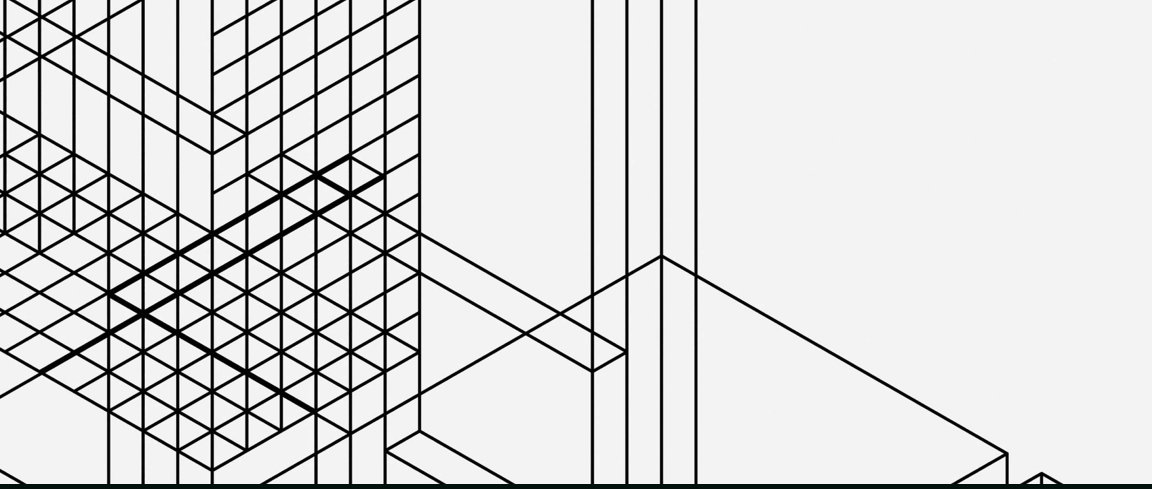

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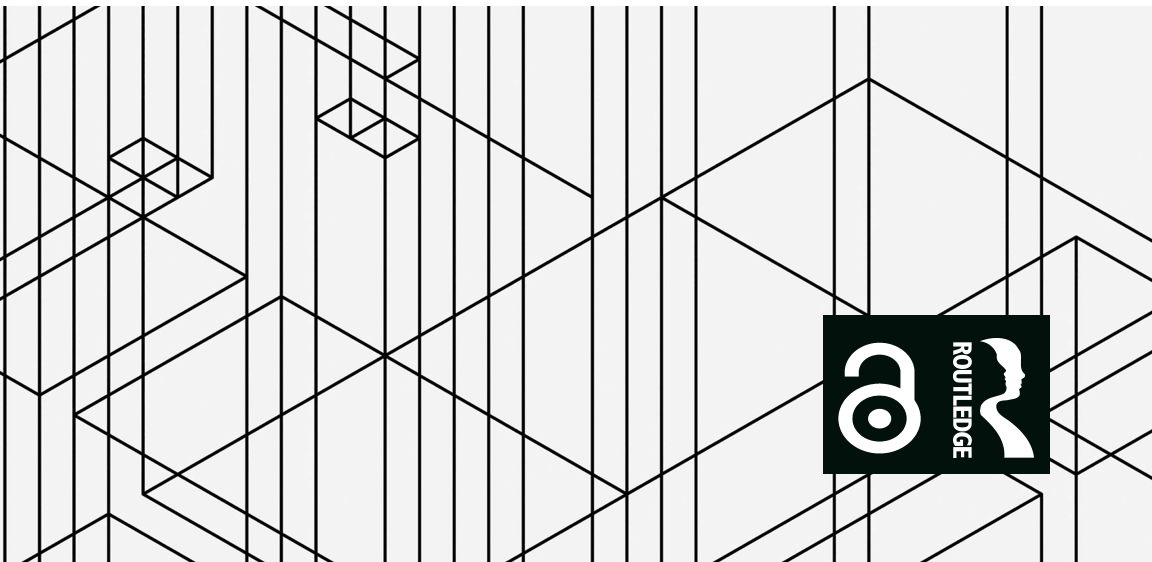
DIGITAL TRANSFORMATION IN EDUCATIONAL ORGANISATIONS

