity and attracted many students, focusing on self-study and motivation.

NBU's strategic plan includes regular on-site education and distance education, both of which are enabled for digital provision. The university's mission is to be an autonomous liberal education institution dedicated to advancing university education by offering accessible and affordable opportunities for interdisciplinary and specialized education and research of high quality.

The implementation plan builds on enablers while addressing barriers, with priorities including developing education to support students' needs and expectations, fostering research capacity in innovative and technological areas, and turning continuing education into an integral part of individual diploma pursuits.

NBU aims to further develop distance and digital education by diversifying the offer of bachelor and master study programs, increasing the number of students, improving the Moodle platform, introducing completely digital forms of education, and training and re-training teachers. The strategic plan includes objectives related to distance education, digital education, and promoting the use of new technologies in education.

NBU is implementing a digital education model that aims to modernize existing educational provision and offer new digital opportunities. The university has established a Centre for Educational Resources to support teachers and administrators in using contemporary teaching methods, teamwork, inclusiveness, conflict, and time management. The Centre organizes group trainings, seminars, and maintains the Teachers' Café forum.

Digital-age learning supports and complements both regular and distance education, with the aim of further developing distance and digital forms of education by diversifying bachelor and master study programs, increasing student numbers, improving the Moodle platform, and introducing new teaching methods and technologies. The School of Distance, Digital and Continuing Education oversees various units providing alternative forms of education and teaching at NBU, including the Centre for Distance and Digital Education, the Centre for Professional and Continuing Education, and the IT Certification Centre.

The Centre for Professional and Continuing Education offers a wide range of professional qualification programs, postgraduate pedagogical and other qualifications, trainings, seminars, workshops, summer and business schools, IT certification courses, foreign language courses, and public lectures. The Lab for Language Technologies is a learning, practical, and research unit that develops scientific and applied corpus and computer linguistics, focusing on linguistic software development, digital resources creation, and technology application for translation practices and studies.

The Digital Innovation Lab at NBU is part of the Computer Science department, focusing on consultancy, research, and practical activities in digital education, big data, data analytics, and e-leadership. The lab is responsible for developing new learning content, courses, and study programs to meet industry needs and connect academic and business communities. The university maintains academic standards and enhances the quality of its learning, teaching, and research provisions through a Quality Assurance System that balances academic quality with market competition. The system uses input, process, and output indicators to evaluate the outcomes of its initiatives.

NBU also promotes collaboration and networking, participating in international academic networks through mobility of lecturers and students, and membership in reputable educational associations. The university also recognizes knowledge exchange efforts and organizes annual summer international schools and master classes. The Digital Innovation Lab supports the digital transformation of businesses in Bulgaria and beyond, promoting innovative educational practices and technological solutions in the classroom. The university actively seeks to maintain collaboration between different departments and units and promotes interdisciplinary study programs.

NBU aims to improve both internal and external communication through an internal development project. The university has a dynamic online presence, with approximately 20.000 visitors per day from over 130 countries on its website. It is also present on popular social network platforms like Facebook, Instagram, YouTube, and Twitter.

NBU is committed to knowledge exchange through partnerships, actively pursuing collaborations with companies, business organisations, national and international Higher Education Institutions (HEIs), governmental institutions, non-governmental organisations, national and international stakeholder associations, and networks. The university also encourages staff and students to be actively involved in partnerships, investing in their professional development and participating in networks, forums, conferences, and events.

Physical and virtual learning spaces are optimized for digital-age learning. In 2013, NBU launched the project "Improving the Quality of Distance Education at the Centre for Distance and Digital Education" as part of the Human Resources Development Operational Programme co-funded by the European Social Fund of the EU. This project resulted in 10 additional classrooms equipped with cameras and

microphones, allowing lessons from 20 classrooms to be recorded and broadcasted from the university campus.

The NBU's digital infrastructure is accredited by the National Evaluation and Accreditation Agency, granting the university the right to provide distance education. The idea to create a university system for digital education originated in 2002 with the project "Virtual Master Programmes" funded by the Open Society Foundation. In 2005, the Information Environment for Distance Education (IEDE) was launched, enabling virtual lectures and discussions.

An acceptable usage policy is in place on the NBU's Moodle digital learning platform, providing access to technical support, presentations, instructions, tutorials, calendars, feedback channels, information about distance education, and other useful information. Personal data is treated according to the Bulgarian legal requirements and NBU is a registered administrator of personal data at the Committee for the Protection of Personal Data.

NBU utilizes a range of digital learning technologies to support anytime/anyplace learning. The Moodle platform allows students and teachers to access individual course pages, complete digital tests, and access electronic learning materials. The NBU-video, a video-training system, transmits lectures in real time, recording and making available for further re-use. The BigBlueButton virtual classroom complements the options available at NBU, offering online or blended learning.

The electronic learning platform supports Bring Your Own Device (BYOD) approaches, allowing students and teachers to use their devices in the classroom and connect to multimedia resources. A tutoring scheme is an important part of the Centre Supporting Students with Special Educational Needs, creating a suitable environment for each student to succeed irrespective of their specific needs.

Technical and user support is evident in the development of online training modules in Bulgarian for teachers and students on how to use the Moodle platform, including access, evaluation, plagiarism checking, sending and receiving messages, forums, profile settings, and more. Information about project presentations, tutors, bachelor or master thesis preparation, open training sessions, lectures, events, and projects is also available in Moodle.

Assistive technologies address special needs, with the library providing resources and services tailored to special needs and assistive technologies supporting self-study. The procurement of technological equipment for the smooth implementation of distance education is an essential element of its management, funded from the budget of the School of Distance, Digital and Continuing Education, the Central Fund for Strategic Development, and the Fund for Facility Development.

Croatia

The **University of Zagreb's Faculty of Organisation and Informatics (FOI)** has implemented a digital strategy to enhance its online learning and public engagement. The strategic plan includes the mission, vision, and benefits of digital learning technologies, as well as the role of open education in the institution.

FOI is dominant in two scientific fields: information and communication sciences and economics. The strategic plan focuses on four areas: Information systems of the future, big data analytics and artificial

intelligence, economics of entrepreneurship and innovation management, management of organisations and business processes, educational technologies, and information security and open systems.

The Faculty has developed new study programs and upgraded existing ones, while also establishing new labs and centres for further scientific and professional activity in these strategic areas. The "Educational Technologies" (EdTech) area is a research discipline that encompasses e-learning or distance education, with a focus on online and mobile learning, open content and licenses, learning analytics and adaptive learning, digital badges, virtual and remote labs, and BYOD (Bring Your Own Device) and Flipped Classroom concepts.

Four core research areas are based on the competencies of FOI researchers, including learning analytics, design and quality of education technologies, student-centred approaches and technologies, and strategic management of educational technologies. The FOI vision focuses on innovative approaches to learning and teaching, the development of digital-era competences, project activities, and international partnerships.

Key risks associated with the implementation of this strategic plan include maintaining the existing staff structure, assessing the development potential of strategic areas, changes in the higher education financing system, and dropping the number of students and reaching enrolment quotas.

The first e-learning strategy was defined at FOI in 2007 and has since been adopted by the University of Zagreb. The strategy recognizes three different maturity levels of e-learning courses and prescribes characteristics for each level. All FOI courses within all study programs and levels are available as e-courses at the Learning Management System (elf.foi.hr). FOI is continuously improving the quality and offer of e-courses available at FOI LMS in line with the latest pedagogical trends and job market needs.

Several strategic European projects, mostly Erasmus+, have been aimed at fostering relations with other strategic partners across Europe and developing new learning technologies in teaching and learning at FOI. The FOI Online Portal provides teachers and students with relevant information on e-learning at FOI.

The research of educational technologies is interdisciplinary and includes educational, informatics, mathematical, and economic sciences. FOI is currently involved in at least seven international project applications related to educational technologies, with about 20% of all works published by FOI researchers having a link to e-learning. The Laboratory for Learning Analytics designed the concept and tool for learning design titled Balanced Learning Design Planning (BDP), which has more than 1200 users worldwide (30+ countries).

FOI established a learning platform (learn.foi.hr) that offers learners the possibility to start studying online to develop personal interests, as a stepping stone to new career opportunities, or to enhance their career as part of their continuing professional development. The main research areas based on the competences of FOI researchers include learning analytics, learning design, design and quality of educational technologies, student-centred approaches and technologies, and strategic management of educational technologies.

FOI, a leading faculty in the field of information and communication sciences, has developed a unique educational approach that connects professional and technological knowledge, business aspects, applied use of knowledge and technologies, and digital innovations. The faculty aims to raise the

quality of education and enable students to acquire practical knowledge and experience in line with the labour market needs. The teaching process is innovated through work-based learning, mandatory internships, intensive courses, and a student career portal.

Work-based learning involves employers directly in the teaching process, providing mentorship support and practical skills development. Mandatory internships are offered for all study levels, with the internship process being digitalized to facilitate communication between students, mentors, and faculty. Intensive courses are offered by partner companies, such as Speck and Arbona, to keep students on track with market innovation and digitalization practices.

The Faculty of Organisation and Informatics of the University of Zagreb has a strategic orientation in information systems since the early 1990s, focusing on planning, development, application, and maintenance of information systems. The school's ability to effectively execute this aspect of its strategy depends on credible operational plans, resources, and the development of required competencies and capabilities.

The implementation of digital transformation at all levels, including the digitized economy, public administration, and daily services, is crucial for a digitized society. Education is a key stakeholder in this process, as it provides students with advanced skills in information and communication technologies. FOI (Faculty of Information and Communication Technologies) is leading the way in the digital model of learning and teaching, with online classes conducted on its own online infrastructure. FOI has been working on developing web services, applications, and systems to facilitate the educational process for students, teachers, and other faculty members. FOI was among the first faculties in Croatia to have a complete system ready for the transition to online classes and registrations.

The implementation plan builds on enablers while addressing barriers, with internal stakeholders having a degree of autonomy. Opportunities, incentives, and rewards for staff acquiring digital competence and creating digital content are identified, and digital-age learning is aligned with broader priorities. FOI has coordinated several strategic EU funded projects aimed at developing and introducing new teaching and learning technologies and has the richest practice among all faculties within the University of Zagreb. The school aligns faculty competence with the requirements involved for the digitalization of learning and teaching, as well as research.

The School is implementing a digital management and governance model to ensure a digitally-competent educational organisation. The implementation plan includes a shared understanding of management responsibility, aligned resources, and performance indicators. The school has developed an online portal and policy for conducting classes using digital technologies, which includes tools, timing, resources, and formats. The Management Team is clear in its approach to digitalization and communicates this to key departments. The School uses three laboratories for e-learning and communicates with the E-learning Committee to detect and plan the implementation of new technologies. The School also has an appropriate Quality Assurance framework in place and processes to assure the quality of online programs. The School assesses the quality of online learning and accounts for the virtual experience and goals achieved compared to traditional exchange opportunities. The School has developed an online survey to receive feedback on course quality during COVID-19, allowing students to evaluate both online and face-to-face learning. The School also uses

student voice as a feedback mechanism and organizes workshops to address common teacher skills gaps.

FOI promotes collaboration and networking among staff, students, and faculty members. They actively participate in mobility programs, such as the Erasmus+ programme and Erasmus+ Blended Intensive Programmes (BIPs), which encourage students to spend part of their study period abroad. FOI has more than 30 bilateral agreements with universities worldwide, and is part of UNIC - European University, an alliance of ten universities educating through teaching, research, and community engagement. The school also has a strategic approach to digitalization, utilizing digital content creation, social media engagement, SEO optimization, email marketing, webinars, online events, and collaboration with alumni and influencers. The school's marketing strategies align with modern trends and technology, ensuring effective communication and knowledge exchange.

FOI uses various communication channels to engage with its audience, including the official faculty website, social media platforms, email newsletters, webinars, podcasts, and online advertising. The effectiveness of these strategies is evaluated through metrics such as website traffic, social media metrics, email campaign analytics, webinar attendance, and feedback from event participants. The FOI also evaluates the return on investment (ROI) of marketing channels and project campaigns. The school is innovating and exploring digital learning spaces, with an acceptable usage policy, pedagogical and technical expertise, and direct investments in digital technologies. The virtual learning environment and digital tools used for learning are well-equipped, and the facilities are shared between different programs.

FOI has implemented a virtual learning environment since 2000, using Moodle LMS as the default LMS. The institution maintains a reliable ICT infrastructure, with the latest upgrade in 2021 involving two servers and a data management centre. The university has a policy for e-learning, describing three ways of course organisation and possible implementation. Teaching rooms are equipped with advanced video conferencing solutions, and 11 laboratory rooms are equipped with modern desktop computers. A small recording studio is available for teachers. The Office for Students with Disabilities provides individual support to students with disabilities, mental health issues, and peer support. Communication and a team approach are essential for students to achieve academic success.

Germany

The **Münster University of Applied Sciences (FH Münster)** in Germany has been a leading institution in the field of digital-age learning since its establishment. The university has developed new teaching and learning formats and has emphasized the use of digital tools to promote new competencies from students, teachers, and employees. The university's Higher Education Development Plan (HEP) for 2021-2025 outlines six strategic development fields: internationalization, continuing education, digitization, transfer 2020, human resources development, and content profiling.

Digital teaching is defined as any form of teaching in which digital tools are used to record, transmit, or enrich the course. Opportunities of digital teaching include flexibility in terms of location and time, methodological and content flexibility, and modern and future-proof courses. Challenges include preventing students from being overwhelmed, allowing sufficient time for conceptualization, and ensuring social inclusion.

The university's educational mission statement expresses its self-image and common values regarding teaching and learning. The central goal of FH Münster is the academic success of its students, who are academically qualified, adaptable, and willing to change. The university sees the interweaving of scientific and professional qualification, as well as personality development, as a central profile feature of its university.

The university has recognized digitalisation as one of six key challenges, requiring new skills from students, teachers, and employees. To promote these skills, the university has developed new teaching and learning formats and e-learning tools. The university has taken a leading role in the university landscape, with research questions on digitalization bundled in its two research institutes, Institute for Society and Digital Studies (GUD) and Institute of Process Management and Digital Transformation (IPD). The university has initiated and implemented numerous projects to complete the transformation toward digital processes, such as installing a campus management system and document management system.

Open Education (OER) is an aspect of public engagement, offering low-threshold accessibility and the possibility of exchanging, customizing, and reusing teaching/learning materials. The Open Resources Campus NRW is a cross-university online portal for digitally supported teaching and learning at universities in North Rhine-Westphalia. The portal aims to strengthen digitally supported teaching and learning locally, promote cooperation between universities, and make e-learning activities more visible.

The university's digital strategy is reinforced by an implementation plan that builds on enablers while addressing barriers. The plan includes establishing appropriate teaching/learning and assessment formats, supporting the development of agile curricula and modules, transferring the educational mission statement into curricula, sharpening the content profile, promoting interdisciplinary competencies, and enabling lifelong learning. The university actively builds on the potential of digital technologies while staying aware of the challenges its integration into its offerings entails.

FH Münster uses the Academic Scorecard (ASC) as a strategic management tool for structuring and operationalizing planning. The university-wide ASC focuses on goals and activities that can be influenced centrally, while departmental ASCs consider goals and activities that the respective department will implement decentralized over the next five years. Important university-wide concerns, such as internationalization and entrepreneurship promotion, are anchored in separate ASCs to agree on a goal-oriented and binding approach.

In terms of digital learning, lecturers have far-reaching autonomy. Support structures like Wandelwerk offer opportunities for staff to acquire digital competence and create digital content. The university has two support mechanisms to balance the twin goals of modernizing existing educational provision and offering new digital opportunities. These are quality improvement funds and internal change funds.

The implementation plan is based on joint discussions and understanding of the university's leadership, senate, council, and representatives of all faculties. Management responsibility is clearly assigned, and resources are aligned with budgets and staffing. Performance indicators are regularly reviewed to assess the outcomes, quality, and impact of the implementation plan.

Collaboration and networking are essential for the university's success in integrating digital learning elements. FH Münster is promoting networking, sharing, and collaboration through various initiatives. The Learning Culture project, funded by the "Innovation in Higher Education" foundation, aims to make learning paths more flexible and improve learning locations at FH Münster. The university's development plan acknowledges the importance of communication and marketing to ensure its role in the local, regional, national, and international ecosystem. FH Münster communicates through various channels, including its website and social media platforms like Instagram.

The university is committed to knowledge exchange through partnerships, being a partner for research and innovation projects nationally and internationally. The university has been a "Gründerhochschule" (university for start-ups) since 2020 and has received funding as part of the BMWi competition "EXIST-Potentiale." FH Münster is also participating as a consortium partner in the DH-NRW project "Higher Education Didactics in the Digital Age" (HDDHnrw), aiming to develop teachers' competence in teaching and learning in the digital age. Staff and students are incentivized to be actively involved in partnerships.

FH Münster offers a range of digital learning spaces, including lecture halls, seminar rooms, co-creation labs, and digital exam rooms. These spaces are equipped with interactive media desk displays, cameras, and other technology to facilitate interactive learning. The digi.lab, a co-creation lab, offers a large touchscreen, conference camera, beamer, 360-degree camera, 3D printer, factory simulation, and augmented and virtual reality applications. The digital course room on the learning platform ILIAS allows lecturers to provide content, create quizzes, upload videos, and interact with students.

