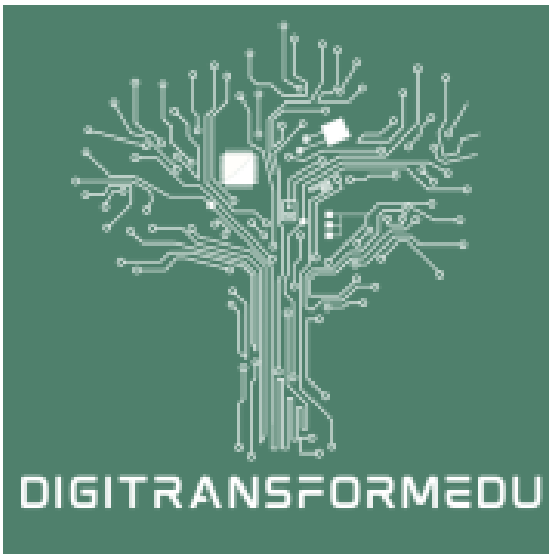
Co-funded by the
Erasmus+ Programme
of the European Union



Report

R3: Concepts, case studies, best practices, and blueprint for the strategical approach to digitalisation

A1: Analysis and presentation of the existing digital transformation concepts

Authors:

Ivana Ogrizek Biškupić, Algebra University College

Goran Radman, Algebra University College

December 2022

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

Contents

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

FOREWORD

This Report represents Project Result 3 (R3), Activity 1 (A1), 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.

R3 refers to: **Concepts, case studies, best practices, and blueprint for the strategical approach to digitalisation**. The ultimate scope of R3 is 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 will be 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 will focus 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 will centre 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 will be in the form of a report.

This Report refers to the R3 in general and R3/A1 subject in particular.

The other R3 related and following Activities are:

R3/A2: Exploring the institutional approach to digital strategy

R3/A3: Collection of best practices and development of case studies

R3/A4: Blueprint for digital transformation strategy in education

1 INTRODUCTION

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 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).

[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

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.

2 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 taking into account before the actual process of considering 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.

2.1 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

2.2 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.

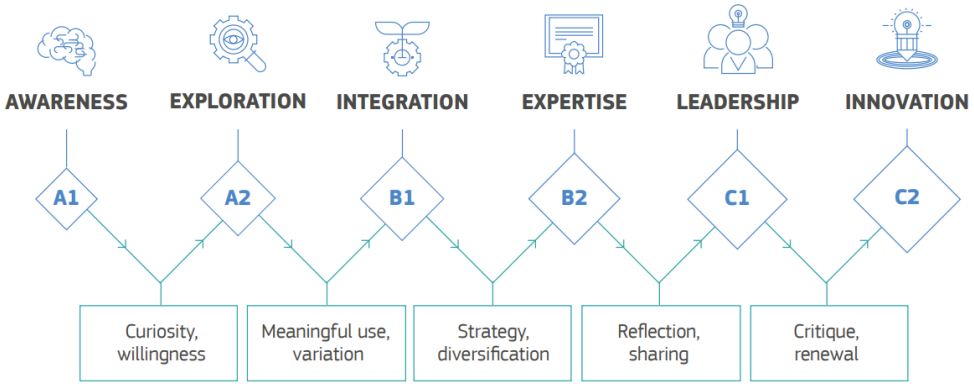


Figure 1: Educators' competence Progression model (DigCompEdu 2017, p. 29)

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.

2.3 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.

3 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.

3.1 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".