LEADERSHIP, INNOVATION AND INDUSTRY 4.0

Paweł Poszytek



Digital Transformation in Educational Organisations

Technological transformation should enhance people's potential and the development of their social competences, especially those connected with effective communication on different levels. The COVID-19 pandemic has intensified all these processes, and for better resilience and effectiveness at work, it now requires different sets of competences. This book gives direct insight into changes that take place in education in the context of an unprecedented and rapid technological advancement, which requires the reorientation of goals and functions based on innovative, adaptive and flexible solutions – in most cases driven by individual leadership. It describes the way to reach this reorientation and shows through thorough research how educational leaders position themselves in this way in this fast-changing ecosystem. Exploring how educational leaders manage the challenges of digital transformation, using European collaborative projects, this research volume discusses how this process impacts the effectiveness and sustainability of organisational activities. Establishing a model for assessing digital transformation in educational organisations and evaluating the effectiveness of their leaders will be of value to researchers, academics, practitioners and advanced students in the fields of leadership, organisational change, management of technology and innovation and those interested in the development of education and the utilisation of digitalisation.

Paweł Poszytek is an associate professor of WSB University and a visiting scholar at Stanford University at the time of its volume's release. He has also been a member of various advisory and consultative groups to the European Commission for many years.

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Digital Transformation in Educational Organisations

Leadership, Innovation and Industry 4.0

Paweł Poszytek

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Introduction

The publication presents a theoretical and practical approach to assess how well educational leaders handle the challenges of the digital transformation era by using European collaborative projects. It investigates the impact of this process on the effectiveness and sustainability of their organisational activities. The study is based on a review of conceptual and empirical work on the relational and network paradigms in management and competences 4.0. In addition, the theoretical part of this study lays the groundwork for formulating the concept of paradigm 4.0 in education, and finally, the research part helps in fine-tuning this concept in the light of the research.

The entire study is based on two distinct research components. The first research focuses on Erasmus+ project leaders, representing various sectors such as public universities, schools, private companies, NGOs and associations engaged in international innovative projects. These organisations work towards developing competences for diverse target groups, including pupils, students, young workers and adults. By the definition, this group constitutes the cohort of educational leaders implementing innovations into the system. The second research concentrates on a specific sub-group of this group, namely, higher education leaders participating in the European Universities Initiative. This initiative holds significant importance and priority for the European Commission, aiming to transform the European Higher Education Area from both innovative and digital perspectives. The European University Initiative aims to foster collaboration among higher education institutions in Europe, with the primary goals of promoting excellence, innovation, and, most importantly, digital transformation in teaching, research and administration. It should be noted that in this study, educational leaders are not only understood from an individual perspective, such as project coordinators driving organisational change, but also from an institutional viewpoint. These leaders represent innovative organisations that effectively undergo a complete digital transformation, becoming full-fledged digitally transformed institutions, often referred to as organisations 4.0. The innovative

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projects coordinated and carried out by these individuals meet all the criteria of temporary organisations, serving as the foundation for further permanent organisational changes within their respective institutions. According to Packendorff (1995:326), a comprehensive definition of temporary organisations describes them as consortia of international, institutional partners of different organisational types, collaborating for a specific period of time to achieve certain goals or develop specific products. This kind of cooperation allows them to share experience, learn and expand their institutional capacities. It is also highly interesting to observe how this entire group of leaders has coped, particularly during COVID-19 and the post-pandemic period, which has necessitated and accelerated digital advancements in organisations to a significant extent.

The second research is focused on an elite group of leaders actively involved in activities within the European Universities Initiative. Their aim is not only to develop innovative methods and solutions for international cooperation between European universities in teaching and research areas, often using digital tools, but also to reform universities as organisations by implementing digital solutions. Thus, once again, by definition, this group of educational leaders represents a pertinent and critical target for the research, not only from an individual perspective but also from an institutional point of view. Apart from diagnostic character of this research, there is also a comparative element included in it which also looks at this phenomenon from an American perspective.

Both of the mentioned research activities serve mainly as diagnostic tools, assessing the progress of digital transformation and the effectiveness of this process, which indicates the level of digital maturity achieved.

The first research evaluates the competences 4.0 of educational leaders, particularly focusing on digital competences, and examines to what extent these competences facilitate the realisation, management and sustainability of Erasmus+ projects during the COVID-19 pandemic. Accordingly, the research questions at this stage are as follows:

- What are the levels of digital competences among Erasmus+ project leaders?
- Which competences 4.0 facilitate the management of Erasmus+ projects during the COVID-19 pandemic?
- How does the learning potential of educational leaders influence the effective management of Erasmus+ projects during the COVID-19 pandemic?