The university's digital infrastructure is planned and managed, with an acceptable usage policy from 2022 containing binding guidelines for the use of IT systems and services. The DVZ team considers the economic impact and financial viability of digital technologies in their actions. The main learning platform ILIAS supports various types of interaction between lecturers and students, and students are free in their choice of device.

Risks related to inequality and digital inclusion are addressed, and technical and user support is evident. Assistive technologies address special needs, and measures to protect privacy, confidentiality, and safety are well established. An information security guideline serves as a guide for the creation of further guidelines, information security concepts, and regulations on information security and data protection.

Italy

The **Institution of Research and Economic Studies (IRES)** in Italy is responsible for vocational education, research, and consultancy. It operates through public resources at regional, national, and EU levels, and offers training programs in close cooperation with the Friuli Venezia Giulia Region and VET institutions. The potential of digital learning technologies is evident, as the region was responsive to adapting regulations to the new online training world during the Covid-19 pandemic.

IRES's target population comes from diverse backgrounds, including social services, unemployment services, mental health issues, and remote areas. Digital learning technologies have supported students in attending courses, although some courses remained online or partially online to enhance

their appeal. The Strategic Plan encompasses the mission and vision of digital-age learning, and IRES has a strong advocacy mission for inclusion of disadvantaged people into the job market.

The implementation plan builds on enablers while addressing barriers. IRES offers a wide range of training courses, involving professionals who are experts in their field, providing high-quality learning. However, trainers have a diverse approach to teaching and lack clear online guidelines. IRES constantly reads student feedback to improve their quality.

Internal/external stakeholders have a degree of autonomy, with professional qualifiers working autonomously on competencies with a "Lego approach" framed in the context of typical situations according to the Friuli Venezia Giulia Competence Framework. IRES is also cooperating closely with companies to co-create training courses adapted for their specific needs and the updated needs of the job market.

IRES is focusing on digital competence and content creation, offering technical training to trainers and a focus on connection and web-conferencing platforms. The organisation has recently started providing training to senior people over 70 years old to support them in the transition to the digital age. The twin goals are modernizing existing educational provision and offering new digital opportunities.

The digital management and governance model is in place, with shared understanding and commitment to the implementation plan. Resources are aligned with budgets and staffing, and performance indicators are used to evaluate the outcomes and impact of the implementation plan. IRES is also accredited as a Digital Badge Provider, starting from September, to grant Digital Badges to students.

IRES works with companies to upskill their workforce through blended learning programs that are mainly digital but open and end with lessons in presence. This approach is increasingly preferred by companies instead of traditional classrooms.

Collaboration and networking are promoted, with long-term training courses featuring scheduled meetings for teachers and didactic discussions. Knowledge exchange efforts are recognized, but not regularly done. Students engage in effective networking through online activities, which enhances interaction quality and promotes collaborative and peer-to-peer learning. Distance coaching activities have proven effective, but IRES does not promote any policy for assessing how training materials are participative and engaging.

Companies participate in knowledge exchange activities and events, contributing to the definition of expected competence profiles according to market needs. Co-projected courses can also benefit companies.

The text highlights the strategic approach taken by IRES, which includes internal collaboration and knowledge exchange, a dynamic online presence, and partnerships. The Regional System for the Recognition of Competences has made it easier to integrate information among institutions and training bodies. IRES and other training providers have created a shared catalogue for reskilling and upskilling courses in cooperation with employment offices. Staff and students are incentivized to be actively involved in partnerships.

The infrastructure includes physical and virtual learning spaces, with physical learning still being the standard at IRES. Virtual learning spaces are optimized using a Moodle platform, but there is a lack of someone who stimulates the learner's community. Digital infrastructure is planned and managed, with an acceptable usage policy in place. Pedagogical and technical expertise and a Whole of Life Cost Model direct investments in digital technologies are also invested.

IRES supports Bring Your Own Device (BYOD) approaches, addressing risks related to inequality and digital inclusion. Modalities for disadvantaged categories are foreseen, such as providing digital devices for those who cannot afford them. Technical and user support is evident, with teachers and students having access to technical assistance throughout trainings. Assistive technologies address special needs, and measures to protect privacy, confidentiality, and safety are well established.

IRES is well equipped for hybrid lessons and supports students to participate from IRES classrooms to digital learning activities. An operational plan for core ICT backbone and services is in place, but analytics for optimizing training experience and interaction are not common.

The Future of Digital Education

The future of digital education design and delivery is likely to be shaped by ongoing technological advancements, evolving pedagogical approaches, and the lessons learned from past experiences.

The landscape of education is undergoing a profound transformation, driven by the integration of digital technologies and innovative pedagogical strategies. This transformation is characterized by a multifaceted approach that seeks to enhance the learning experience while addressing the diverse needs and challenges of students and educators. One key avenue for achieving these goals is the adoption of hybrid and blended learning models, which seamlessly blend online and in-person elements. These models offer the flexibility to accommodate individual learning styles and preferences while preserving the valuable face-to-face interactions that foster engagement and collaboration.

In the pursuit of personalized learning experiences, institutions are turning to adaptive learning systems that harness the power of data and artificial intelligence. These systems have the capacity to tailor educational content and assessments to individual student needs, pacing, and preferences. By leveraging data-driven insights, educators can optimize instructional design, identify at-risk students, and enhance student support services, ultimately improving learning outcomes.

The global interconnectedness of today's society demands a shift toward fostering global collaboration and cross-cultural experiences in education. Institutions are facilitating opportunities for students from diverse backgrounds to work together on projects, share perspectives, and engage in cross-cultural exchanges. This not only enriches the learning experience but also prepares students for a globalized workforce where cross-cultural communication and collaboration are essential skills. Global standards for digital education quality and accreditation are essential to maintain consistent quality across institutions and programs. These standards help ensure that digital education meets rigorous academic standards and provides value to students.

In the pursuit of excellence, institutions are also placing a premium on professional development for educators. Ongoing training equips educators with the latest instructional technologies and pedagogical strategies, enabling them to navigate the evolving educational landscape effectively.

AI-powered support services, in the form of chatbots and virtual assistants, offer round-the-clock assistance to students, answering common queries, providing guidance, and enhancing the overall support system.

However, the digital transformation of education also presents challenges and ethical considerations. Robust cybersecurity measures and data privacy protections are essential to safeguard sensitive student information. Additionally, ethical considerations surrounding technology use and responsible digital citizenship must be integrated into the curriculum to prepare students for ethical dilemmas in a digital world.

Interdisciplinary collaboration among faculty members is fostering innovation and holistic educational experiences. Breaking down disciplinary silos allows for the development of interdisciplinary courses and research projects that reflect the complexity of real-world challenges.

Engaging all stakeholders, including students, educators, employers, and policymakers, in the design and evaluation of digital education initiatives is essential for their success. Collaboration and input from these diverse perspectives ensure that educational offerings align with real-world needs and expectations.

Flexible credentialing options, including certificates, microcredentials, and degrees, enable learners to tailor their educational journey to their specific career goals and interests. This flexibility promotes lifelong learning and encourages individuals to upskill and reskill throughout their careers.

Microlearning and just-in-time training modules are emerging as valuable resources to address specific skill gaps and support continuous learning. These bite-sized learning opportunities are readily accessible and can be customized to meet the immediate needs of learners, ensuring that education remains relevant and adaptable.

The HyFlex learning model provides multiple pathways for students to participate in the learning process. Students are allowed to take part in learning activities before, during, and after the face-to-face class. All the learning modes enable them to interact with the course content, their teacher and their peers regardless of the learning path their peers have chosen. Collaboration and participation in group activities that include students from different learning modes should be supported whenever possible so that no one feels isolated or left-out. Throughout the course, students should always be provided with opportunities to engage in self-reflection tasks and activities.

Innovative assessment methods, such as competency-based assessments, e-portfolios, and real-world projects, move beyond traditional testing to provide a more comprehensive and authentic evaluation of student learning.

Maintaining consistency in design and branding throughout all digital education materials and platforms is essential for crafting a cohesive and unified learning experience. When a uniform design is applied to all course materials, students can easily identify and associate the content with the institution or program, reinforcing the branding identity. A consistent visual identity not only enhances

the overall user experience but also fosters a sense of professionalism and credibility, contributing to the institution's reputation.

Connecting course content to real-world applications and scenarios is a pedagogical approach that underscores the relevance and practicality of what students are learning. By illustrating how theoretical knowledge can be applied in real-life situations, educators make the content more engaging and meaningful for students. This approach not only enhances the learning experience but also equips students with valuable skills and insights that they can readily apply beyond the classroom, ensuring that education remains a dynamic and applicable endeavour.

Continuous improvement and evaluation are integral to the success of digital education programs. Institutions must regularly assess the effectiveness of their initiatives, gathering feedback and data to make iterative improvements.

Improving the design of digital education requires a commitment to ongoing assessment, adaptation, and a learner-centric approach. By integrating these strategies, educators and institutions can create engaging, effective, and inclusive digital learning experiences for students.

In conclusion, the future of digital education holds great promise for expanding access, improving learning outcomes, and adapting to the evolving needs of learners. These recommendations emphasize flexibility, innovation, inclusivity, and a commitment to quality and ethics as guiding principles for the future of education. By embracing these principles and leveraging the transformative potential of digital technology, institutions can shape a brighter future for education, equipping individuals with the skills and knowledge they need to thrive in an increasingly digital world.

Collection of Selected Case Studies of Best Practices

Editor: Goran Radman, Algebra University College

During 2022 and 2023, DigiTransformEdu project partners have mapped the digital readiness and resilience of HE/VET institutions in response to the COVID crisis in the context of governance and enabling services, teaching and learning practices, and infrastructure in Bulgaria, Croatia, Germany, Italy and EU. Project partners also collected information about concepts and frameworks, examined case studies and best practices, and were outlining a blueprint for the strategical approach to digitalisation while exploring the institutional approach to digital strategy.

DigiTransformEdu project partners have facilitated search for and identification, description of a template structure, development and presentation of the selected best practices in the institutional strategic approach to digital transformation. The aim of the project was to provide at least one best practice selected per every project participating country, but the task was not limited to this goal. The direct output of this effort is the following collection of the selected case studies. Case Study Document Template and its Vocabulary Descriptors constitute respectively Addendums I and II of this Report.

Collection of selected DigiTransformEdu case studies of best practices consists of six case study documents presenting the references and experiences in the institutional digital transformation by the following educational institutions: The University of Ruse (Bulgaria), New Bulgarian University (Bulgaria), The University of Zagreb's Faculty of Organization and Informatics (Croatia), Münster University of Applied Sciences (Germany), and The Institution of Research and Economic Studies (Italy). In addition, EFMD (Belgium) provided supplementary guidelines supporting partners in managing interviews and design of their case studies. The case studies were explored, designed and elaborated in close collaboration between the respective national project partners and selected educational institutions in the first half of 2023.

Before selecting these best practices, DigiTransformEdu project partners were mapping experiences and practices of how different educational institutions responded through administration, governance, use of pedagogy and technology to the COVID-19 crisis at national or international level. The findings of this mapping were published in the form of national and EU level reports[27] (Project Results 1 and 2 combined), where institutions for further study and exploration were identified and shortlisted. Consequently, a Case Study Document Template (Addendum I) and Vocabulary Descriptors (Addendum II) have been designed and agreed upon before the case study research and inquiry commenced. By September 2023, the following case study documents were presented.

[27] DigiTransformEdu: Lessons Learned From the COVID-19 Crisis: Governance and Enabling Services, Teaching, Students and Infrastructure, ISBN 978-953-322-492-3.

University of Ruse (Bulgaria)

Case Title	Implementation of the Policy for Modernisation and Digital Transformation at "Angel Kanchev" University of Ruse
Institution	
Name of the Institution	"Angel Kanchev" University of Ruse (RU) Русенски университет „Ангел Кънчев"
Country	Bulgaria
Ownership	Public
HEI / VET	HEI
Type of Education	Formal
National Accreditation	Yes (National Evaluation and Accreditation Agency)
International Accreditation	No
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☒ (b) Digital Collaboration and Networking ☒ (c) Digital Infrastructure ☒ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	*The Centre for Innovative Educational Technologies is particularly focused on digital learning technologies. The Centre was created in 2002 in response to the e-Learning initiative of the European Commission. It forms an integral part of the university Scientific Research Complex and cooperates with the Centre for Distance Education and the Centre for Technology and Intellectual Property Transfer.* *The first accomplishment of the Centre was an e-learning platform (the e-Learning Shell) that provided lecturers with a tool for easy and quick development of online courses and students with a virtual course library. Since its establishment, the Centre has been working on a range of innovative initiatives related to the use of digital technologies in teaching and learning, such as virtual labs, the Bulgarian virtual university, a national network of virtual libraries, etc.* *Each year the Centre with the support of the Bulgarian Ministry of Education and Science organises national seminars and international conferences dedicated to digital education. The attendees represent most of the Bulgarian higher education institutions, the Bulgarian Academy of Science as well as European and international organisations.* *RU clearly states its intention to introduce the distance form of educational provision[28] for the majority of its bachelor and master programmes. The teaching process in distance education is implemented primarily through digital education and organised electronically with the students learning remotely. The course of action is to focus on the master programmes first.*

[28] The provision of distance education in the Bulgarian HEIs is regulated with an Act of the Council of Ministers that sets clear requirements for the delivery of digital content and the organization of the teaching process. In this respect, the National Evaluation and Accreditation Agency is the body responsible to grant the accreditations. The assessment is made at two levels, the university digital infrastructure as general and the individual program that needs to be accredited. The digital infrastructure consists of teaching, administrative and technical staff, management and organizational structure, regulatory base for informative actions, digital activities and resources, information and communication systems, software and hardware.

	In this respect, eight master and four bachelor programmes are already accredited for distance education and included in the educational offer. Some more are in the process of preparation. Online courses are developed and introduced for the continuing and tertiary vocational education offered by RU. *Based on an idea coming from the university students' union and developed in the framework of a project funded by the university research fund, an information system is established. The system is comprised of big interconnected screens that are hanging at various places in all university buildings to present results from research projects, to inform about future and past events, and to provide relevant information from the academic community and about technological developments. Similarly, interactive interconnected terminals are placed all over the university to inform students about planning, lesson schedules, availability of materials in the library, etc. The terminals are also funded by the university research fund.* *The vision inspires the development of RU as a university of the future. This translates into focusing on the use of innovative educational technologies and digitalisation that are seen as prerequisites for achievements and growth.* *In addition, the availability of technological and information infrastructure is considered as essential for the fulfilment of the university mission. The mission is centred upon the delivery of knowledge, conducting fundamental and applied research, and the practical implementation of innovation that should support the development of highly qualified professionals and the stable growth of the region and the country.* *The Concept for Adapting the Educational System to the Digital Generation is reflected in the quality assurance strategy and other strategic and planning documents. However, there is no particular strategy and/or strategic plan dedicated specifically to digital-age learning.*
Digital Strategy Reinforced by an Implementation Plan	*Online education at RU was developed with the help of a range of EU projects and initiatives, of which the most significant in terms of scale was implemented in the framework of the Human Resources Development Operational Programme co-funded by the European Social Fund.* *In Bulgaria, HEIs can use distance education also to provide additional qualifications to professionals who have already obtained a diploma (either bachelor or master) in another domain as well as for continuing and complimentary education. In order to do this their particular programme, course or module needs to be accredited for distance provision.* *e-Learning Shell (the university e-learning platform introduced by the Centre for Innovative Educational Technologies) was developed by a RU PhD student. After its launch, a series of training seminars were organised as of May 2006 by the Distance Learning Centre to present the new e-learning system. More than 150 participants from different university departments attended the seminars.* *In the period November 2010 – January 2011 the Distance Learning Centre collaborated with the Ministry of Education, Youth, and Science in a project to train university teachers to use ICT in the teaching process. As a result, 75 RU professors and 25 professors from other Bulgarian HEIs were trained.* *In 2014, a team from RU under the lead of prof. Smrikarov and with the involvement of the Distance Learning Centre successfully finalised a project to develop digital forms of distance education at the university. As a result, 11 classrooms were equipped with interactive presentation systems, staff was trained to use and maintain these systems involving all university departments, more than 200 teachers were trained to use ICT in education, 5 master programmes were developed for distance education, more than 300 online courses were created and included in the university virtual library, 7 virtual labs for distance education were initiated, about 1500 students participated in distance (digital) education, and a Lifelong Learning Centre was established.*