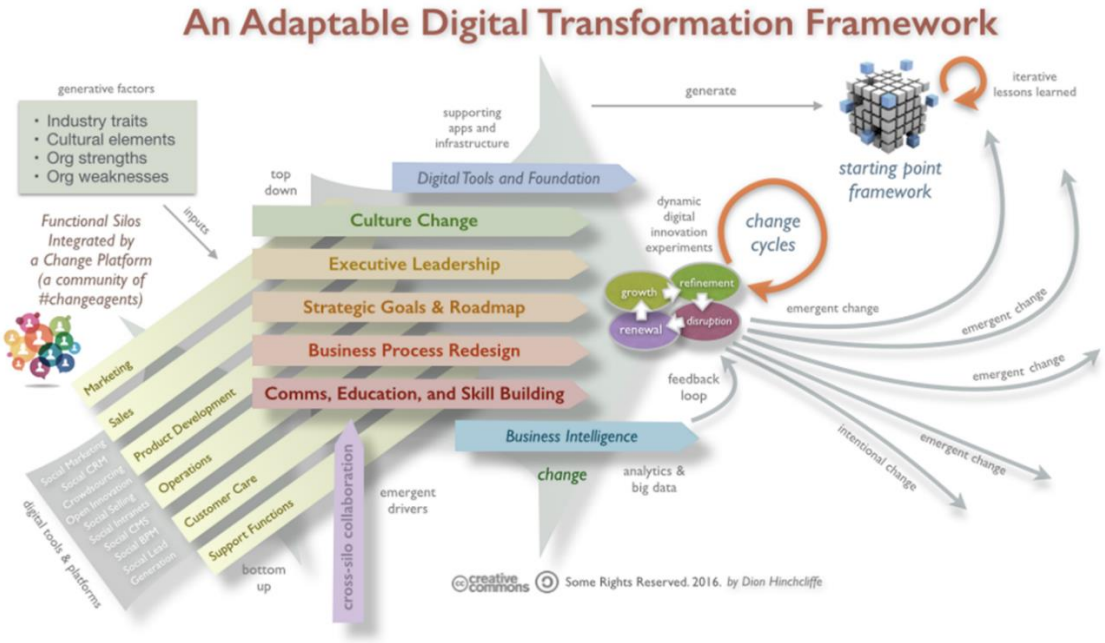


Figure 2: An adaptable digital transformation framework (Hinchcliffe, 2016)

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.

3.2 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.

3.3 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	**Basic** Some common project	**Progressing** Projects are managed through a	**Developing** Agile project management	**Impactful** Agile principles of digital project

	done differently for different projects.	management principles are used.	structured but often lengthy process.	principles and practice are used. There is a launch, test and improve approach.	management are consistently used in all projects to improve efficiency and increase impact.
Technology	**Primitive** Systems are limited in scope and aren't integrated. They may be insecure.	**Outdated** Systems aren't keeping up with the needs of the organisation.	**Keeping up** Systems are stable and enable basic operations.	**Effective** Tools and systems are delivering improvements in effectiveness.	**Leading edge** 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:

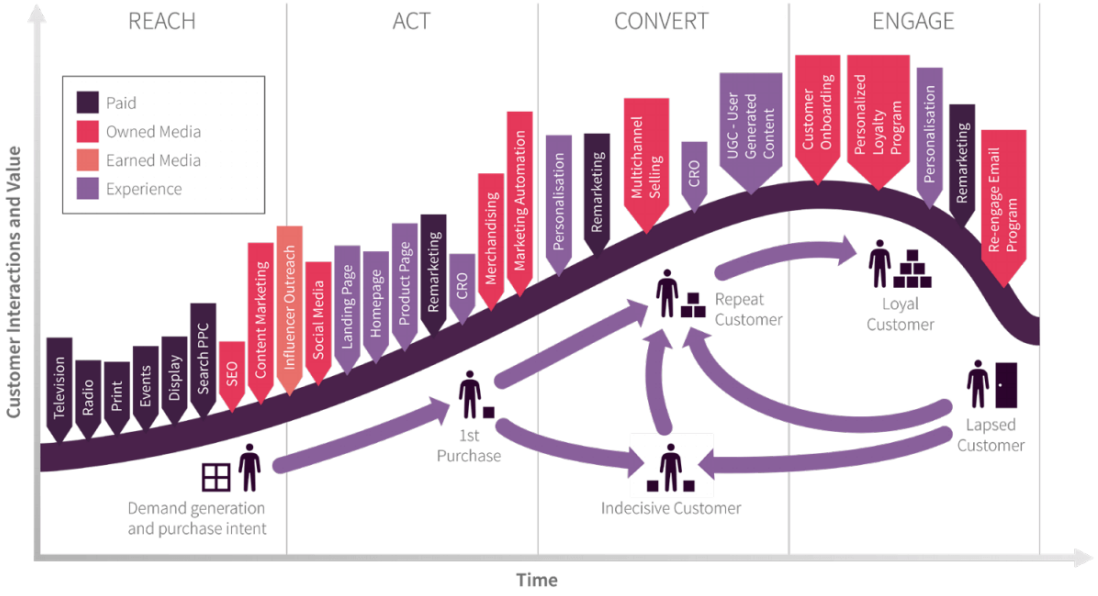


Figure 5: Digital customer omnichannel journey model ([E-commerce customer lifecycle)]

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.

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

Table 1: Evolution of digital transformation models and frameworks in business

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.

A) 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

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

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

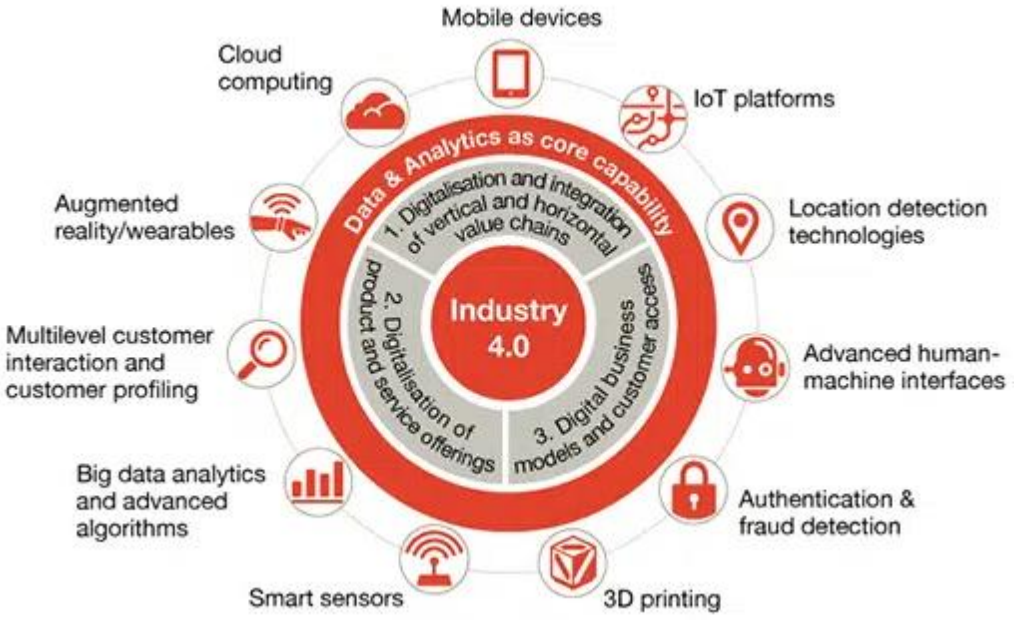


Figure 6: Building the digital enterprise (PwC, 2016)

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.

B) 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.