	During the Covid-19 pandemic, a series of internal webinars were organised to train RU professors to work in digital environment. Topics included "Designing Distance Education – the New Normal" and "Selecting a Synchronous System for Distance Education". In addition, the Distance Learning Centre and the Centre for Innovative Educational Technologies participated as training providers in a national programme to increase the digital competence of public HEIs educating future teachers. *The Virtual Information Centre for doctoral students is a site that provides all the information needed during the doctoral study – common and individual study plans, virtual library, digital resources, etc. It can be used by doctoral students from all over the country.* *RU has introduced a scheme of stimuli to encourage publications, the participation of its staff in projects, the identification of sponsors, the application for patents and protection of intellectual property, and to honour significant contributions. In addition, staff of the Centre for Innovative Educational Technologies has received a number of prestigious awards for their participation in the National programme to create a virtual educational space and other initiatives promoting the development of digital education in Bulgaria (https://ciot.uni-ruse.bg/awards.html).* *Digital-age learning is associated with quality assurance and internationalisation at RU. Its implementation is aligned with strategies and implementation plans adopted at national and European level.* *RU is focused on the use of blended learning that incorporates the advantages of both face-to-face and online education.*
Digital Management and Governance Model in Place	*The distance education at RU is regulated by Rules of Procedures for the Structure and Activity of the Distance Learning Centre and Internal Rules for the Distance Form of Education that are adopted by the Academic Council. In addition, there are regular references to the implementation of distance education, the digitalisation of the educational process, and the development of digital infrastructure in other strategic and regulatory documents.* *The distance education at RU is coordinated by the Distance Learning Centre. The Centre was established on 19 April 2005 with a decision of the Academic Council and backed with the necessary regulatory documentation. The Centre secures technically, technologically, and logistically the distance form of education at the university. It also trains the teachers, is in charge to inform the students about the specificities of distance education, collaborates with programme and course coordinators, and monitors the development of the necessary resources and technologies.* *In September 2013, the RU digital infrastructure was accredited by the National Evaluation and Accreditation Agency granting the university the right to provide distance education. At the same time 4 master programmes at the Transport faculty were accredited for distance education.* *The Centre for Innovative Educational Technologies supports digital pedagogy at RU. The Centre is part of the university Scientific Research Complex and actively collaborates with the Distance Learning Centre and the Centre for Technology and Intellectual Property Transfer.* *The University Computing and Information Services Centre develops and maintains the digital and network infrastructure, hardware, software, multimedia, etc.* *The Continuing Education Centre oversees the online provision of continuing and vocational training.* *All centres are financially resourced and have devoted management and staff.* *The quantitative performance indicators consist of number of accredited programmes for distance education and number of students in these programmes. Another quantitative performance indicator measures the number of students who follow online courses provided by the Continuing Education Centre. The increase in the number of entries in different data*

	bases is also measured as well as participation in relevant conferences and events. *The quality of the implementation plan is measured through the participation in key national and international projects, such as establishing an ICT Competence Centre, establishing a Centre of Excellence, establishing centres for innovative educational technologies in 15 universities in Central Asia, and others. In addition, various external evaluations made by regulatory and accreditation bodies acknowledge the achievements of RU.* *The Development Policy of RU is regularly assessed by the Ministry of Education and Science.* *For the last two assessments of the Development Policy (for the periods September 2020 – September 2021 and September 2021 – September 2022) the Ministry granted RU the highest possible score.* *As of 26 October 2022, the Council of Ministers acknowledged RU as a Research University.* *RU aims to gradually transfer its main buildings into smart buildings by 2030. This means to develop a holistic intelligent environment in the buildings that includes providing digital education, using social networks and communication for collaboration, ensuring environmental sustainability, maintaining ICT stability with smart systems for sensor control, securing health protection and health prevention measures, acquiring smart building control and security monitoring, etc.*
Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	*The RU staff is regularly informed about opportunities for project funding and available calls for proposals at national, EU and international level.* *The RU staff and students are frequently invited to attend training seminars in project management and the funding instruments of the EU and other international donors.* *A Transnational Interdisciplinary Studies Centre in the Area of Social Sciences (TISCASS) was established in 2009 as a result of the educational and research cooperation between "Angel Kanchev" University of Ruse - Bulgaria, the Bucharest Academy of Economic Studies - Romania, and the Ternopil "Volodimir Hnatyuk" National Pedagogical University - Ukraine. TISCASS is integrated into the structure of all three partner universities with decisions of their Academic Councils. Being a joint structure TISCASS exists in the virtual space with a specially created website (http://tiscass.uni-ruse.bg/).* *RU creates and maintains an attractive regulatory, financial and institutional environment that promotes partnerships between science and business through the creation and development of clusters, start-ups, and other network structures and regional innovative centres in the Danube area.* *Knowledge exchange at RU is coordinated by the Centre for Technology and Intellectual Property Transfer. The Centre enhances the active cooperation between science and practice and promotes the transfer of knowledge and technologies from the university to enterprises and organisations that can take advantage of innovation. It also assists research in the fields of technology and innovation and supports start-ups.* *RU organises and runs annual scientific sessions and events for students. Students' works are awarded with the Best paper Crystal Prize and published in paper and electronic journals.* *Students are considered as partners in the university management through the active involvement of the Student Union and the assignment of various jobs and tasks to students.* *RU strives to develop various formats of collaboration with companies in order to improve the educational and practical experience of students as well as the knowledge exchange.*

	RU intends to: • *Further develop the Centre for Innovative Educational Technologies through developing national and international projects to implement the Concept for Adapting the Educational System to the Digital Generation and intensive use of digital technologies in education and research.* • *Further develop the Centre for Technology and Intellectual Property Transfer through establishing a platform to connect innovation with implementation, models and prototypes with companies and financial institutions.* • *Establish a research institute in technology and innovation.*
Strategic Approach is Communicated	*RU has a communication strategy in place and is currently developing a strategy for its international branding. The university informs the general public about its scientific and technological achievements taking advantage of regional and national channels for communication.* *The RU websites are regularly maintained, updated, and improved.* *The functionalities of the e-Student system are extended.* *Widespread access to the Internet is ensured. Specific software is used to improve the quality of education for students and of research for professors and doctoral students. In this respect, the following information systems are developed: Publications, e-Learning Shell, Antiplagiat, the websites of the relevant centres, and databases are maintained with researchers, publications, and a library of OERs of the National Centre for Information and Documentation (NACID).*
Partnerships are Developed	*The Centre for Technology and Intellectual Property Transfer identifies existing opportunities for development and problems of potential customers who can take advantage of the methods and technologies generated by multidisciplinary teams of RU researchers. In this respect, the Centre stimulates: 1) the formation of teams involving RU professors and business representatives; 2) the establishment of strategic partnerships and common research programmes with leading European research centres; 3) participation in international and transnational research networks, programmes, alliances, forums, and projects; 4) interdisciplinary efforts to develop fundamental and applied research results, etc.* *Teachers, doctoral students, and students interested in innovative educational technologies from different university departments and faculties come together and contribute to look for answers and solutions of concrete challenges and tasks coming from the implementation plan.* *Existing interdisciplinary research labs are developed and new labs are created in order to transform the RU research complex into a technological alliance of the future.*
Infrastructure	
Physical and Virtual Learning Spaces	*More than 50 classrooms are equipped with interactive presentation systems (interactive white boards with a touchscreen).* *Online lectures are provided to students from the two university branches that are located in other cities (synchronous online teaching).* *The RU digital infrastructure is accredited by the National Evaluation and Accreditation Agency granting the university the right to provide distance education.* *Virtual and augmented reality are used in courses when applicable. Virtual labs are also created and integrated in the webpages of the subjects they belong to. Gamification, Internet of Things and other technological innovations are also utilised in the educational process whenever possible.* *e-Learning Shell (eLSe-01) was the first e-learning platform created at RU in 2001. It contains 256 courses and counts more than 30.000 users. The platform was used as the fundament for the e-learning platforms of more than 10 universities in Bulgaria and universities from Russia, Hungary, Belgium, and Germany. Later on e-Learning Shell was updated and transformed into*

	a new e-learning platform (eLSe-02) similar to Moodle. eLSe-02 contains 650 courses and the number of users is about 12.000. The eLSe-2 platform for digital education is regularly updated, improved, and complemented with new functionalities. *In addition to its own e-Learning Shell (eLSe), RU uses Moodle, BigBlueButton, and other available learning technologies.* *All sites belonging to the university are hosted and maintained on university servers. If needed additional servers are obtained to support systems like the BigBlueButton virtual classrooms, for example.* *In addition to paper-based publications, RU stimulates its professors to make their materials available in a digital format.* *The Virtual Information Centre for doctoral students is upgraded with a Research Room of the Future. Through the establishment of the lab devoted to the virtual educational space of the future, the Centre is integrated into the university scientific research complex. The integration with the university library, the information functions, and the system for public activity aim to support and stimulate the academic research at RU.* *The Continuing Education Centre is developing on its website a virtual library of specialised online courses for vocational training.*
Digital Infrastructure is Planned for and Managed	*There is a devoted section on the website where presentations, instructions and video lectures are available to demonstrate how to use e-learning systems, to organise virtual classrooms, to conduct online exams and other useful tips related to digital education.* *RU maintains the e-Learning Shell platform, a Moodle platform, and a BigBlueButton platform.* *There is devoted "Support" section on the e-Learning Shell platform divided into two subsections for teachers and for students where the users can find extensive information, instructions, and visual demonstrations on how to access and use the system. There is also a direct support link on the main webpage of the website allowing to send an e-mail to the support unit. In addition, the RU Computing and Information Services Centre has a devoted website with detailed information about the services for staff, students, and the public, as well as contact details, news section, gallery, and other useful information.* *Following a RU students' idea, an application was developed that converts a text written in Bulgarian, using the Cyrillic alphabet, into text in Braille.* *RU intends to procure specific technical devises and create automated places in the library to allow access for students and staff with special needs.* *In addition to the Rules of Procedures of the university that deals with the topic in general, there is a strategy for transparency and effectiveness and internal rules for the use and protection of personal data.* *RU is planning to procure network equipment for the Scientific Research Complex and the Centre of Excellence.* *RU plans to:* • *Improve and expand the digital education systems.* • *Extend and improve the functionalities of the e-Student system.* • *Maintain, update, and improve the university websites.* • *Develop the university publishing centre into a digital centre to reflect the work in real time.* • *Take advantage of technologies and increase the computer-based and digital resources.* • *Develop digital training materials and introduce innovative educational technologies in the continuing education courses.* • *Improve the website of the Continuing Education Centre and highlight the development of the virtual library of specialised online courses for vocational training.*

	• *Turn the university campus by 2030 into an integrated, digitally connected university city that can be used as a living lab to test innovations and technologies for smart cities.* • *Further develop the university intranet and foster its utilisation by all teachers and students by linking it to the Centre of Excellence and the Scientific Research Complex among others.* • *Ensure and expand the digitalisation of the academic leadership, the directorates, and the university administration.* • *Maintain and update the portal for doctoral students.* • *Develop a new system for scheduling the lessons.* • *Develop an interactive university environment that can accommodate the organisation of seminars, sessions, symposia and conferences.* • *Ensure broad access to the Internet and utilise specialised software that can improve the quality of education for students and of research for professors and doctoral students.* • *Increase the quality of the network services and the capacity of the cable and wireless computer networks.* • *Maintain, expand and introduce new services for the users of the computer network.* • *Develop the digitalisation of the information and communication structure.* • *Retro converse the special library funds (dissertations, collections of papers and reports, yearly collections, etc.).* • *Maintain active links of the library website with the library digital funds and the digital catalogues of other national and international libraries.* • *Maintain national and international inter-library exchange and use of resources.* • *Maintain databases of publications and the creation of bibliographies.*
Sector Specific	
Sector-specific sub-element(s)	None
Supporting References	
Reference and Supporting Material	On-line link(s): Centre for Innovative Educational Technologies: https://ciot.uni-ruse.bg/home.html Distance Learning Centre: https://www.uni-ruse.bg/centers/TSDO Continuing Education Centre: https://www.uni-ruse.bg/education/PO University Computing and Information Services Centre: https://www.uni-ruse.bg/centers/TSIKO
	Addendum(s) (documents in Bulgarian): Mission and vision of the university: https://www.uni-ruse.bg/university/Documents/ndo_5_2016.pdf Mandate programme 2020-2023: https://www.uni-ruse.bg/university/Documents/Ndo_6_MP_2020.pdf Internal quality assurance strategy: https://www.uni-ruse.bg/university/accreditation/Documents/Strategiya_Kachestvo.pdf Implementation plan for 2023: https://www.uni-ruse.bg/university/Documents/Ndo_6_MP_2020.pdf

	Annual report for 2022: https://www.uni-ruse.bg/university/Documents/GDRSRU_2022n.pdf Other normative documents: https://www.uni-ruse.bg/university/regulations
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New Bulgarian University (Bulgaria)

Case Title	Development of the Distance and Digital Education at New Bulgarian University
Institution	
Name of the Institution	New Bulgarian University (NBU) Нов Български Университет
Country	Bulgaria
Ownership	Private
HEI / VET	HEI
Type of Education	Formal
National Accreditation	Yes (National Evaluation and Accreditation Agency)
International Accreditation	Yes The NBU Centre for Foreign Languages is a co-founder and an Accredited Member of OPTIMA Bulgarian Association for Quality Language Services, which is an Associate Member of EAQUALS (Evaluation & Accreditation of Quality in Language Services), an international association of institutions and organisations involved in language education. NBU is an approved examination centre for the ÖSD (Österreichisches Sprachdiplom Deutsch), an Austrian state-approved examination and assessment system for German as a Foreign Language / German as a Second Language.
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☒ (b) Digital Collaboration and Networking ☒ (c) Digital Infrastructure ☒ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	*NBU is the first university in Bulgaria that with its establishment in 1991 introduced a new for the country type of distance education called the Radio University that was based on the Open University model using films, radio lectures, sending textbooks by post. Until 1994 a national radio channel was used to broadcast the recorded radio lectures. Once recorded, the radio lectures could be re-used.* *Classes on site were also included, but aimed to consult the students rather than teach them. In addition to the main site in Sofia, three local centres were available for the students coming from the rest of the country. During these consultations, the students, who had to review the learning content in advance, had the opportunity to discuss with the teacher issues that were not clear or difficult to grasp. Students were not obliged to attend the consultations. The students received textbooks and other materials in paper but also had access to the virtual learning environment. Exams were organised on site and relied predominantly on using tests. The Radio University gained a lot of popularity and attracted many students demonstrating a need to fill an existing gap in the educational provision.* *The focal point in this format of education is the students' self-study and relies on their motivation, discipline, and persistence.* *The study programmes at NBU are two types: regular on-site education and distance education. Both formats are enabled for digital provision.*

	The mission of New Bulgarian University is to be an autonomous liberal education institution dedicated to the advancement of university education by offering accessible and affordable opportunities for interdisciplinary and specialised education and research of high quality. Bringing its academic potential to the service of society, the University prepares its graduates for the challenges of modern democratic life cultivating critical and creative thinking, sensitivity to cultural difference, and problem-solving.
Digital Strategy Reinforced by an Implementation Plan	*Among the priorities, set in the strategic plan, are: to develop the education at NBU in support of the students' needs and the expectations of the stakeholders; to foster research capacity in innovative and technological areas as well as in areas important for the society and to cultivate internationally recognisable alternative art; to turn the continuing education into an integral part of the individual pursue of a diploma and a persistent encouragement of the personal striving for success.* *In this respect the development of digital education is seen as an important tool for the optimisation of the structure, content, and the organisation of student-centred study programmes. The continuing, digital and distance professional and specialised forms of education are expected to become standard that can lead to reduced numbers of regular on-site students. In anticipation, NBU aims to further develop the distance and digital forms of education by diversifying the offer of both bachelor and master study programmes, increase the number of students in these programmes, improve the Moodle platform, introduce completely digital forms of education, introduce new teaching methods and technologies, train and re-train the teachers.* *In order to achieve these goals NBU has included in its strategic plan the following objectives related to:* *Distance education* *1. Increase the quality of the distance education through:* *a. Improving the learning content* *b. Introducing new forms of electronic communication* *c. Training and re-training the teachers* *d. Attracting practitioners as lecturers* *e. Moving to education without definite semesters and exam sessions* *f. Introducing adequate normative regulations* *2. Introduce new study programmes focusing on:* *a. Master programmes* *b. Programmes in departments with low numbers of students in the regular on-site form* *c. Development of individual programmes for distance education* *3. Develop new promotional strategy to attract students from the small and medium sized towns* *Digital education:* *1. Introduce new functionalities in the Moodle platform* *2. Expand the integration of Moodle with the other systems* *3. Introduce digital courses* *4. Introduce adequate normative regulations* *5. Develop a strategy to train and re-train the teachers on how to implement digital education* *6. Follow the leading trends and new technologies in education* *Decentralisation and a degree of autonomy are natural to NBU and require a high level of coordination and cooperation.* *When introducing digital education at NBU, all full-time teachers were required to follow training on how to use the e-learning platform. Newly employed full-time teachers are expected to pass an exam in digital literacy. In addition, there is a minimum requirement on the use of digital education and the teachers are required to have at least 75 pages of content made available via the e-learning platform.* *The Centre for Educational Resources is established to support the training of the teachers and administrators at NBU. The Centre trains them to use*