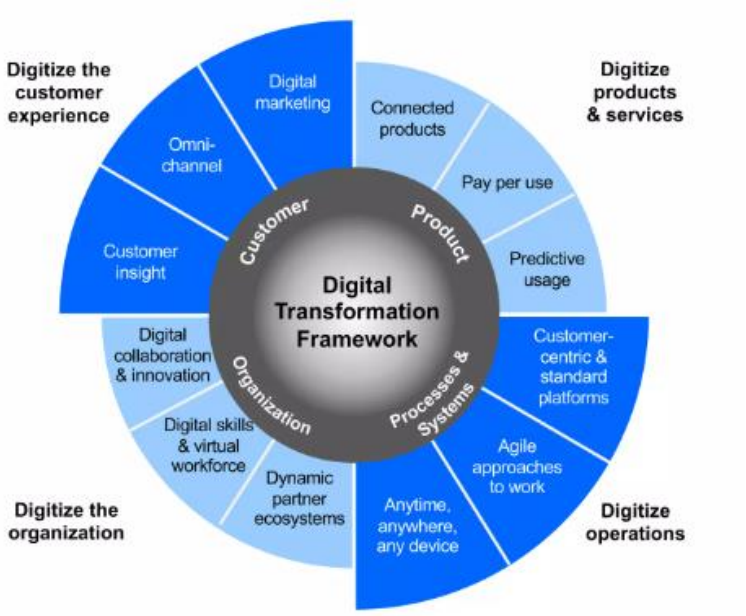


Figure 7: Cognizant's Digital Transformation Framework (Cognizant, 2014)

C) 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.

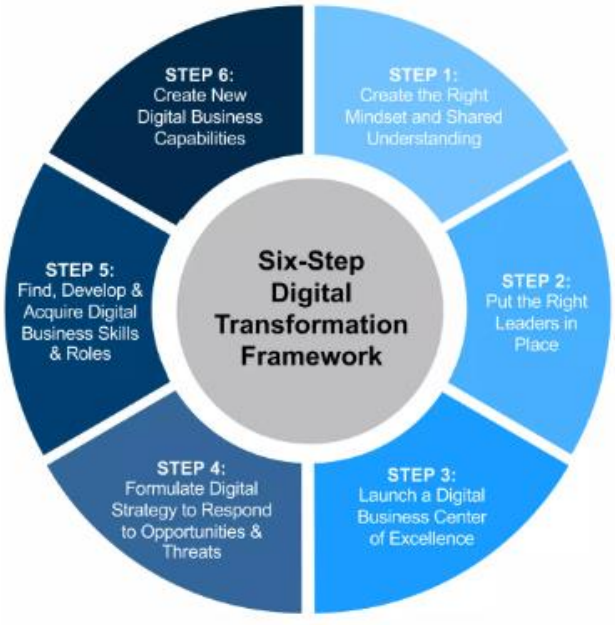


Figure 8: Gartner's Digital Transformation Framework

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.

D) 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)

E) 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).

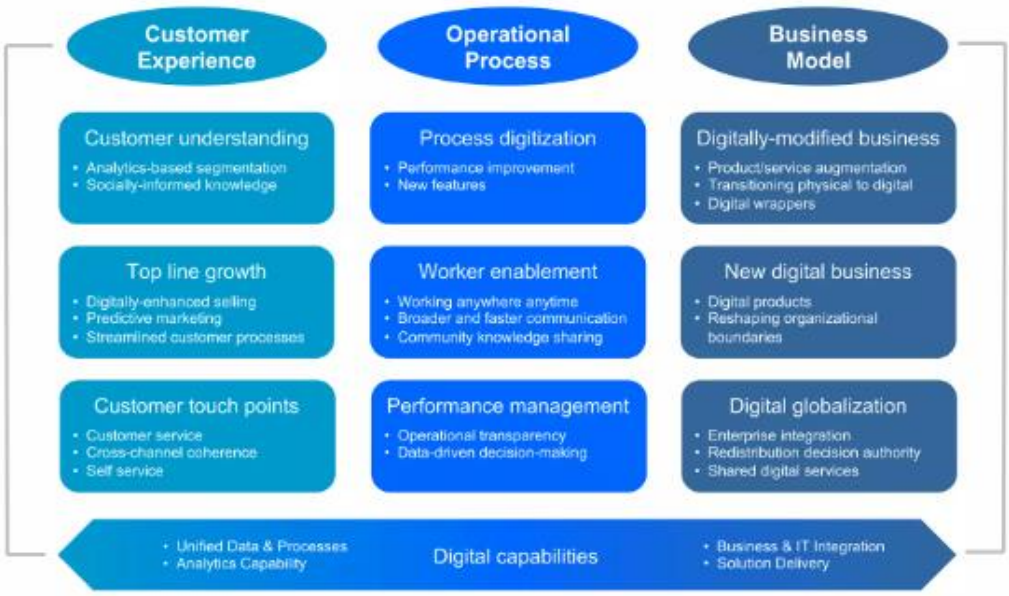


Figure 10: Capgemini DT Framework (CG & MIT Centre for Digital Business, 2011)

F) 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)

G) 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).

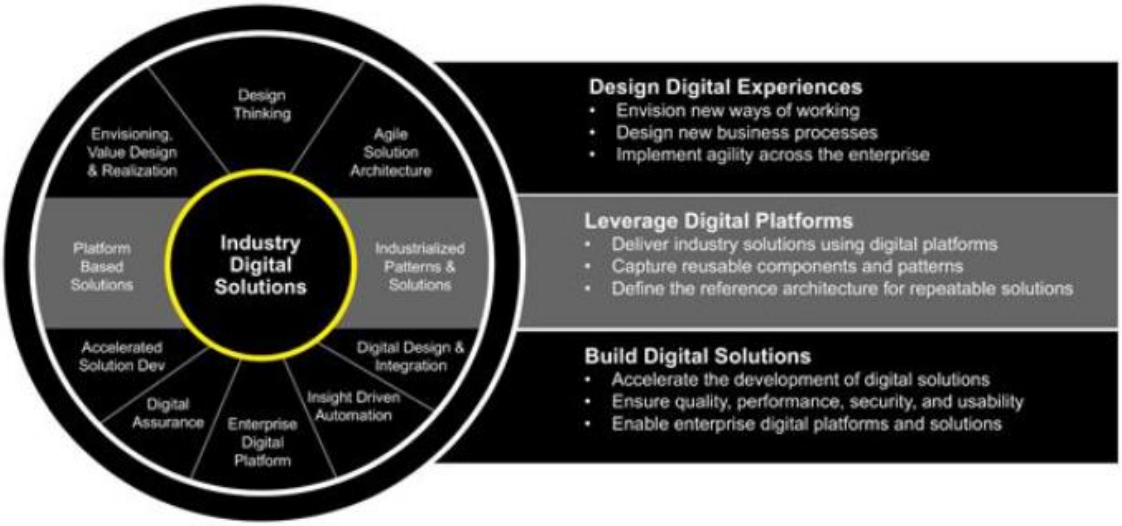


Figure 12: DXC's Digital Transformation Framework (DXC, 2017)

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.

4 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.

4.1 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).

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)

Table 2: Selection of digital (transformation) university strategy documents

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.

4.2 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.

5 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).

6 REFERENCES

6.1 List of Figures

6.2 List of Tables

6.3 List of Literature References

1. Abraham, C. and Junglas, I. (2011) 'From cacophony to harmony: A case study about the IS implementation process as an opportunity for organizational transformation at Sentara Healthcare', Journal of Strategic Information Systems, 20(2). doi: 10.1016/j.jsis.2011.03.005.

2. Alenezi, M. (2021). "Deep Dive into Digital Transformation in Higher Education Institutions". *Educational Science*, vol 11, pp. 770

3. Ash, J., Kitchin, R. and Leszczynski, A. (2018) 'Digital turn, digital geographies?', *Progress in Human Geography*, 42(1). doi: 10.1177/0309132516664800.

4. Bailey, Allison; Vaduganathan, Nithya; Henry, Tyce; Laverdiere, Renee; Pugliese, Lou (2018). Making digital learning work: success strategies from six leading universities and community colleges. P. 53 Boston, Massachusetts: Boston Consulting Group

5. Bendik Bygstad; Egil Øvrelid; Sten Ludvigsen; Morten Dæhlen (2022). From dual digitalization to digital learning space: Exploring the digital transformation of higher education. Computers & Education, Volume 182, June 2022, 104463, https://doi.org/10.1016/j.compedu.2022.104463

6. Berghaus, S. and Back, A. (2016) 'Stages in Digital Business Transformation: Results of an Empirical Maturity Study', Mediterranean Conference on Information Systems (MCIS), (Paper 22).
7. Bharadwaj, A., el Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. MIS Quarterly: Management Information Systems, 37(2). https://doi.org/10.25300/MISQ/2013/37:2.3