	contemporary teaching methods, forms and techniques, skills for teamwork, inclusiveness, conflict and time management as well as to use the technical equipment and electronic systems of NBU. The Centre organises group trainings and seminars in current topics of interest and maintains the sessions of the Teachers' Café, a forum devoted to up-to-date methods, techniques and skills as well as to exchange of experience and best practices. It also offers consultations on how to use the electronic resources of the university. *Digital learning supports and complements the education in both regular and distance forms of education.* *NBU aims to further develop the distance and digital forms of education by diversifying the offer of both bachelor and master study programmes, increase the number of students in these programmes, improve the Moodle platform, introduce completely digital forms of education, introduce new teaching methods and technologies, train and re-train the teachers.*
Digital Management and Governance Model in Place	*The digital education at NBU is regulated by a Standard for Digital Teaching of a Course and a Standard for Distance Education.* *The School of Distance, Digital and Continuing Education oversees a variety of units providing alternative forms of education and teaching at New Bulgarian University. The School consists of the Centre for Distance and Digital Education, the Centre for Professional and Continuing Education and the IT Certification Centre.* *The Centre for Distance and Digital Education coordinates the organisation of all programmes delivered in the distance form of education, supervises the work of the teachers and the programme directors, and provides administrative services to the students. Distance learning programmes employ a variety of modern teaching methods that include printed and visual course materials, video tutorials, self-study and consultations with course advisors. The Centre was established in 2010 and in 2014 was transformed into the School of Distance, Digital and Continuing Education. In 2013, following the newly adopted criteria for the organisation of distance education, the National Evaluation and Accreditation Agency accredited the first study programme at NBU to be delivered in the distance form of education. According to the new criteria, two features are evaluated and accredited: the capacity of the university as a whole to deliver distance education and the study programme in particular. The accreditation was granted to NBU without any remarks. At the moment 10 bachelor and 17 master programmes are accredited and offered at NBU in the distance form of education.* *The Centre for Professional and Continuing Education offers a wide range of professional qualification programmes, postgraduate pedagogical and other qualifications, various trainings, academies, seminars, workshops, summer and business schools, IT certification courses, foreign language courses, Bulgarian language for foreigners, public lectures, and other trainings and events in a variety of fields to learners of all ages. The majority of the programmes are online and are designed to suit the needs of full-time working people or people in other geographical locations so that they can join the training remotely (online) in the evenings and at weekends. These programmes are typically offered intensively throughout the calendar year and have a strong practice orientation.* *The Lab for Language Technologies is a learning, practical and research unit of the School of Distance, Digital and Continuing Education. It develops scientific and applied corpus and computer linguistics. Among its activities, the Lab is responsible for the development of linguistic software, the creation of digital resources for studying a language both as foreign and native, the application of technology to support translation practices and studies. The Lab collaborates closely with the Computer Science department and the Digital Innovation Lab.* *The Digital Innovation Lab forms part of the NBU's Computer Science department to deliver consultancy, research, learning-by-doing practical activities, and project work. Its research activities are directed to digital*

	education, big data, data analytics, didactic games, e-leadership, applied research together with companies, etc. The Lab is also responsible for the development of new learning content, courses, and study programmes in response to the needs of industry and connects the academic and business communities. *The Information Technologies department is responsible for the maintenance of the university hardware and software resources, the local networks and the internet access as well as for the cybersecurity.* *The School of Distance, Digital and Continuing Education, the centres and the labs are financially resourced, technically and technologically equipped, and have devoted management and staff.* *New Bulgarian University is committed to maintain its academic standards and constantly enhance the quality of its learning, teaching and research provisions. The University's Quality Assurance System is focused on striking a balance between academic quality and market competition, and is guided by the following principles:* • *Cultivating a culture of transparency and accountability of the University and its units to students, parents, employers, the society, and the state* • *Enhancing the competitiveness and encouraging the self-development of the University units* • *Ensuring an overall commitment to a quality culture at NBU* • *Evidence-based management decision-making* *The Quality Assurance System is based on the model in which Input, Process and Output indicators are distinguished.* *Output Indicators:* • *Job placement rates of NBU graduates* • *Employers' opinion of NBU graduates* • *Standardised Testing Results at graduation* • *Overall Grade Point Average (GPA) at graduation* *Process Indicators:* • *Student satisfaction* • *Grade Point Average (GPA)* • *Interdisciplinary approach* • *Active teaching and learning* • *Average student dropout rate* • *Average workload per student* • *Percentage of students participating in student mobility programmes* • *Financial efficiency* *Input Indicators:* • *Number of applicants per place and average entrance examination scores* • *Number of students per faculty member* • *Average annual number of publications per faculty member* • *Faculty mobility* • *Facilities*

Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	*New Bulgarian University participates in international academic networks through various forms of mobility of lecturers and students, through bilateral collaborations, jointly developed projects, and membership in reputable educational associations.* *The membership in a number of respected international organisations contributes to the alignment of the education offered by NBU with world standards. In addition, international advisory councils review curricula, create opportunities for different educational initiatives, and provide international internships to students.* *New Bulgarian University organises annual summer international schools and master classes, and is the initiator of numerous seminars and conferences where students meet important scientists and artists from Bulgaria and other countries.* *The recruitment of international students is part of the NBU's internationalisation strategy, is updated annually, and supplemented with new proposals and opportunities.* *The Digital Innovation Lab provides expertise and services to support the digital transformation of businesses in Bulgaria and beyond. It also strives to support and stimulate the digital transformation of the Bulgarian schools by promoting the introduction of innovative educational practices and technological solutions in the classroom.* *NBU strives to maintain collaboration between the different university departments and units and promotes the development of interdisciplinary study programmes. It is also keen on sustaining beneficial links with industry and the society as a whole by contributing to significant societal initiatives, supporting the development of its immediate surroundings, and acting environmentally responsible. NBU actively attempts to identify new partners (companies, industry associations, NGOs, etc.), create schemes for effective collaboration, and implement projects requested by external beneficiaries.*
Strategic Approach is Communicated	*Important element of the NBU's strategic plan is to improve both internal and external communication. This will be realised through the implementation of an internal development project.* *There are about 20.000 visitors per day from more than 130 countries on the website of NBU. There are about 30.900.000 Google search results linked to the name of the university. Each year, more than 100 organisations partner with NBU in different initiatives.* *The NBU's website provides easy access from its home page to potential students, students, teachers, and external stakeholders where they can find up-to-date information about the university and its values, the study programmes, their content, entry requirements and prospects, lesson schedules, evaluation requisites, schemes and follow-up, relevant procedures, mobility and internationalisation opportunities, details about the university life during and after the studies, entry to the virtual learning environment, the systems for administrative services, the university library, technical support, relevant contact details, etc. Moreover, a chatbot was recently introduced to virtually assist visitors of the website and answer their questions.* *NBU is present on the most used social network platforms, such as Facebook, Instagram, YouTube, Twitter.* *The NBU's Moodle virtual learning system allows access to content and materials for all courses a teacher or a student is entitled to, possibility to submit assignments and project works, provisions for consultations and forums, integrated virtual classrooms and other useful tools and learning support.*

Partnerships are Developed	*NBU is actively pursuing partnerships with companies and business organisations, national and international HEIs, governmental institutions, non-governmental organisations, national and international stakeholder associations and networks. It also promotes the participation in projects funded by national, EU and international donors and provides access to the Central Fund for Strategic Development to finance projects of high importance for its development.* *NBU is part of the European Reform University Alliance (ERUA). ERUA is a university consortium formed by five European reformed universities from Bulgaria, Denmark, France, Germany and Greece. Universities united in their efforts to form an international university network with common values and goals in the development of scientific research, teaching and institutional development. Among its activities, ERUA intends to re-imagine learning pathways that in practice means to: develop a common conceptual and digital approach to education and research, develop a deep disciplinary knowledge and foster interdisciplinarity, enable students to design their own learning pathways through uniquely flexible combinations of courses. ERUA also offers a wide range of learning opportunities, such as intensive courses, travelling seminars, service learning, joint study programmes, pre-PhD training programme, and an e-learning platform.* *NBU values people who are active in research and do not hesitate to work in small, big, narrowly specialised and interdisciplinary teams. The NBU academic staff members invest in their professional development and participate in networks, forums, conferences, and events.* *NBU has developed a tutoring scheme for the first-year bachelor students that aims to develop contacts and partnerships between students and teachers, to support students' university life in all its aspects, and to make students feel comfortable at the university. The tutoring system supports students' initiatives, encourages exchange of experiences and good practices, advices students about study and learning opportunities, and helps them with issues related to administrative and enabling services.*
Infrastructure	
Physical and Virtual Learning Spaces	*In 2013, NBU launched the project "Improving the Quality of Distance Education at the Centre for Distance and Digital Education" in the framework of BG051PO001-4.3.04 "Development of Electronic Forms of Distance Education in the Higher Education System", as part of the Human Resources Development Operational Programme co-funded by the European Social Fund of the EU. NBU implemented the project via its Centre for Distance and Digital Education and achieved some of its priorities related to the organisation of distance education. As a result, 10 additional classrooms were equipped with cameras and microphones that allowed lessons from 20 classrooms in total to be recorded and broadcasted from the university campus.* *The NBU digital infrastructure is accredited by the National Evaluation and Accreditation Agency granting the university the right to provide distance education.* *The idea to create a university system for digital education at NBU originated at the beginning of 2002. It was realised with the project "Virtual Master Programmes" funded by the Open Society Foundation. The project was implemented during 2002-2003 and was meant to support primarily courses of the Software Technologies in the Internet master programme. A bachelor student in his fourth year of study at the Computer Sciences department became the main developer. The interface was simple and intuitive, and was easy to work with for both teachers and students. Teachers could upload lectures in the form of classic linear text while students could download it, but also were able to respond to assignments by uploading files in the system. This e-learning system was called VEDA and was often presented during academic conferences that generated interest at other master and bachelor programmes. This led to introducing the system at university level to be used by all teachers and students that made it the first system for digital education at NBU and one of the first in the country. Trainings were*

	organised for all teachers and learning content of many courses is stored in its database. However, the possibilities for upgrade and further development were limited and after the student who developed the system graduated and left the university, it became difficult to provide proper maintenance. *In March 2005 a new platform, the Information Environment for Distance Education (IEDE), was launched. It made it possible for virtual lectures to be executed and allowed students and teachers to discuss and reflect. It offered multilingual and intuitive for use interface, and could be accessed with a login and a password. It was possible the digital courses, introduced in the platform, to be transformed into a multimedia learning CD that could be used autonomously without internet connection.* *After a period, in which the three platforms for digital education were simultaneously in use (i.e. VEDA, IEDE, and Moodle), at the end of 2008, NBU decided to sustain only Moodle that is now the core of the distance and digital education at the university.* *Funded by the Central Fund for Strategic Development at the NBU's Board of Trustees, the Centre for Professional and Continuing Education has implemented a project to launch an electronic learning platform allowing online education for the participants in the various courses and programmes offered by the Centre.*
Digital Infrastructure is Planned for and Managed	*On the home page of the NBU's Moodle digital learning platform, on the left side there is a scroll-down bar allowing access with a login and a password, but also linking to technical support, presentations, instructions and tutorials demonstrating how to use the platform and to organise the BigBlueButton virtual classrooms. On the right side one can find a calendar, a feedback channel, information about the provision of distance education, and other useful information. The middle block of the page is devoted to news. On the top of the page, students and teachers can access other dedicated electronic services like for example, e-student and e-teacher.* *Personal data is treated according to the Bulgarian legal requirements. NBU is a registered administrator of personal data at the Committee for the Protection of Personal Data. In accordance with GDPR, NBU has adopted a Policy on Privacy and Personal Data Protection that is included in the NBU's internal regulations and available on the website.* *All students and teachers at NBU have access to the Moodle platform where they can enter the individual pages of the courses they are enrolled in for the respective semester. In the course page they can find electronic learning materials uploaded and duly arranged by the teacher leading the course. There they can also complete digital tests generated individually for each student from a pool of questions made available for the course.* *The video-training system, called NBU-video, allows the transmission in real time of lectures broadcasted from the classrooms particularly equipped for this purpose. The lectures can be also recorded and made available for further re-use. More than 95% of the classes for the students in the distance form of education are conducted using this video-training system that is also integrated in the platform for digital education.* *The Moodle platform was also complemented with the possibility to set a virtual classroom. The open source BigBlueButton software was selected for this purpose. The BigBlueButton virtual classroom complements the options available at NBU that support anytime/anyplace learning.* *In addition, an antiplagiarism software was added to Moodle in order to detect not correctly used citations and to prevent copy/paste practices. NBU is among the first educational institutions in Bulgaria to have implemented such a form to control the examination materials (project works, case studies, essays, etc.). Turnitin and PlagScan are the applications selected by NBU for this purpose and integrated in Moodle.* *The electronic learning platform, available for the participants in the training provided by the Centre for Professional and Continuing Education, is with simple and functional design, and gives the learners the opportunity for completely online or blended learning. The platform has various*

	functionalities depending on the specifics of the teaching course, including forums, chats, video integration and other learning facilitation tools. It also allows creative approaches for monitoring, testing, and final examination. *NBU also benefits from a range of technological tools and systems that support the university administration, services, document exchange, library, and other units.* *In addition to the classrooms, equipped with computers and other necessary devices, the students and teachers are free to use their own devices in the classroom. They can also freely use the internet available in the different university campuses and connect to the multimedia, available in the classrooms for presentations or group work.* *At NBU the tutoring scheme is an important part of the work of the newly opened Centre Supporting Students with Special Educational Needs. A main priority of the Centre is to create a suitable environment, so each student can strive irrespective of his/her specific needs that is in line with the current requirements for inclusive education.* *In addition to the tutorials, provided by Moodle itself on how to use the platform and its add-ons, NBU has developed online training modules in Bulgarian separately for teachers and students on how to use the Moodle platform with particular attention to access, evaluation, checking for plagiarism, sending and receiving messages, forums, profile settings, and other important features. The setting and exploitation of the virtual classroom are also in detail explained and demonstrated depending on the user – teacher or student. This is particularly useful for newcomers who use the systems for the first time, but comes also handy for the more experienced ones who want to try additional features.* *In Moodle, information is also available about how to present a project, who the tutors are and how to contact them, how to prepare the bachelor or master thesis, what open training sessions or lectures are available, what events are coming, which projects NBU is working on and a lot more.* *NBU has ensured supportive environment, special equipment, suitable learning materials and teachers' assistance to address students with special needs. In addition, the library provides various resources and services particularly adjusted to special needs as well as assistive technologies that support self-study. In the framework of the project "Developing the Information Competence of Students with Special Educational Needs", funded by the Central Fund for Strategic Development at the NBU's Board of Trustees, different guidelines and toolkits are elaborated that support students with special educational needs to develop digital competences.* *The procurement of technological equipment, necessary for the smooth implementation of the distance form of education, is an important element of its management. Funding for this equipment comes from the budget of the School of Distance, Digital and Continuing Education, the Central Fund for Strategic Development, and the Fund for Facility Development. The procurement is arranged on the basis of a careful planning made in the context of the immediate needs for the upcoming semester in combination with an annual and a biannual plan. The planning process is complex and includes preparations and discussions at three levels: school, department and administration of the Board of Trustees. This not only prevents the separation between administration and pedagogy, but allows to look for as many intersections of interests and needs as possible.*
Sector Specific	
Sector-specific sub-element(s)	None

Supporting References	
Reference and Supporting Material	On-line link(s): About New Bulgarian University: https://nbu.bg/en/about-nbu/new-bulgarian-university Annual reports: https://www.nbu.bg/bg/za-nbu/struktura-i-upravlenie/strategicheski-dokumenti/godishni-finansovi-otcheti School of Distance, Digital and Continuing Education: https://www.nbu.bg/en/schools/school-of-distance-online-and-continuing-education Centre for Professional and Continuing Education: https://cpo.nbu.bg/en NBU Moodle platform: https://e-edu.nbu.bg/ Electronic training platform of the Centre for Professional and Continuing Education: https://lll.nbu.bg/ European Reform University Alliance (ERUA): https://erua.nbu.bg/en
	Addendum (documents in Bulgarian): Chukurliev, H. (2018). Upravlenie na distantsionnoto obuchenie vav vissheto uchilishte: formi, tendentsii i perspektivi. PhD Thesis. New Bulgarian University Standard for Digital Teaching of a Course: https://www.nbu.bg/download/za-nbu/normativni-documenti/II.T.2/2-5-nup-pril5-seok-17-05-2022-1.pdf Standard for Distance Education: https://www.nbu.bg/download/za-nbu/normativni-documenti/II.T.2/2-6-nup-pril6-sdo-28-02-2023.pdf NBU 2023-2028 Strategic plan: https://strategic.nbu.bg/?p=30
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University of Zagreb, Faculty of Organization and Informatics (Croatia)

Case Title	FOI Digital Strategy Implementation
Institution	
Name of the Institution	University of Zagreb, Faculty of Organization and Informatics (FOI) Sveučilište u Zagrebu, Fakultet organizacije i informatike (FOI)
Country	Croatia
Ownership	Public
HEI / VET	HEI
Type of Education	Formal
National Accreditation	Yes (Agency for Science and Higher Education)
International Accreditation	No
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☒ (b) Digital Collaboration and Networking ☒ (c) Digital Infrastructure ☒ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	*FOI is dominant in two scientific fields - information and communication sciences and economics and, to a lesser extent, in other fields of science. The interdisciplinarity is embedded in every aspect of the Faculty, and this is the strength that gives a unique physiognomy to the Croatian higher education area..* *In the Development Strategy of the Faculty of Organization and Informatics, of the University of Zagreb for the period 2018 – 2023, (https://www.foi.unizg.hr/sites/default/files/development_strategy_of_the_foi_2018-2023.pdf), mission, vision, strategic goals, the expected outcomes of the strategic program of scientific research, strategic areas and strategic map of FOI were defined and presented.* *Scientific activity at the Faculty is growing in terms of a number of published papers in the prestigious journals, projects and the image of the Faculty as a recognisable scientific and research institution. The mobility of teachers and students to relevant universities has also increased. Project activities at the Faculty are intensive and, on average, five projects are monthly submitted to different funds. The FOI project database can be found on: https://projects.foi.hr/projects/public/all/en.* *The future strategic development of the Faculty is determined and evaluated in Strategy according to the following criteria: the propulsive area, the existing research group, papers within this area in journals or leading conferences, representation in teaching, representation in doctoral study, organized conferences, summer schools, competitions and other events, wider cooperation within or outside the institution, etc.* *Defined strategic areas in the Strategy are: 1. Information systems of the future, Internet of everything and relevant disciplines; 2. Big data analytics and artificial intelligence; 3. Economics of entrepreneurship and innovation management; 4. Management of Organizations and Business Processes; 5. Educational Technologies; 6. Information security and open systems.* *Within teaching, the Faculty developed new study programs and upgrade the existing with new content. In the scientific sense, new labs and centres were*

established with a mission of further scientific and professional activity in strategic areas.