8. Bygstad, E. Øvrelid, S. (2021) Managing two-speed innovation for digital transformation. CENTERIS - Inernational Conference on Project MANagement / HCist - International Confer. Procedia Computer Science 181 (2021) 119–126 https://doi.org/10.1016/j.procs.2021.01.111

9. Bygstad, E. Øvrelid, S. Ludvigsen, M. Dæhlen (2022). "From dual digitalization to digital learning space: Exploring the digital transformation of higher education". *Computers & Education.* vol. 182

10. Chanias, S. and Hess, T. (2016) 'How digital are we? Maturity models for the assessment of a company's status in the digital transformation', LMU Munich.

11. Constantinides, P., Henfridsson, O. and Parker, G. G. (2018) 'Introduction - Platforms and Infrastructures in the Digital Age - Semantic Scholar', Information Systems Research, 29(2).

12. Council Recommendation of 29 November 2021 on blended learning approaches for high-quality and inclusive primary and secondary education 2021/C 504/03, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021H1214(01)&from=EN, Official Journal of the European Union, 14.12.2021

13. Davenport, T. H. (2018) 'The AI Advantage How to Put the Artificial Intelligence Revolution to Work (Management on the Cutting Edge)', Information Research, 24(1).

14. Elwood, S. and Leszczynski, A. (2018) 'Feminist digital geographies', Gender, Place and Culture, 25(5). doi: 10.1080/0966369X.2018.1465396.

15. EU Science HUB, The Digital Competence Framework 2.0 https://joint-research-centre.ec.europa.eu/digcomp/digital-competence-framework_en

16. European Commission, Digital Education Plan (2021-2027) https://education.ec.europa.eu/focus-topics/digital-education/about/digital-education-action-plan

17. European Commission, European Skills Agenda: Communication on a European Skills Agenda for sustainable competitiveness, social fairness and resilience https://ec.europa.eu/social/BlobServlet?docId=22832&langId=en 2020

18. European Commission (2021). European Pillar of Social Rights Action Plan https://op.europa.eu/webpub/empl/european-pillar-of-social-rights/en/

19. Gafurov, I.R.; Safiullin, M.R.; Akhmetshin, E. M.; Gapsalamov, A.R.; Vasilev, V.L. (2020). "Change of the higher education paradigm in the context of digital transformation: From resource management to access control," *International Journal of Higher Education*, vol. 9, pp. 71–85

20. Geschke, M. (2017) The 5 Stages of Digital Transformation Maturity in Mid-Sized Businesses (no date). Available at: https://www.xuviate.com/5-stages-of-digital-transformation-maturity-in-mid-sized-businesses/ (Accessed: 16 February 2022).

21. Ghemawat; Pankaj (2017) Strategies for Higher Education in the Digital Age, California Management Review, https://doi.org/10.1177/0008125617717706 , Volume: 59 issue: 4, pages: 56-78

22. Gieseking, J. J. (2019) 'Digital', Keywords in Radical Geography: Antipode at 50, pp. 85–89. doi: 10.1002/9781119558071.CH15.

23. Holmström, J. (2021). From AI to digital transformation: The AI readiness framework. Business Horizons. https://doi.org/10.1016/j.bushor.2021.03.006

24. Jackson, N.C. (2019). "Managing for competency with innovation change in higher education: Examining the pitfalls and pivots of digital transformation". *Business Horizons*, vol. 62, pp. 761–772.

25. Kampylis, P., Punie, Y. & Devine, J. (2015). Promoting Effective Digital-Age Learning - A European Framework for Digitally-Competent Educational Organisations; JRC Science for policy report; EUR 27599 EN; doi:10.2791/54070, European Commission, Publications Office of the European Union, Luxembourg

26. Kane, G. C. et al. (2015) 'Strategy , not Technology, Drives Digital Transformation Becoming a digitally mature enterprise', Sloan Management Review, (57181).