Strategic area „Educational Technologies "(*EdTech) is a research discipline, but also a large area of application involving a wide range of tools and resources used to enhance learning, teaching and creative research. The concept of educational technology in our Strategy encompasses the concepts of e-learning or distance education, since the role of information and communication technologies in research and application is increasing.*

In FOI Strategy, education technologies include online and mobile learning, open content and licenses, learning analytics and adaptive learning, digital badges, virtual and remote labs, while in digital strategies, particularly, it also includes the BYOD (Bring Your Own Device) and the Flipped Classroom concepts.

Four core research areas based on the competencies of FOI researchers having the potential to be internationally competitive are: learning analytics, design and quality of education technologies, student centred approaches and technologies, strategic management of educational technologies.

Unlike other strategic areas, the research of Educational technologies has an internal relevance for FOI in terms of improving the teaching process. In this respect, it can be stated that this area was developed in three directions.

TEACHING: Encourage innovation and application of educational technologies in teaching at FOI through the establishment and operation of the Centres and Laboratories. The innovation of graduate studies Informatics in Education was done and new postgraduate specialist study programme „E-learning in education and business" was developed (https://www.foi.unizg.hr/en/about-us/psp/spds).

RESEARCH: Empowering and focusing research in the field of educational technologies by establishing a Centres and Laboratories that would be the leaders of FOI's participation in significant national and international projects.

TECHNOLOGY TRANSFER: Establish the leading role of FOI in Croatia and recognized role in Europe in the field of educational technology field through the technology transfer activities of the Centres and Laboratories.

In the 'FOI vision' the focus is on innovative approach to learning and teaching, the development of digital-era competences and its project activities and international partnerships.

The Action Plan is also a part of the Strategic document and it can be found here: https://www.foi.unizg.hr/sites/default/files/development_strategy_of_the_foi_2018-2023.pdf

The key risks associated with the success of the implementation of this strategic plan can be grouped into four groups: Fundamental risks relate to maintaining the existing and developing the new staff structure motivated by the great organizational changes envisaged by this strategy; The second group of potential risks refers to an eventual failure in assessing the development potential of strategic areas; The third group of risks refers to changes in the higher education financing system; The last risk is related to the drop in the number of students and reaching the enrolment quotas.

The first Strategy for e-learning was defined at FOI in 2007 and it was the first e-learning strategy at a higher education institution (HEI) in Croatia. Shortly after that the E-learning strategy of the University of Zagreb was adopted and the FOI team that prepared the FOI e-learning strategy worked on building the University of Zagreb E-learning strategy. The work at the University of Zagreb was coordinated by SRCE (University Computing Centre) which also coordinated the Tempus project on e-learning EQIBELT (Education Quality Improvement by E-learning Technology). E-Learning strategies (FOI and University of Zagreb) recognize 3 different maturity levels of e-learning courses and prescribe characteristics for each level.

All FOI courses within all study programmes and levels are available as e-courses at Learning Management System - elf.foi.hr. FOI is continuously improving the quality and offer of e-courses available at FOI LMS in line with the newest pedagogical trends and needs imposed by the job markets.

	Several strategic European projects, mostly Erasmus+ such as AMED - Advancing higher education in Maldives through E- learning development (https://amed-project.eu/en), RAPIDE - Relevant assessment and pedagogies for inclusive digital education (https://rapide-project.eu/), Teach4Edu4 - Accelerating the transition towards Edu 4.0 in HEIs (https://teach4edu4-project.eu/) and iLed - Innovating Learning Design in Higher Education (https://iled-project.eu) and especially, research project (financed by Croatian Research Foundation) HRZZ HIGHERDECISION ("Development of a methodological framework for strategic decision-making in higher education – a case of open and distance learning implementation" http://higherdecision.foi.hr) have been aimed at fostering relations with other strategic partners across Europe and at development and introduction of new learning technologies in teaching and learning at FOI. *Furthermore, FOI's e-learning strategy has been furthermore utilised through FOI Online Portal (https://www.foi.unizg.hr/hr/online-nastava) where teachers and students can find all relevant information in regards to e-learning at FOI.* *Furthermore, one of the strategic fields of research highlighted in FOI's strategy are educational technologies. Educational technologies are an extremely propulsive scientific discipline due to their interdisciplinary nature and high level of application in educational and business contexts. The field of learning analytics is at the cross section of the field of educational technologies and big data analytics, i.e. data science (Eng. Big data, Data science), for which there is also FOI's interest in further development, so it is particularly significant as a research domain (FOI Laboratory for Learning Analytics was established in 2015). FOI is also performing the project HELA - Improving HEI maturity to implement learning analytics (funded by Croatian Science Foundation, https://decision-lab.foi.hr/en/project-hela) with the aim to contribute to a better understanding and optimization of the teaching and learning processes supported by learning analytics (LA) through improving higher-educational institution (HEI) maturity to implement LA.* *The research of educational technologies is interdisciplinary and includes educational, informatics, mathematical and economic sciences, which makes it possible to use the interdisciplinary capacities of FOI. Until recently, three large projects related to e-learning were implemented at FOI, the work of which involved three laboratories (Laboratory for Advanced Technologies in Learning, Laboratory for Learning Analytics and Academic Analytics, and Laboratory for strategic planning and decision making): Horizon 2020 project CRISS - Certification of Digital Competences in Primary and Secondary Schools, the HRZZ project HigherDecision with the theme of developing a methodological framework for strategic decision-making in higher education on the example of the implementation of open and distance learning and the national e-School strategic project (funded by ESF and ERDF) in which the FOI was the only academic partner of CARNET, implemented with the goal to establish a system for the development of digitally mature schools in Croatia.* *FOI is currently involved in at least seven international project applications where it is intended to research topics related to educational technologies. It is estimated that about 20% of all works published by FOI researchers have a link to e-learning, that is, educational technologies. Within its PhD study programme, doctoral theses (about 20) on topics related to e-learning and information technologies were also defended in the last few years, which indicates interest in the field and mentoring potential.* *Additionally, the Laboratory for Learning Analytics designed the concept and the tool for learning design titled: Balanced Learning Design Planning (BDP). The tool is web-based (https://learning-design.eu), collaborative and free to use and has more than 1200 users worldwide (30+ countries).* *FOI with experts from University Computing Centre (SRCE) and School of Medicine participated in development of methodology for the e-course assessment for which SRCE later developed web application for self-assessment (Matrica kriterija kvalitete e-kolegija (srce.hr)) enabling teachers/course designers to assess the quality of their e-course according to different criteria.* *FOI established a learning platform (learn.foi.hr) that offers learners the possibility to start studying online to develop a personal interest, as a stepping stone to new career opportunities, or to help enhance your career as part of your continuing professional development. Among other, FOI Learning Platform, offers self-paced*

	MOOCs in different topics including innovative pedagogies, digital skills, learning analytics and learning design. *The main four research areas based on the competences of FOI researchers that have the potential to be internationally competitive are: learning analytics; learning design; design and quality of educational technologies; student-cantered approaches and technologies; strategic management of educational technologies.* *FOI coordinated a dozen of international projects related to e-learning with global reach (https://projects.foi.hr/en).* *In the scope of the project e-Schools FOI researchers have developed the Framework for the Digital Maturity of Schools which defines the areas and levels of the digital maturity of schools. It is being developed as part of the e-Schools pilot project and is coordinated with the DigCompOrg European framework which is applicable to all educational institutions (https://pilot.e-skole.hr/en/results/digital-maturity-of-schools/framework-for-the-digital-maturity-of-schools/). It was implemented in more than 1000 schools in Croatia assessing the level of digital maturity of schools.* *In the scope of the Higher education project the Digital Maturity Framework for Higher Education Institutions (DMFHEI) was developed. The DMFHEI has recognised seven areas that can be divided into 43 describable elements (http://higherdecision.foi.hr/).* *Following FOI's vision of becoming a leading faculty recognised for its innovative approach to learning and teaching, a unique educational approach has been developed for years through connecting professional and technological knowledge, business aspects, applied use of knowledge and technologies as well as digital innovations. The FOI Student Support and Career Development Centre (CPSRK FOI) is the main point for connecting students with employers and the first student stop in their career development. By forming long-term partnerships with employers, the Faculty aims to raise the quality of education and enable students to acquire practical knowledge and experience, in line with the needs of the labour market. Teaching process was innovated through several processes of which the most important are:* *1. Work-based learning, which includes the direct involvement of employers in the teaching process through the academic year. Employers, as an important chain in the knowledge transfer, through extensive mentorship support and setting concrete work-related case studies and situations, work with students mentoring and helping them to gain knowledge, experience and practical skills, connecting knowledge, technologies and digital skills in the process. Until now, the model was implemented in 20 subjects, with participation of mentors from 22 companies and the involvement of 200 students and 12 teachers.* *2. Mandatory internship, on all study levels, offering a well-rounded learning cycle. Students use knowledge, technologies and apply gained skills, according to the level of their education, working with mentors from selected companies. Students of the Information Technology in Business Application, take part in an internship that lasts 15 working days, while students of the graduate study programme in Informatics as well as the Economics of Entrepreneurship take part in an internship that lasts 20 working days. From the academic year 2022/2023 internship is mandatory for students of the undergraduate programme Information Systems and Business Systems, in the form of a job shadowing, lasting for 5 working days. Based on identified needs, and wanting to facilitate the process of monitoring the internship process, the complete procedure of applying, implementing, reviewing and completing the internship, inducing the communication between student, mentor and faculty was digitalized inside a dedicated portal.* *3. Intensive courses, as part of the additional offer for students, performed together with employers. Aiming at keeping students on track with the latest market innovation and digitalization practices, FOI offers students 2 intensive courses taught by partner company's experts (Speck and Arbona). Additional value of the collaboration lies in the valorisation of the courses for students in their Diploma Supplement.* *4. Student career portal, following great emphasis the Faculty places on the career development of students. A dedicated application was developed, digitalizing the process of communication between students and employers, monitoring the work*

	and informal education opportunities (e.g. workshops, courses) as well as the proper presentation (CV) to the employers. *The Faculty of Organization and Informatics of the University of Zagreb is a higher education institution with a tradition in the field of information and communication sciences that has, over the years, positioned itself as Croatian central higher education and research institution within the field of informatics. The document Development Strategy of the Faculty of Organization and Informatics, of the University of Zagreb for the period 2018 - 2023 is the key document of the Faculty of Organization and Informatics of the University of Zagreb and it defined information system and digitalization as a key strategy. Information Systems have been a strategic orientation of FOI since the early 1990s. The area of information systems is concerned with the planning, development, application and maintenance of information systems. By nature, it is an interdisciplinary field because it requires the knowledge and skills of other areas, such as economics, organization and management, both theoretical and applicable. At the application level, the information systems deal with the infrastructure and technical base. The strategy document includes a strategic plan so it is clear the main direction of FOI.* *A prerequisite for a digitized society is the continuous and effective implementation of digital transformation at all levels. This includes the digitized economy, digital public administration and all public services that make up our daily lives. Education is a key stakeholder in that process. In addition to the fact that the education sector itself is going through an intensive digitalization process at all levels, it is also the starting point for creating the preconditions for a digitalized society, because the bearers of these changes are precisely those who acquire formal education in the field of information and communication technologies. During their studies, FOI students acquire advanced skills and knowledge about the creation and management of such technologies, and in addition they also acquire business skills that enable them to more easily implement them into the system itself (smart industry). They are actually the future bearers of these changes, and that is why at FOI we continuously work on improving and modernising study programs, which follow these social and technological changes, as well as new technologies that the process of digital transformation on a global level carry. By new technologies, we primarily mean artificial intelligence, the Internet of Everything, networked systems and the design of business systems that make up the so-called Industry 4.0. We implement all of this in our curriculum, which follows trends in the labour market itself. That is why we continuously work on connecting with the real sector, listening to the needs of employers, especially in IT. We introduce them into our teaching processes, so that students are as ready as possible to enter the labour market. We emphasize work-based learning and problem-based learning with an emphasis on the development of students' critical thinking and the ability to solve specific problems, so that FOI students can have their first contact with real business processes already during their undergraduate studies. In addition, at FOI we are leading the way in the digital model of learning and teaching, because online classes (in these extraordinary but also regular circumstances) are conducted on our own online infrastructure - servers, e-learning system, authentication and authorization system and the system for webinars.* *Because of its own resources and expertise, FOI has been working for many years on the development of web services, applications and systems that facilitate the educational process for students, teachers and other employees of the Faculty's professional services on a daily basis. Because of the Centre for the Development of Software Products - its own organizational unit, FOI was among the first faculties in Croatia to have a complete system ready for the transition to online classes, online registrations, as well as other services that facilitate the process of education in a digital environment.* *Through continuous planning, design of new software products and ways of implementing them, FOI creates new standards in the development and use of information and communication technologies and thus readily responds to all digitalization needs. Functionalities implemented in their products greatly speed up the work process and reduce bureaucratic processes.*
Digital Strategy Reinforced by an Implementation Plan	*As already indicated, FOI has coordinated several strategic EU funded projects which aimed at developing and introducing new teaching and learning technologies. All those projects involved dozens of FOI teachers and several dozen students and the new teaching and learning practice has been piloted throughout dozens of*

	courses at FOI. FOI is also a pioneer in offering Blended Intensive Programs within the University of Zagreb as it piloted several BIPs so far. Therefore, FOI has the richest practice among all faculties within the University of Zagreb. *The University of Zagreb established rewards for the best e-learning courses in 2008 and the first winner was the Mathematic course from FOI and also several times after that FOI courses were rewarded. Unfortunately, that reward was terminated in 2016 and several faculties established their own rewards for e-learning.* *Such a diverse learning practice is also shared through internal workshops where teachers present their current practice with different methods of teaching, online exams, etc.*
Digital Management and Governance Model in Place	*FOI Online Portal - available online for students and teachers - a proxy that integrates all major documents and highlights related to online teaching and learning.* *Policy for conducting classes using digital technologies - identifies 3 possible models with extensive description of every model (includes tools to be used, timing for online and face-to-face teaching, needed resources, format of digital resources required, etc.).* *Within its E-learning strategy FOI developed a comprehensive online survey to receive feedback about the quality of all courses in the time of COVID-19. Online quality survey has been integrated within the FOI's survey system, and students can assess the quality of the course as well as the quality of the study programme. Survey also offers students the ability to evaluate not only the online component of the course, but face-to-face one as well. They are even able to estimate whether they would be more comfortable with more online teaching and learning or not. Individual course data as well as the aggregated data is then discussed within the Faculty departments to detect low performing courses and to propose measures to improve. Aggregated data at the level of departments and study programmes is then discussed within the Management board, E-learning board and Quality control board to tackle any issues and to propose measures and activities for further improvement of online learning. Having that said, it is evident that the student voice is integrated as a feedback mechanism. Also, based on students' feedback, if a set of common problems are detected which are related to teachers' skills, FOI organises workshops to tackle those gaps.*
Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	*The Faculty of Organization and Informatics is actively involved in more mobility programmes that enables student exchange. Students are encouraged to spend a part of their study period abroad, via the Erasmus+ programme as a main (mobility for studies or internship) as well as short exchange programmes, like study trips, winter/summer schools, workshops, and since 2021 - the Erasmus+ Blended Intensive Programmes (BIPs). Erasmus+ Blended Intensive Programmes are teaching/learning elements jointly delivered by several universities, combining virtual components with short-term physical mobility. FOI quickly discovered that Erasmus+ BIPs can be a great way to increase mobility, both students and staff members, incoming and outgoing, and already in 2021 joined as a partner in first BIPs organised by partner universities from Slovenia and Netherlands. Later FOI also organised BIP as a coordinator, in 2022 and 2023. An important part of a blended intensive programme is a virtual mobility, which is even longer than a physical mobility (3-4 weeks).* *Students can spend a semester at one of the Faculty's partner institutions and interest in this experience is growing from year to year. FOI currently has more than 30 bilateral agreements with the universities worldwide. Aside from usual physical exchange, cooperation with some universities is also virtual - students from several courses at bachelor and master level have the opportunity to do virtual exchange and collaborate with colleagues from universities in USA and Europe.* *FOI, as a constituent unit of the University of Zagreb, is included in UNIC - European University, an alliance of ten universities educating through teaching, research and community engagement, towards inclusive societies.*

Strategic Approach is Communicated	*Regarding digitalization, Faculty of Organization and Informatics (FOI) has multiple marketing activities, marketing strategies as well as effectiveness evaluation systems. The marketing and promotion of the Faculty of Organization and Informatics activities with regards to digitalization are organized in a way that aligns with modern trends and technology. This involves a mix of centralized and decentralized strategies, often leveraging digital tools and platforms to reach the target audience effectively.* *FOI Marketing strategies and operations:* ● ***Digital Content Creation:*** *Creation of high-quality digital content is crucial. This includes articles, web posts, videos, webinars, podcasts, and interactive infographics that highlight the significance of digitalization in the field of informatics and economics, which are the two basic education programmes FOI provides for domestic and international students.* ● ***Social Media Engagement:*** *Leveraging platforms like Facebook, Instagram, Tik Tok, Twitter and LinkedIn to share content, engage with the multiple audiences, and showcase the faculty's expertise in digitalization.* ● ***Search Engine Optimization (SEO):*** *Optimising the faculty's website www.foi.unizg.hr and content to rank higher in search engine results, ensuring that those seeking information on informatics and economics find relevant content easily. There are multiple tools for providing statistics and basic analytical tools for search engine optimization (SEO) and marketing purposes, and FOI is turned to GA 4 (Google Analytics 4) in June, 2023.* ● ***Email Marketing:*** *Sending regular newsletters and updates to several thousand subscribers, providing insights into the latest advancements, research, and events related to digitalization in informatics. Newsletters are being sent quarterly.* ● ***Webinars and Online Events:*** *Hosting online seminars, workshops, and conferences (with special emphasis on Central European Conference on Information and Intelligent Systems) that focus on the implications of digitalization in informatics, attracting academics, students and professionals. This is a crucial activity for FOI professionals because it ensures experience and knowledge exchange.* ● ***Collaboration with Alumni and Influencers:*** *Collaborating with influential figures in the field of entrepreneurship, informatics and tech industry is the key to amplify the reach and credibility of the faculty's messaging. We have established a great connection to more than 700 IT enterprises and professionals, based on our alumni network.* ***FOI Communication channels:*** ● ***Official Faculty Website*** *is the most important channel to our audience. Hosting web with dedicated sections and other microsites (centres, projects etc.) highlight our digitalization-related activities, research achievements, and courses.* ● *Sharing content on* ***Social Media Platforms*** *and engaging with the audience, fostering discussions on platforms like Facebook, Tik Tok, Twitter, LinkedIn, and YouTube is the key activity providing information and discussion on a daily basis.* ● *Sending* ***Email Newsletters*** *and regularly updating subscribers with relevant news, research findings, and upcoming events is an important communication tool for all teachers and staff of the Faculty's professional services.* ● *FOI teachers and staff are using* ***webinars and several online event platforms*** *like Big Blue Button, Zoom, Microsoft Teams and other webinar software (developed by inhouse IT professionals) to engage with a remote audience, especially students and foreign lecturers.* ● ***Content Sharing Platforms*** *like YouTube are used at FOI for distributing content like podcasts. FOI has two podcast shows: Podcast@FOI and FOI Business Talks, broadcasted periodically for wider audiences.*

	• *FOI is using online advertising platforms like Google Ads or social media ads manager tools (Facebook, Instagram, LinkedIn) to target specific demographics interested in higher education, especially in the field of informatics, economics and entrepreneurship.* ***FOI Marketing effectiveness evaluation:*** *Effectiveness of the FOI marketing strategies are evaluated through various metrics and methods, including:* • ***Official FOI Website and other microsites analytics:*** *FOI is using tools like GA 4 for tracking website traffic, page views, bounce rates, and time spent on FOI-related content to gather information on relevant user engagement.* • ***Social Media Metrics:*** *FOI is monitoring likes, shares, comments, and follower growth on social media platforms to measure audience interaction using business manager platforms on social networks.* • ***Email Campaign Analytics:*** *FOI is tracking open rates, click-through rates, and subscription growth for all official email newsletters.* • ***Webinar Attendance and Feedback:*** *FOI teachers and educators are measuring the number of students and other attendees, participant engagement, and gathering feedback to assess the success of FOI online events.* • ***Surveys and Feedback Forms:*** *FOI is annually collecting feedback from FOI event participants to understand their perceptions, needs, and suggestions for improvement. It is especially done with FOI alumni community.* • ***ROI (Return on Investment):*** *FOI is evaluating the cost-effectiveness of different marketing channels and project campaigns in terms of their impact on enrolment, engagement, and overall goals.* ***Enrolled students' measurement:*** *Every year, FOI analyses the number of enrolled students and compares it with other related faculties and the number of enrolled students in previous years, which shows the success of the marketing strategy and quality. RU has a communication strategy in place and is currently developing a strategy for its international branding. The university informs the general public about its scientific and technological achievements taking advantage of regional and national channels for communication.*
Partnerships are Developed	
Infrastructure	
Physical and Virtual Learning Spaces	*Virtual learning environment at FOI has been implemented from 2000 in some courses, and started in 2006. with systematic implementation of Moodle LMS as the default LMS for the institution. Today all courses are implemented in Moodle LMS and the system is maintained by Faculty's resources (Centre for Software Development). LMS is further supported with ePortfolio Mahara and BigBlueButton (BBB) as an open-source virtual conferencing tool. Zoom licences are also used as an add-on to teaching large classes.*
Digital Infrastructure is Planned for and Managed	*In order to support all the services required for e-learning, faculty is continuously maintaining reliable ICT infrastructure. All the critical resources are hosted on private faculty infrastructure (on 2 separate locations) which is continuously maintained and upgraded. Latest substantial upgrade (from 2021) consisted of 2 servers and a data management centre capable of hosting all the resources needed for online teaching. Besides relying on private infrastructure, redundant*

infrastructure is available at the University of Zagreb University Computing Centre which guarantees us high availability of all the services.

FOI also defined a policy for e-learning where it described 3 different ways of course organisation and possible implementation by combining online and traditional classes. In the policy, a set of different tools is described to offer teachers help in approaching online teaching. With that respect, all teachers use LMS Moodle, BBB or Zoom, online tests with or without SafeExamBrowser, different tools for collaboration of students, etc. Of course, policies have been analysed considering study programmes and possible ways of conducting classes on those programmes.

All the main teaching rooms are equipped with advanced video conferencing solutions that support face to face, online and hybrid teaching.

Faculty offers 11 laboratory rooms equipped with modern desktop computers (at least 20 computers per room), and there is also the ability for students to bring their own devices (BYOD). Some laboratory rooms are equipped for work-based learning and project-based learning with special furniture that allows moving and grouping the students very easily. All projectors have been replaced with large LCDs to offer high graphics standards and ability for students to showcase their work from their computer.

Several rooms are available to students from 8 AM till 8 PM with several LCDs and Wi-Fi access so students can work together.

In order to support production of video and other multimedia content, a small recording studio is available for all the teachers.

***Assistive technologies**:*

Students with disabilities are students with visual or hearing impairments, motor disabilities, chronic illnesses, mental disorders and illness, specific learning difficulties and other health issues and impairments. They are unrepresentative group of students that needs the variety of different learning materials adjustments.

The Office for Students with Disabilities on University level includes individual approach to each student in order to help and support their study achievement. The interdisciplinary team with medical doctor and other professionals such as psychologists, psychiatrists, speech therapists etc. provides recommendations that could help each student to fulfil academic goals and tasks.

Those recommendations are great help for professors and staff at the College level, in order to provide the best individual approach that are fit to student's specific needs: some students require extra time for exams, visually impaired students need different font size, deaf students and students with hearing impairment require specific communication software etc. Those specific recommendations are shared with professors and students, so they can arrange adjustments according to specific requirements for each study course and student's individual needs. College web site has options for specific adjustments such as Dyslexia letter type, contrast, screen size / font size.

Students with mental health issues have additional psychological support at the college level. All students, including students with disabilities, have free online or face-to-face counselling option at the Psychological counselling centre. Students contact this centre with the variety of different issues such as mental health issues, communication issues, etc.

Students initiative is very important as well. The accessibility analysis for architectonic barriers was carried out by student in weal chair and this document is published at the college web site. Additionally, some students require peer assistants who help them during their studying but also during other parts of social life. The course Peer support for students with disabilities enables peers to learn how to provide specific types of individual support and to share their experiences with other students. This course is organized at the university level and provides opportunity for lateral student mobility. One of Faculty of organization and Informatics student alumni started the YouTube channel Liter of proud, Kilo of Prejudice where she shared specific study experiences and tips from the perspective of a student with disabilities.

Communication and team approach are the main conditions for helping students in achieving their academic success.

Sector Specific	
Sector-specific sub-element(s)	None
Supporting References	
Reference and Supporting Material	On-line link(s): https://www.foi.unizg.hr/ https://www.foi.unizg.hr/en
	Addendum(s):
Contact	
Contact Details for Further Information	Name: Nina Begičević Ređep
	Email: nbegicev@foi.unizg.hr
	Telephone: +385 91 3390957

Münster University of Applied Sciences (Germany)

Case Title	FH Münster
Institution	
Name of the Institution	FH Münster University of Applied Sciences (FH) Fachhochschule Münster FH)
Country	Germany
Ownership	Public
HEI / VET	HEI
Type of Education	Formal
National Accreditation	Yes (Akkreditierungsrat der Stiftung zur Akkreditierung von Studiengängen in Deutschland - German Accreditation Council)
International Accreditation	Yes (for selected study programs - EFMD)
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☒ (b) Digital Collaboration and Networking ☒ (c) Digital Infrastructure ☒ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	*Since its foundation, FH Münster has developed into one of the largest and most successful universities of applied sciences in Germany. In its Higher Education Development Plan (HEP) for the period 2021 to 2025, FH Münster has defined, among other things, six strategic development fields that run through its overall plan like a common thread:* 1. *Internationalization* 2. *Continuing education* 3. *Digitization* 4. *Transfer 2020* 5. *Human resources development* 6. *Content profiling* *Rapid technological developments open up new opportunities for the world of work and society, but also require new or different competencies from students, teachers and employees. In order to promote these, we have developed new teaching and learning formats and have also intensively dealt with a didactically meaningful use of e-learning tools.* *We are a face-to-face university. Digital tools in teaching primarily serve to make presence more valuable. We are flexible, digital and international. In our work with digital tools, we are guided by the search for didactic added and different value. In particular, we focus on competence orientation and student-centeredness. Teaching and examinations are geared to the competencies of our students for a changing world.* *The offers in the field of digital teaching at our university are jointly managed by several central service facilities:* - *DVZ (provision of IT infrastructure & technical support).* - *Library (ILIAS support, lending of equipment)* - *Wandelwerk (exchange, continuing education and didactic consulting)*

We actively communicate the benefits but also potential challenges of digital teaching on our dedicated pages about e-learning at the FH Münster:

We define digital teaching as any form of teaching in which digital tools are used - to record, transmit or enrich the course. Courses in which teachers and students are in direct, digitally mediated exchange are referred to as synchronous courses. Recorded formats are described as asynchronous courses. In this case, the learners can come together in presence or online. The spectrum of digital teaching ranges from the digitization of existing formats (e.g., recording a course) to the conceptual development of new formats (e.g., the use of virtual reality in the lab). Designers of digital teaching should always ask themselves: Does the use of digital tools contribute to increasing the quality of the course? Does the use of digital tools offer added value?

Opportunities of digital teaching:

- *Flexibility in terms of location and time. Individual needs of students (e.g. professional activity) can be considered. Tasks and contents can be worked out by students flexibly in terms of time.*
- *Methodological and content flexibility. Variety of tools offers interactive and varied design of the course. Existing digital content (e.g. OER) can be integrated. Different learning styles of students can be addressed with the help of different tools.*
- *Modern and future-proof. Digitally enriched courses can support students in their creative and active engagement with content and at the same time promote the acquisition of digital skills.*

Challenges

- *Prevent students from being overwhelmed. Be careful not to overwhelm your students with the use of digital tools. Select tools and content according to the learning goals you are trying to achieve, and allow enough time to design new formats. Introduce students to more active teaching.*
- *Allow sufficient time for conceptualization. Schedule time to create a sound instructional design, select appropriate tools, and learn how to use them. It's best to build 1-2 elements into your course at first and thereby slowly feel your way toward digital teaching.*
- *Ensure social inclusion. The use of digital media and formats must not lead to a reduction in contact time between students and students and teachers*

Our educational mission statement expresses our self-image and our common values regarding teaching and learning. The profile of FH Münster is characterized by its quality culture, the central goal of which is the academic success of our students. For us, academic success means that our graduates are academically qualified as well as adaptable and willing to change. They are able to meet the requirements of today's and tomorrow's professional fields at different levels (bachelor's, master's or doctorate) and are motivated and capable of actively shaping their environment and assuming responsibility in society. Scientific and professional qualification as well as personality development are legally binding goals of a university degree. We see the interweaving of these three goals as a central profile feature of our university: Education at Münster UAS is, in our understanding, application-oriented, scientifically sound and personality-developing.

https://en.fh-muenster.de/hochschule/aktuelles/publikationen/bildungsleitbild.php

Our previous university development plan acknowledged digitalisation as one of six key challenges that we as a university must face. Rapid technological developments open up new opportunities for the world of work and society, but also require new or different skills from students, teachers and employees. students, teachers and employees. To promote these skills, we have developed new teaching and learning formats and have and learning formats and have also intensively dealt with a didactically Strategic university-wide considerations for the use of e-learning tools. With our competence-oriented approach to teaching and our understanding of the changing world of life and work, we are taking a leading role in the university landscape. of the changing

world of life and work, we have become a pioneering role. Research questions on digitalization are bundled in our two research institutes GUD and IPD. IPD. In addition, numerous projects have been initiated and implemented in our service facilities to complete the transformation toward digital processes. For example, we installed a campus management system and subsequently put it into regular operation. We have started to set up a document management system. We have already digitized selected processes within the administration, such as the billing of teaching assignments; others will follow.

We were able to achieve or even exceed the targets set in all six strategic development areas. We have supported the development of our focus areas financially and with and with positions for professors. We have no longer explicitly included these development fields in the new university development plan - but this does not mean that we are no longer pursuing these topics or that we no longer consider them important. In all of the development areas described above, we will continue to continue to be intensively engaged in all of the development areas described above. On the contrary part of our "university DNA" and have been incorporated in various ways into our current strategic planning.

https://www.fh-muenster.de/hochschule/downloads/HEP-FH-Muenster-2021.pdf

One of the main advantages of digitizing university teaching is the low-threshold accessibility and the possibility of exchanging, customizing and reusing teaching/learning materials. At present, various political and scientific initiatives are attempting to realize the advantages of digitizing university teaching even more extensively than before through the open licensing of teaching/learning materials.

The advantages of using OER in teaching are manifold and lie above all in the open licensing of the materials, which enables their reusability and - depending on the specific license - also their modifiability or adaptability.

It is often emphasized that

- *Course content can be better adapted to current developments in the world of work and life, as it is no longer necessary to create all new content oneself,*
- *courses can be better tailored to the specific requirements and needs of concrete learning groups, since a large pool of adaptable material can be accessed, and*
- *an increase in the quality of teaching/learning materials is possible, since these are created collaboratively and can be continuously improved.*

But not only teachers and students benefit: The low-threshold accessibility of teaching/learning materials enables prospective students, for example, to get an impression of the content and (learning) requirements and thus make informed decisions regarding the choice of a field of study.

Our Wandelwerk advises and supports the creation, licensing and use of OER and the portal ORCA.nrw. The Open Resources Campus NRW is a cross-university online portal for digitally supported teaching and learning at universities in North Rhine-Westphalia. ORCA.nrw is the central portal for digital teaching and learning in NRW, where all relevant information and services as well as teaching/learning material for teachers and students can be easily accessed. The goal of the portal and the associated network is to strengthen digitally supported teaching and learning locally in the universities, to promote cooperation between the universities of the Digital University NRW, and to make e-learning activities more visible.