27. Kergerl, D.; Heidkamp-Kergel, B.; Arnett, R.; Macino, S. (2020). *Communication and Learning in an age of Digital Transformation*. Routledge

28. Krčo, S.; R. van Kranenburg, M.; Lončar, X.; Ziouvelou, F.; McGroarty (2019). "Digitization of Value Chains and Ecosystems" in *Digital Business. Models Driving Transformation and Innovation* (A. Aagaard ed.). pp.81-116. Palgrave Macmillan

29. Kučina Softić, Sandra; Odak, Marko; Lasić Lazić, Jadranka (2021). Digitalna transformacija, novi pristupi i izazovi u obrazovanju. Sveučilište Sjever, Centar za digitalno nakladništvo, e-ISBN 978-953-7986-38-4, Koprivnica (scientific monograph)

30. Marek, D.; Rak, D.; Bell, B. (2021) Digital transformation readiness: perspectives on academia and library outcomes in information literacy. Volume 47, Issue 5, September 2021, 102403 https://doi.org/10.1016/j.acalib.2021.102403

31. Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. Business and Information Systems Engineering, 57(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

32. McGrath, R.; McManus, R. (2020). "Discovery-driven planning". *Harvard Business Review.*

33. McKinsey & Company, accessed 10 February, 2022. Retrieved from https://www.mckinsey.com/business-functions/mckinsey-digital/how-we-help-clients

34. McKinsey & Company (2015). Raising your Digital Quotient.

35. M.E. Auer, Tsiatsos, T. (2018) The Challenges of the Digital Transformation in Education, Springer

36. Meeteren van, M.; Trincado-Munoz, F.; Rubin, T. H.; Vorley (2022) Rethinking the digital transformation in knowledge-intensive services: A technology space analysis. Technological Forecasting & Social Change 179 121631 https://doi.org/10.1016/j.techfore.2022.121631

37. Mehndiratta, M. (2018) 'Overcoming The Challenges Of A Digital Transformation', IEEE Software, 35(4).

38. Menshikova, M.; Fedorova, A.; Gatti, M. (2020). Introducing Smart-Working in the Conditions of Digital Business Transformation: Analysis of an Employee's Experience., Digital Transformation and New Challenges, Lecture Notes in Information Systems and Organisation 40 (E. Zaramenskikh, A. Fedorova (eds.). Springer

39. Michael Gaebel; Thérèse Zhang; Luisa Bunescu; Henriette Stoeber (2018). Trends 2018 Learning and teaching in the European Higher Education Area. EUA European University Association, ISBN 9789078997658, Geneva, Switzerland

40. Mohamed, Ashmel; Mohamed, Hashim;· Issam Tlemsani; · Robin Matthews (2021) Higher education strategy in digital transformation. Education and Information Technologies, https://doi.org/10.1007/s10639-021-10739-1 Springer

41. Oberc, H.; Kuhlenkötter, B. (2020) Methodology for the development of transformation concepts for digital challenges in the production site. 10th Conference on Learning Factories, CLF2020, Procedia Manufacturing 45 (2020) 485–490 https://doi.org/10.1016/j.promfg.2020.04.060

42. Ogrizek Biškupić, Ivana (2022) Digital strategies in Higher Education – from digital competences to Digital Transformation // EduLearn22 14th annual International Conference on Education and New Learning Technologies. The International Academy of Technology, Education and Development IATED Palma de Mallorca (Spain) 4th- 6th July, 2022., pp. 8675-8684 doi:10.21125/edulearn.2022

43. Ogrizek Biškupić, Ivana; Banek Zorica, Mihaela; Šiber Makar, Katarina (2022) Digital Transformation of Higher Education Institutions - Applying models from Enterprises // EduLearn22 14th annual International Conference on Education and New Learning Technologies.