With its offerings, it is intended to contribute to making even greater use of the didactic possibilities of a digitally shaped world and to offering differentiated and flexible ways of achieving learning goals.

https://www.fh-muenster.de/wandelwerk/hochschuldidaktik/orca.nrw.php/oer/oer.php

https://www.fh-muenster.de/wandelwerk/hochschuldidaktik/orca.nrw.php/orca.nrw.php

Digital Strategy Reinforced by an Implementation Plan	*For our main goal of becoming a magnet higher education institution by increasing the attractiveness our educational offerings and shape change, we have specified the following sub-goals and measurements:* *1. Establish appropriate teaching/learning and assessment formats.* - *Support development of agile curricula and modules* - *Transfer educational mission statement into curricula* - *Sharpen and implement scenarios such as "curated studying" and "WG kitchen* - *Further develop face-to-face and online formats and consider their mix* *2. Sharpening the content profile* - *"Understanding materials - conserving resources", "Living health", digitalization as well as sustainability and future technologies in educational offerings.* *3. Promote interdisciplinary competencies* - *Initiate interdisciplinary offerings* - *Strengthen the internationality and interculturality of all university employees*.* - *Implement international partner strategy** - *Enable students to become entrepreneurs***. - *Use digitization as a driver for changes in learning objectives and competency requirements* *4. Enable lifelong learning* - *Accompany expansion of continuing education offerings* - *Establish continuing education centre* *We actively build on the potential of digital technologies in order to achieve our goals, while staying aware of the challenges its integration into our offerings entail.* *As a strategic management tool for structuring and operationalizing our planning, we are using our Academic Scorecard (ASC). This is a variant of the Balanced Scorecard that we have adapted for educational institutions with the three perspectives of education, research and resources. Here, we consider resources differentiated according to personnel, infrastructure and finances as well as management. The university-wide ASC focuses on goals and activities that can be influenced centrally. The ASCs of the departments, on the other hand, consider goals and activities that the respective department will work to implement in a decentralized manner over the next five years. Through a careful coordination process (top-down and bottom-up) of the ASCs, we ensure that, on the one hand, the strategic and concrete goals are in line with the university's mission statement and maxims for action and, on the other hand, that the goals of the departments are compatible with each other and with the goals of the university management.* *Important university-wide concerns, such as the desired internationalization and the promotion of entrepreneurship, are anchored in separate ASCs in order to agree on a goal-oriented and binding approach. and binding approach.* *In regards to the integration of digital learning elements, our lecturers have far reaching autonomy.* *The various support structures actively invite staff to acquire digital competence and apply it in their teaching. For example, Wandelwerk offers a one-year educational program called E-Teaching Fellowship.* *The E-Teaching Fellowship is a structured one-year continuing education program. Within the framework of the program, implementation approaches are developed on specific topics in a collegial exchange. Information on the program and registration can be found on the E-Teaching Fellowship website. In the E-Teaching Fellowship 2022/23, participants will jointly explore the potential of Educational Escape Games and be accompanied on their way to creating a prototype for their own teaching. This ranges from the design of an*

	own physical room to a special form of digital scavenger hunt to a purely digital learning experience in ILIAS. *As stated in the university development plan, digital learning and teaching is part of our university's DNA and being leveraged to achieve our overall goals.* *We have two support mechanisms to balance the twin goals of improving existing offerings and creating new innovative learning opportunities.* *For the first part, we have the so-called quality improvement funds. These are state funds that are earmarked for the improvement of teaching and study conditions, in particular for the improvement of the supervision ratio between our teaching staff and students.* *For the second part, we have the internal change funds ("Wandelfonds"). In the call for proposals "Wandelfonds individuell" lecturers can apply for their innovative project in the field of "Flexible learning paths and digital learning spaces".* *Projects for the renewal and change of teaching and studying at FH Münster with individual focal points are funded. These can relate to individual courses, a module, a study section, but also to an entire study program or focus on associated support processes and structures. Cooperative projects in which several teachers or organizational units of the university work together are particularly welcome.*
Digital Management and Governance Model in Place	*The implementation plan is based on joint discussions and understanding of our leadership, senate, council and representatives of all faculties. All faculty ASCs are aligned with the overall FH Münster ASC.* *Our Vice President for Teaching, Sustainability and University Planning is head of the commission for education, which consults the governing board on the topics of teaching, study, lifelong learning and international topics.* *Further, our chancellor and our vice president for teaching are part of a working group on the specific topic digitalisation in education.* *All three supportive organisations (DVC, library, Wandelwerk) are staffed accordingly. Budgets for improvements and new developments are regularly assigned.* *All goals and measures on all ASCs are connected to performance indicators which are regularly reviewed by the governing bodies of the FH Münster.* *The allocation of funds for Wandelfonds or quality improvement funds is governed by commissions that check upon proposal submission the fit to the university's goals and checks during and after project completion whether the promised outcomes are achieved.*
Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	*As an example of our university-wide exchange and collaboration, we initiated the project Learning culture. it is a project funded by the "Innovation in Higher Education" foundation to make learning paths more flexible and improve learning locations at FH Münster. The project idea is based in particular on the consequences and challenges of the pandemic digitalization of educational operations at Münster UAS. We want to bring about an innovative and future-oriented change in the culture of learning after the change in the culture of teaching as a result of digital teaching!* *Learning Culture wants to realize its projects according to the "bottom-up" principle: The students are the basis for impulses and innovations. For this reason, the student committee of the Sounding Board accompanies Learning Culture.* *On June 5, 2023, we used the project Learning Culture in coordination with the Executive Board to exchange ideas with about 100 participants across the university on the topic of "Learning Culture in Times of Artificial Intelligence" and to come to an assessment of the current situation. In addition to the insight into the technical basics and the debates from the perspective of department*

	heads, students had their say, and all participants were invited to contribute to Münster UAS's assessment of the current situation on this topic. *https://www.fh-muenster.de/wandelwerk/hochschuldidaktik/lernkultur/tag-der-lernkultur.php*
Strategic Approach is Communicated	*The university development plan explicitly acknowledges the importance to communicate and market the various offerings, in order to ensure that the FH Münster can fulfil its role in the local, regional, national, and international ecosystem and shape the change.* *The FH Münster communicates over various channels. The website is currently its main channel. However, social media platforms are gaining importance especially in the acquisition of new students (i.e., Instagram). Currently, the faculty Münster School of Business is running a pilot project thereon, in accordance with the development plan, to market its study programs to the right target groups.*
Partnerships are Developed	FH Münster is firmly anchored in regional and supra-regional structures. Nationally and internationally, we are sought out as a partner for research and innovation projects. Our university has a clear, nationally and internationally visible profile. We only succeed in this because our activities are based on a broad foundation, that involves all departments - interdisciplinary cooperation is a living standard at Münster UAS. In 2017, we expanded our research guidelines to include a separate transfer strategy, which was approved by the central university committees. At the latest since our award as "Innovative University" as well as the associated project funding by the federal-state program of the same name, efforts of "Science to Society" are also clearly visible at our university. Münster University of Applied Sciences has been stimulating business start-ups by university members and alumni for many years. We have been doing this so successfully that we have been a "Gründerhochschule" (university for start-ups) since 2020 and have received funding as part of the BMWi competition "EXIST-Potentiale". Last but not least, we have helped to establish an active start-up scene in our region in the recent past. active start-up scene has formed in our region in the recent past. On the topic of digital technology, FH Münster is participating as a consortium partner in the DH-NRW project "Higher Education Didactics in the Digital Age" (HDDHnrw). Teachers from NRW have the opportunity to access the continuing education formats and offerings developed in the HDDHnrw project. The aim of the project is to develop the competence of teachers with regard to teaching and learning in the digital age.
Infrastructure	
Physical and Virtual Learning Spaces	*Various lecture halls and seminar rooms are, besides the standard set of PC, microphone, and a beamer, equipped with interactive media desk displays and a camera that allows for more interactive lecturing and also enables hybrid or streamed lectures.* *For more interactive seminars or group projects, various learning spaces like a co-creation lab or the digi.lab enable testing of innovative solutions or developing own business models. The equipment of the digi.lab includes a large screen with touchscreen, a conference camera, a beamer, a 360-degree camera for simulation observations, a 3D printer, a factory simulation, and augmented and virtual reality applications that add digital aspects to the real world. In addition, a smart board acts as a digital flipchart and writable walls as a gathering place for joint brainstorming sessions.* *All of our courses get a digital course room on the learning platform ILIAS. In this room, lecturers can provide content, create quizzes, upload videos and get into contact with the students.* *ILIAS also is used to hold digital exams.*

Digital Infrastructure is Planned for and Managed	*Our current acceptable usage policy from 2022 contains binding guidelines for the use of IT systems and IT services at Münster UAS. The target group are the users.* *The usage guidelines represent a practical handout that covers all aspects of information processing within Münster UAS. They thus concretize the general requirements of the information security guideline of Münster UAS regarding information security and data protection. The scope of application is based on the scope of application of the information security guideline.* *The usage guidelines have a high degree of influence on the research, teaching and administrative operations of Münster UAS. Therefore, they are regularly updated and, if necessary, adapted as part of the security process. In order to achieve a high degree of practicability, feedback, comments, and requests for improvements to this usage guideline are therefore expressly desired.* *https://www.fh-muenster.de/uploads/amtliche_bekanntmachungen/52_2022.pdf* *Our DVZ team always considers the economic impact and both initial and ongoing financial viability in their actions.* *As mentioned, our main learning platform ILIAS supports various types of interaction between lecturers and students. In many cases, students are time and space independent in their learning paths.* *Students are free in their choice of device with which they participate in classes. We also offer PC-pools should students require specific software or want to work on a different PC.* *The DVZ IT Support assists all users at the FH Münster in their infrastructural IT questions.* *Almost all processes at FH Münster use information technologies to process information. In order to ensure the security of the data in the process, information security must be directly integrated into these processes. To support the Executive Board in this task, a management system for information security according to ISO 27001 is established at FH Münster and regularly developed further by an information security team. In addition to creating guidelines, the information security team also deals with practical security checks. On the one hand, the central infrastructure is examined for vulnerabilities, and on the other hand, the IT security team offers professors and lab managers a review of the lab networks and servers.* *An information security guideline contains basic principles of information security within FH Münster. It serves as a guideline for the creation of further guidelines, information security concepts as well as regulations and instructions on information security. security. It also serves as a guide for the topics of information security and data protection.* *https://www.fh-muenster.de/uploads/amtliche_bekanntmachungen/4_2021.pdf*
Sector Specific	
Sector-specific sub-element(s)	None
Supporting References	
Reference and Supporting Material	On-line link(s): https://www.fh-muenster.de/hochschule/downloads/HEP-FH-Muenster-2021.pdf International Office

	https://www.fh-muenster.de/hochschule/downloads/Bildungsleitbild_2020-FH-Muenster.pdf
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Institution of Research and Economic Studies (Italy)

Case Title	IRES
Institution	
Name of the Institution	Istituto di ricerca economiche e sociali del Friuli Venezia Giulia (IRES)
Country	Italy
Ownership	Private
HEI / VET	VET
Type of Education	Formal
National Accreditation	No
International Accreditation	No
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☒ (b) Digital Collaboration and Networking ☒ (c) Digital Infrastructure ☒ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	***IRES governance*** *IRES is in charge of vocational education, research and consultancy. Training activities are supported by public resources at regional, national and EU level (FSE + and PNRR). IRES training offers are made in close cooperation with Friuli Venezia Giulia Region and in accordance to the regional network of VET institutions.* *After the outbreak of Covid-19 pandemics, the situation was not clear. They found themselves pushed to solve an emergency situation, dealing with regulations they needed to respect in order to be compliant with funding rules. Regione Friuli Venezia Giulia was very responsive in adapting their regulations to the new online training world, making it possible for IRES to continue working on their training without having to cancel all activities.* *In the first-place digital trainers were aware of the existence of digital learning technologies, but had no idea about how to exploit them. Now their potential is clearer.* *IRES target population comes from a diverse range of backgrounds: some are sent by social services, some from the unemployment service, some are people dealing with mental health issues or coming from remote areas. Digital Learning Technologies supported them in attending the courses, although sometimes the lack of personal computers and the use of mobile phones instead made it difficult for them to focus. After the pandemic some courses remained online or partially online in order to give to student's online attendance as an option and enhance the appeal of the courses.* *Not discussed, but I could infer from the interview that yes, they are encompassed.* *As said before, the mission of open education is very strong in IRES: starting from a research institute and now dealing mostly with vocational training, IRES has a strong advocacy mission for inclusion of disadvantaged people into the job market.*

Digital Strategy Reinforced by an Implementation Plan	*Not discussed, but from the interview we can argue that yes: they have a clear idea of possible barriers and they are making their best to overcome them.* *IRES offers a wide range of training courses, involving professionals who are experts on their job and not just "trainers". On one hand this gives a high-quality level of learning, on the other hand the trainers have a diverse approach to teaching and not clear on line training guidelines are given. This could be seen as a weak point but they are constantly reading from student's feedback trying to improve their quality.* *'Professional qualifiers' have been engaged from outside for bringing an "hands-on approach" to the teaching. They work autonomously on competencies with a "Lego approach" which is framed in a context of "typical situations" according to the Friuli Venezia Giulia Competence Framework, which the trainees are expected to manage in order to succeed in the training courses.* *IRES is also cooperating closely with companies to co-create training courses adapted for their specific needs and the needs of the updated needs of the job market.* *Trainers can benefit from a technical training regarding the focus on digital competences and tools, with a particular attention to connection and web-conferencing platforms. The selection of digital training sources (OERs) is under the responsibility of the trainers.* *IRES has just started providing training to senior people (>70 yr.) for supporting them in the transition to the digital age. They do not have specific guidelines to approach their target. They do not mention specific criticalities with reference to this target.* *Trainers are constantly updated in the light of the evolution of the EU Agenda for competences. The Region enhances and promotes alternative training opportunities on instructional design processes (granted by the FSE+).*
Digital Management and Governance Model in Place	*Distance learning has taken shape during the pandemics. Before that, no specific rules were foreseen in terms of management and governance. As a consequence of the pandemics, rules and procedures have undergone a process of adaptation to build up a system in which entities/institutions could report on distance and digital learning. At the beginning, some criticalities have been identified, but they have been overcome.* *For a proper management of digitally-based training, online platforms have been created, including digital badges and micro-credentials for the certification of the acquired specific competences. They are released in paper form. In these days IRES has gone through the procedures of being accredited as a Digital Badge Provider, starting from next September to grant Digital Badges to their students. They are one of the first examples in Friuli Venezia Giulia Region.* *IRES works with companies to upskills their workforce: they started to offer blended learning programs which are mainly digital, but opens and ends with lessons in presence, in order to introduce students to the training course, get to know each other and sum up the learnings at the end of the programme. More and more companies prefer this formula instead of a "real" classroom.*

Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	*Trainers' staff consists mainly of professionals. No train the trainer's activities on digital learning strategies is provided by IRES-networked collaboration for staff is put in place in long-term training courses, where there are scheduled meetings for teachers and where didactic is discussed.* *There is a clear awareness of the benefits of exchange, but at the moment it is not done on a regular basis.* *The engagement of students in effective networking through online activities has given good results, creating the proper conditions for enhancing the quality of interaction and promoting collaborative and peer-to peer learning. To this aim, trainers are encouraged to conceive shared and participative training experiences which have demonstrated to really make the difference. In order to foster the students' engagement, a particular attention is given to activities which are oriented towards the setup of concrete outputs, on which the success of the training activity can be measured. Distance coaching activities have proven to be highly effective to this aim. IRES does not promote, however, any policy for assessing how training materials are participative and engaging.* *Companies participate in the exchange of knowledge as well as in the finetuning of the trainers' competences. Their contribution consists mainly in the definition of the expected competences profiles according to the market needs. Companies can equally benefit from co-projected courses.* *Internal collaboration and knowledge exchange were not discussed, but I would say yes in the light of the reported experiences.*
Strategic Approach is Communicated	
Partnerships are Developed	*Even before the pandemic a stable and ever-growing capacity of interaction and collaboration among training providers in FVG has been implemented. This has marked a clear difference with the past, when competitive approaches were prevailing, resulting in the difficulty to exchange information and practices. Nowadays, thanks to the Regional System for the Recognition of Competences, such integration has been made easier and possible.* *The exchange of information among institutions and training bodies is fundamental. To this aim, IRES and the other training providers have created a shared catalogue to which all the training entities can access for the reskilling and upskilling courses in cooperation with the employment offices.* *Partnership activities are very common with regional bodies as well as with training entities and centres. Employment centres are expected to have a clear perspective on training courses in order to steer the participants towards the most adequate training path.*
Infrastructure	
Physical and Virtual Learning Spaces	*We had the impression that physical learning still represents the standard at IRES. Some courses can be followed online or in presence, according to the preference and availability of participants.* *They create a Moodle platform (fad.iresfvg.org) where teachers upload the materials, calendar, videos and students can stay updated, where students can also communicate between each other. The issue on this platform is the lack of someone who stimulate the learner's community to make them interact more.*

Digital Infrastructure is Planned for and Managed	*IRES Moodle platform supports the learning of the students anytime/anyplace. Not always the lessons can though be downloaded or followed at student requests because there are strict regulations of attendance. Students can anyway dive back in contents already discussed by teachers, upload tasks and so on.* *Modalities for the inclusion of disadvantaged categories are foreseen. An example is the provision of digital devices for those people who cannot afford to buy them.* *Teachers and students have at their disposal technical assistance throughout the trainings.* *Privacy challenge is taken into consideration as a very high priority: specific modules have been adopted which must be undersigned by participants especially for what regards the authorization to use personal pictures and the right to keep the video-cameras switched off during the training activity.* *IRES is well equipped for hybrid lessons, also to support students to participate from IRES classrooms to digital learning activities.* *Analytics for the optimization of training experience and the level of interaction is not common. They are just used to check the number of participants and not the quality and modality of their participation.*
Sector Specific	
Sector-specific sub-element(s)	None
Supporting References	
Reference and Supporting Material	On-line link(s):
	Addendum(s):
Contact	
Contact Details for Further Information	Name: Lino Frascella
	Email: frascella.l@iresfvg.org
	Telephone:

EFMD (Belgium)

Case Title	EFMD
Institution	
Name of the Institution	EFMD
Country	Belgium
Ownership	Not-for-profit international association
HEI / VET	N/A
Type of Education	Higher Education
National Accreditation	N/A
International Accreditation	N/A
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☒ (b) Digital Collaboration and Networking ☒ (c) Digital Infrastructure ☒ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	*EOCCS (p.6/7/11/12/20):* *More careful review of the existence (or not) of links between strategy and learning:* • *The Institution should have a defined and coherent strategy for online courses, which relates to its overall learning strategy.* • *What objectives does the Institution embrace in online learning? Is there a link present between the institutional mission and the online learning policies?* • *How has the Institution's strategic position changed as regards to strategic plan and considerations on online learning over recent years?* • *Describe the role of online and distance learning for the School. How does it relate to the overall strategy of the School, including research, and support processes?* *To understand if online education appears as "box ticking" or if it is a genuine part of the institution's educational offer:* • *What kind of opportunities and/or risks has the Institution recognised regarding the provision of online courses?* • *How can the Institution benefit from the possibilities of online learning?* • *How does the institution understand the added value of applied technologies to the learning experience?* *EQUIS (p.16):* *To understand if the institutional strategy with regards to digitalization is a matter of monitoring and quality review, making it easier to adjust it to today's changes in the field:* • *Is digitalisation, broadly defined, an integral part of the current strategy? Is the Management Team clear in its approach to*

	digitalisation? How is this approach communicated to key departments in the School? *Is the School able to effectively execute this aspect to its strategy? Does the School have credible operational plans? Have the necessary resources for implementation been secured? Are the required competencies and capabilities already available or how are they being developed?*
Digital Strategy Reinforced by an Implementation Plan	*To understand whether the school has capitalized the benefits of digitalization in terms of improving the learning experience.* *EOCSS (p.12)* • *How are potential new technologies reviewed and, when appropriate, incorporated into courses? How are faculty/students advised of new technologies and trained in their use?* *EQUIS (p.40):* • *Does the School align the faculty competence with the requirements involved for the digitalisation of learning and teaching as well as research?* *EQUIS (p.57/58):* • *How is the learning experience digitalised?* • *How is the School innovating and exploring especially the online learning space?* • *To what extent is digitalisation a pillar of programme content?* *For the Implementation Plan criteria, refer to "Strategic Plan".*
Digital Management and Governance Model in Place	*Beyond indicators: what is the QA culture? Is it effective? Does it collect qualitative data or only "numbers"? How are the results taken into consideration?* *EQUIS (p.13/14/15/16/24/25/26):* • *Does the School have the financial resources and staff that will be necessary to achieve the objectives?* *Specific details:* • *List any policy and procedure documents that have been developed to support the implementation of the strategic plans.* *Focus on the Communication Channels:* • *Is the Management Team clear in its approach to digitalisation? How is this approach communicated to key departments in the School?* • *How are the plans reviewed and updated and by whom?* • *What methods does the School use for tracking progress and completion of individual objectives?* • *What are the key performance indicators?* • *Is there an appropriate Quality Assurance framework in place? Are relevant activities monitored?* • *Are processes in place to assure quality of online programmes?* • *How does the School assess the quality of online learning?* *How the School accounts for the quality of the virtual experience and the goals achieved when compared to more traditional exchange opportunities.*

Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	*EQUIS (p.26/41/42):* *List of collaboration spaces:* • *What are the current arrangements with other academic networks for joint delivery of programmes.* • *What opportunities exist for sabbatical periods and for periods as a visiting professor in other countries?* • *Do faculty members participate in academic and professional organisations?* *Knowledge specific to educators and students:* • *What are the opportunities for student exchange provided within the School's programmes* • *Describe the opportunities for international project work provided within the School's programmes* • *How many external visiting professors engage in the School's activities?*
Strategic Approach is Communicated	*EQUIS (p.16):* *Online presence:* • *Describe the organization for the marketing and promotion of the School's activities with regards to digitalisation* • *What is the nature of the marketing strategies and operations with regards to digitalisation.* *- What communication channels are used?* *- How is the effectiveness of Marketing evaluated? With what result?*
Partnerships are Developed	
Infrastructure	
Physical and Virtual Learning Spaces	*EQUIS (p.58)* *How is the School innovating and exploring especially the online learning space?*
Digital Infrastructure is Planned for and Managed	*EQUIS (p.63/65):* • *Describe the virtual learning environment as well as digital tools used for learning* • *Describe the facilities available: hardware, software, intranet, learning management systems, open-access computer rooms, support services, user induction, training.* *- Are the computing facilities, whether on campus, outsourced or*

	virtual, adequate and are participants provided with adequate access outside normal working hours? • *Describe the educational facilities: auditoriums, classrooms, breakout rooms, individual workstations, social areas for students. - Are these facilities well equipped with educational support material: computer access, projection and amplifier systems, etc.? - How are these facilities shared between the different programmes?* • *Describe the virtual learning environment as well as digital tools used for learning* • *Describe the facilities available: hardware, software, intranet, learning management systems, open-access computer rooms, support services, user induction, training. - Are the computing facilities, whether on campus, outsourced or virtual, adequate and are participants provided with adequate access outside normal working hours? - What is the contribution of computing facilities and associated software to individual programme objectives? What specific knowledge, skills and qualities are developed using information technology and how do these match programme objectives?*
Sector Specific	
Sector-specific sub-element(s)	None
Supporting References	
Reference and Supporting Material	On-line link(s): www.efmdglobal.org
	Addendum(s):
Contact	
Contact Details for Further Information	Name: Christophe Terrasse
	Email: christophe.terrasse@efmdglobal.org
	Telephone:

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Addendums

Case Study Document Template

Case Title	Title
Institution	
Name of the Institution	(full name in the official registration)
Country	(county name)
Ownership	Public / Private
HEI / VET	Educational Organization
Type of Education	Formal, Informal and/or Non-formal
National Accreditation	No / Yes (please provide the name of accreditation authority)
International Accreditation	No / Yes (please provide the name of accreditation authority)
Typology	
Institutional Areas	Please select whether the case fits into the one or more of the following elements: (a) Digital Leadership and Governance Practices ☐ (b) Digital Collaboration and Networking ☐ (c) Digital Infrastructure ☐ (d) Sector Specific ☐
Leadership & Governance	
Digital-age Learning Set by the Mission, Vision and Strategy	The potential of Digital Learning Technologies is clearly flagged The benefits of digital learning technologies are communicated The Strategic Plan encompasses Mission and Vision of Digital-age Learning Open Education is an aspect of public engagement

Digital Strategy Reinforced by an Implementation Plan	Implementation Plan builds on enablers while addressing barriers Internal stakeholders have a degree of autonomy Opportunities, incentives and rewards for Staff acquiring Digital Competence and creating Digital Content are identified Digital-age Learning is aligned with broader priorities There are twin goals of modernising existing educational provision and offering new digital opportunities (i.e. Digital Content)
Digital Management and Governance Model in Place	There is a shared understanding of and commitment to the Implementation Plan Management responsibility is clearly assigned Resources are aligned with budgets and staffing The outcomes, quality and impact of the implementation plan are reviewed through a set of Performance Indicators Specific initiatives or pilots are evaluated Implementation status is Benchmarked Oversight of policy and direction is evident Management and Governance models assure for a Digitally-competent Educational Organization
Collaboration & Networking	
Networking, Sharing and Collaboration Promoted	Networked collaboration for Staff to pool expertise and share contents is the norm Knowledge exchange efforts are recognised Students engage in effective networking Participation in knowledge-exchange activities and events is promoted Internal collaboration and knowledge exchange are expected

Strategic Approach is Communicated	An explicit communication strategy is in place A dynamic online presence is evident
Partnerships are Developed	A commitment to knowledge exchange through partnerships is evident Staff and students are incentivised to be actively involved in partnerships
Infrastructure	
Physical and Virtual Learning Spaces	Physical Learning Spaces optimise the affordances of Digital-age Learning Virtual Learning Spaces are optimised
Digital Infrastructure is Planned for and Managed	An Acceptable Usage Policy is in place Pedagogical and technical expertise, and Whole of Life Cost Model direct Investments in Digital Technologies A range of Digital Learning Technologies supports anytime/anyplace learning Bring Your Own Device (BYOD) approaches are supported Risks relating to inequality and Digital Inclusion are addressed Technical and user support is evident Assistive Technologies address special needs Measures to protect privacy, confidentiality and safety are well established Integration and Effective use of technology is evident in procurement planning An operational plan for core ICT backbone and services are in place
Sector Specific	
Sector-specific sub-element(s)	Sector-specific descriptor(s)

Supporting References	
Reference and Supporting Material	On-line link(s)
	Addendum(s)
Contact	
Contact Details for Further Information	Name:
	Email:
	Telephone:

Terminology Descriptors

Acceptable Usage Policy	An Acceptable Usage Policy (AUP) is a document that outlines a set of rules to be followed by users or customers of a set of computing resources, which could be a computer network, website or large computer system. An AUP clearly states what the user is and is not allowed to do with these resources. Source: Techpedia
Assistive Technology	*Assistive technology* (AT) is a generic term used to refer to a group of software or hardware devices by which people with disabilities can access computers. They can be specially developed and marketed devices or off-the-shelf products that have been modified. Assistive technology can include devices such as alternate keyboards and mice, voice recognition software, monitor magnification software, multiple switch joysticks, and text-to-speech communication aids. Source: Webopedia
Benchmark	Standard, or a set of standards, used as a point of reference for evaluating performance or level of quality. Benchmarks may be drawn from an organization's own experience or from the experience of other organizations in the same field. Adapted from: Business Dictionary
Bring Your Own Device (BYOD)	BYOD reflects a pragmatic response to the reality that today's students are likely to have one or more internet-connected devices available to them for their exclusive personal use (smartphone, laptop, tablet). By allowing students to use such devices for study purposes during their attendance at school (or tertiary education institution), a one-to-one (one device per student) regime can be achieved without the need for the organization itself to make costly investments in similar devices.
Digital Capacity Implementation Plan	Some refer to plans like this as 'Digital Learning Strategy', eLearning Strategy' etc. But the main message here is that (i) there should be such a plan; and (ii) that is should be clear where it fits into the wider institutional context.
Digital Competence	Digital Competence can be broadly defined as the confident, critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society. Source: DigComp Framework
Digital Content	Digital content is a 'catch all' term that encompasses text-based and audio-visual resources (now in digital format) and interactive media (games/mobile apps, simulations, visualizations).
Digital Inclusion	Refers to an individual's effective and sustainable engagement with Information and Communication Technologies (ICT) in ways that allow full participation in society in terms of economic, social, cultural, civic and personal well-being. A digitally inclusive society is therefore one in which all individuals, independent of their socio-cultural and socio- economic background, have equal opportunities to engage with ICT in such a way that a trend for increasing social inequality is halted if not reversed. Adapted from: Digital Inclusion in Europe: Evaluating Policy and Practice.

Digital Learning Technologies	Refers to the expanding range of standalone and internet enabled devices used by teachers and/or by students in the course of their everyday teaching/learning practices, and includes the enabling software, platforms and services. *Devices* include computers, laptops, tablets, smartphones, cameras, wearables, projectors, smartboards, 2D, 3D printers, scanners and other peripherals. *Software* includes general, specialist and education-specific applications, games, 'apps' and tools generally (task-oriented and for communication). *Platforms* include VLE/LMS (Virtual Learning Environments/Learning Management Systems), social media, web portals and repositories. *Services* include broadband internet connectivity, security (passwords, privacy) and file storage and management. Synonyms: Educational Technology, ICT and education, Technology Enhanced Learning (TEL)
Digital-age Learning	Digital-age learning (or Learning for a Digital Age) acknowledges that, almost without exception, life, work, study and leisure take place for all citizens today in a pervasive, highly internet-connected and digitally mediated world. Learning *in* and *for* this digital age represents a new challenge for educators and their students.
Digitally-competent Educational Organization	Refers to the effective use of digital technology by the educational organization and its staff in order to provide a compelling student experience and to realize a good return on investment in digital technology. Adapted from: Jisc, Digital Capability Initiative.
Educational Organization	The term has multiple meanings according to the settings in which is being applied and often it is used interchangeably with the term 'educational institution' (e.g. European Commission, 2013b). In the context of the DigiCompEdu study the term *educational organization* refers primarily to primary, secondary and VET schools as well as higher education institutions such as Universities, University Colleges and Polytechnics
Formal, Informal & Non-formal Learning	*Formal* is the learning that occurs in an organized and structured environment (in an education or training institution or on the job) and is explicitly designated as learning (in terms of objectives, time or resources). Formal learning is intentional from the learner's point of view. It typically leads to validation and certification. *Informal* is the learning resulting from daily activities related to work, family or leisure. It is not organized or structured in terms of objectives, time or learning support. Informal learning is in most cases unintentional from the learner's perspective. Informal learning outcomes do not usually lead to certification but may be validated and certified in the framework of recognition of prior learning schemes. Informal learning is also referred to as experiential or incidental/random learning. *Non-formal* is the learning which is embedded in planned activities not explicitly designated as learning (in terms of learning objectives, learning time or learning support). Non-formal learning is intentional from the learner's point of view. Non-formal learning outcomes may be validated and lead to certification. Non-formal learning is sometimes described as semi-structured learning. Source: Cedefop
Governance	Concerns the structures, functions, processes, and organizational traditions that have been put in place to ensure that the organization is run in such a way that it achieves its objectives in an effective and transparent manner. It is the framework of accountability to users, stakeholders and the wider community. Adapted from: World Bank
ICT	See: Digital Technologies

Integration and Effective Use of Digital Learning Technologies	The term *integration* is used to describe the use of digital learning technologies in a 'natural' and widespread way within and beyond the organization boundaries for achieving its core mission and vision for a quality education. The term *effective* refers to the production of planned, desired and decisive effects by the use of digital learning technologies, for example, the ability to define and achieve more comprehensive learning outcomes that might be otherwise difficult to achieve or even unattainable without the technologies in question.
Learning Spaces	Our understanding of learning spaces has broadened considerably in recent years. Students increasingly make use of connected digital technologies, and do so inside and outside traditional classroom, studio, workshop, laboratory or library environments. Consideration of learning spaces spans the built environment and the online environment in which students now study and the learning and pedagogical theories that underpin a diversity of practice. Adapted from: Educause
Management	Concerns day-to-day operations within the context of the strategies, policies, processes, and procedures that have been established by the governing body. Whereas governance is concerned with "doing the right thing," management is concerned with "doing things right. Adapted from: World Bank
Mission	A Mission statement: defines the present state or purpose of an organization and answers three questions about why an organization exists: WHAT it does; WHO it does it for; and HOW it does what it does. Source: Psychology Today. Vision and Mission - What's the difference and why does it matter?
Open Education	The term 'Open Education' has several interpretations. Openness can refer to widening access to educational opportunities and educational resources (particularly for under-represented, disadvantaged, or marginalized groups). Increasing flexibility in terms of the time, place and pace of study is also a defining characteristic of openness, aligned with ambitions to provide more personalized/individualized curricula and study options (including flexible, online education and/or more personalized / open/ customized learning support for students through use of learning analytics).
Open Educational Resources	Teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Source definition: UNESCO
Performance Indicators	Performance indicator refers to the means by which an objective can be judged to have been achieved or not achieved. Indicators are therefore tied to goals and objectives and serve simply as 'yardsticks' by which to measure the degree of success in goal achievement. Performance indicators are quantitative tools and are usually expressed as a rate, ratio or percentage. Source: EQAVET
Staff	Refers to staff in all categories, involved directly or indirectly in formal educational settings. Job titles include, 'teacher', 'tutor', 'academic', 'lecturer', 'faculty', 'trainer', 'mentor', 'coach' and also include support roles such as 'librarian', 'ICT support', 'eLearning support' and those in management/leadership roles, 'principals', and 'rectors'.
Students	Refers to persons of any age who are engaged in a formal educational process (course or program). Students are often referred to as 'learners', although this term is potentially broader, as it can refer to learning in both formal and informal settings.

Strategic Plan	Strategic planning is an organizational management activity that is used to set priorities, focus energy and resources, strengthen operations, ensure that employees and other stakeholders are working toward common goals, establish agreement around intended outcomes/results, and assess and adjust the organization's direction in response to a changing environment. A *strategic plan* is a document used to communicate with the organization the organizations goals, the actions needed to achieve those goals and all of the other critical elements developed during the planning exercise. Source: Balanced Scorecard Institute
Vision	Vision defines the optimal desired future state - the mental picture - of what an organization wants to achieve over time; It provides guidance and inspiration as to what an organization is focused on achieving in five, ten, or more years. Source: Psychology Today. Vision and Mission - What's the difference and why does it matter?
Whole of Life Cost Model	This is also referred to as a *life cycle cost model* or a *total cost of ownership model*. As regards investments in ICT, such models take account of all expenditures that will be required for as long as the particular item of equipment is in service, including maintenance costs and the costs of essential licenses.