The International Academy of Technology, Education and Development IATED Palma de Mallorca (Spain) 4th- 6th July, 2022., pp. 7223-7232 doi:10.21125/edulearn.2022

44. Redecker, C. (2017) European Framework for the Digital Competence of Educators: DigCompEdu. Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, ISBN 978-92-79-73494-6, doi:10.2760/159770, JRC107466, Luxembourg

45. Reimers, Fernando M.; Schleicher, Andreas; Ansah, Grace A. (2022) Schooling disrupted, schooling rethought How the Covid-19 pandemic is changing education, https://read.oecd-ilibrary.org/view/?ref=133_133390-1rtuknc0hi&title=Schooling-disrupted-schooling-rethought-How-the-Covid-19-pandemic-is-changing-education, OECD

46. Rof, A.; Bikfalvi, P. Marquès (2020). "Digital Transformation for Business Model Innovation in Higher Education: Overcoming the Tensions". *Sustainability*, vol. *12*, pp. 4980

47. Rogers, D. L. (2016) The Digital Transformation Playbook, The Digital Transformation Playbook. doi: 10.7312/roge17544.

48. Rouse, W. B. (2005) 'A theory of enterprise transformation', Systems Engineering, 8(4). doi: 10.1002/sys.20035.

49. Sanchez, M. A. (2017) 'Framework to assess organizational readiness for digital transformation', Dimensión Empresarial, 15(2). doi: 10.15665/rde.v15i2.976

50. Scuotto, D.; Magni, R.; Palladino, M.; Nicotra. (2022). "Triggering disruptive technology absorptive capacity by CIOs. Explorative research on a micro-foundation lens*". Technological Forecasting and Social Change*, vol. 174, 121234

51. Shaughnessy, H. (2018) Creating digital transformation: Strategies and steps. Strategy and Leadership, 46(2), 19–25. https://doi.org/10.1108/SL-12-2017-0126

52. Skov, Anders (2016) What is Digital Competence? Center for Digital Dannelse, https://digital-competence.eu/dc/front/what-is-digital-competence/

53. Sofronijevic, A., Milicevic, V. and Ilic, B. (2017) 'Strategic approach to digital transformation of business', Tehnika, 72(2). doi: 10.5937/tehnika1702273s.

54. Solis, B. and Szymanski, J. (2016) 'The 2016 State of digital Transformation', Alitmeter @Prophet.

55. Spremić, M. (2017) 'Governing digital technology – how mature IT governance can help in digital transformation?', International Journal of Economics and Management Systems, 2.

56. Sydow, J., Schreyögg, G. and Koch, J. (2020) 'On the theory of organizational path dependence: Clarifications, replies to objections, and extensions', Academy of Management Review, 45(4). doi: 10.5465/AMR.2020.0163.

57. *The best digital transformation frameworks in 2020*. (n.d.). Retrieved November 2, 2022, from https://www.slideshare.net/run_frictionless/the-best-digital-transformation-frameworks-in-2020

58. Tancini, F. et al. (2012) 'Digital Business Transformation: A Conceptual Framework', European Journal of Organic Chemistry, (14).

59. Tommaso, F. Federico, S. Frattini, M. Soncin (2020) "Digital Innovation in Times of Emergency: Reactions from a School of Management in Italy" in *Sustainability*, vol. 12(24), pp. 1-17

60. Verhoef, P. C. et al. (2021) 'Digital transformation: A multidisciplinary reflection and research agenda', Journal of Business Research, 122. doi: 10.1016/j.jbusres.2019.09.022.

61. Vial, G. (2019) 'Understanding digital transformation: A review and a research agenda', *The Journal of Strategic Information Systems*, 28(2), pp. 118–144. doi: 10.1016/J.JSIS.2019.01.003.

62. Vuorikari, R., Kluzer, S. and Punie, Y. (2022) DigComp 2.2: The Digital Competence Framework for Citizens, EUR 31006 EN, Publications Office of the European Union, ISBN 978-92-76-48882-8, doi:10.2760/115376, JRC128415, Luxembourg

63. Zaramenskikh, E.; Fedorova, A. (2020). *Digital Transformation and New Challenges*. Springer

64. Wessel, L. et al. (2021) 'Unpacking the difference between digital transformation and it-enabled organizational transformation', Journal of the Association for Information Systems, 22(1). doi: 10.17705/1jais.00655.