The main objective of the second research activity is to diagnose the level of advancement of digital transformation of universities affiliated with the European Universities alliances and also to compare this level of advancement

to selected American universities. The study is based on the underlying assumption that progressive digital transformation towards Education 4.0 (Morańska, Ciesielska and Jędrzejko 2021) is built upon four interrelated pillars:

- Mature use of new digital technologies both in the teaching process and in the area of academic research and administrative service
- Personalisation of the knowledge and skills imparted and adaptation of educational services to the individual needs of the student
- Responsible data collection and analysis (including digital data)
- The readiness of teaching, academic and administrative staff to work with smart technology solutions.

In addition, the study aims to examine the extent to which the surveyed universities are addressing the challenges of developing Education 4.0, as identified by the World Economic Forum, i.e.:

1 Preparation of content tailored to the adaptation needs and to the development of social competences (transformative competences, i.e. innovative thinking, ability to solve tensions and dilemmas and readiness to take responsibility for one's own actions)
2 Preparing students for gaining experience during their education (personalisation of learning, inclusive learning, problem-based learning, lifelong learning).

The study also demonstrates how the digital transformation, which clearly accelerated during the COVID-19 pandemic, has changed the way universities operate in the areas of teaching, academic research and administration. As a result, it brings the educational model of universities closer to the Education 4.0 paradigm.

As a point of reference for the analysis of the digitalisation of universities, it is worthwhile to draw on the assumptions of a parallel digital transformation in the industrial sector. To some extent, the management system, strategy and overall development of a university can be approached similarly to a well-functioning enterprise. In the industrial sector, we can observe an accelerating development of companies towards Industry 4.0, characterised by intelligent manufacturing, advanced use of digital technologies and big data analytics. This transformation leads to increased productivity, flexibility and agility within the company.

The study carried out at universities aims to demonstrate whether similar solutions are also implemented in the education sector and, if so, in which areas and to what extent. The development of companies towards Industry 4.0 is based on five pillars as the main areas of change. These are:

1) management model, 2) strategy, 3) human capital, 4) infrastructure and 5) product. Similarly, the elements identified in the digital transformation model of companies can be successfully highlighted in the case of university operations – each of the mentioned areas of technological evolution of companies has its counterpart in the educational ecosystem.

Accordingly, the research questions in this second part of the study are as follows:

- How do universities within the European Universities Initiative digitally transform?
- How do universities within the European Universities Initiative compare to American examples?

And finally, taking into consideration both research activities, the main research question is:

- How digitally mature are educational leaders included in the research?

To sum up, the main purpose of the study is to develop a model against which the assessment of digital transformation in educational organisations can be carried out on the one hand, and the effectiveness of their leaders can be evaluated on the other hand. As stated before, digital maturity depends on digital transformation but is not necessarily the immediate result of this transformation; maturity means both implementation and effectiveness. Consequently, the main aim of the book is to map the ways in which digital transformation is being carried out and to what extent digital maturity is being achieved by educational leaders within a broader European context.

Furthermore, digital transformation and achieving digital maturity, as a tangible sign of this transformation in the broader context of the Fourth Industrial Revolution, are not limited only to the implementation of new technologies in organisations, both in business and education. It is also not merely about the dissemination of digital goods and services among various consumers, including students. This transformation, or digital transition as the European Commission calls it, is first and foremost about changing business and operational models in all spheres of educational and broader socio-economic life. What is crucial and relevant here is that this transition, in order to achieve substantial digital maturity, must lead to the functional change of public institutions, especially universities. What underlies this process is the fact that in order to achieve greater resilience, competitive advantage and foster innovation, educational institutions and their leaders must base their activities on network, relational and hybrid modes of operations. These are also the lessons learnt from the COVID-19

pandemic. All these factors influence the current and future modes of work. The work environment now is already defined by distant and online operations, the use of big data, systems based on artificial intelligence and the common use of technologies as such. This also means that people and machines will complement each other and have to communicate with each other effectively. All these technological transformations should lead to enhancing people's potential and the development of their cognitive and social competences, especially those connected with effective communication on different levels. The COVID-19 pandemic has intensified all these processes, and for better resilience and effectiveness at work, it now requires different sets of competences. On a more general level, Hewlett Packard Enterprise states that digitalisation must be perceived as one of the key enablers of effective management of various processes offering savings and bringing benefits such as access, transparency and quality. Digital tools allow optimisation, increased processing speed and boost cross-institutional and cross-departmental collaboration. This is increasingly relevant in today's complex realities where policy areas of various sorts can be impacted by interrelated factors such as climate change or others (Hewlett Packard Enterprise 2023:6).

Accordingly, the study presented in this book also includes research carried out during the pandemic and related to educational leaders' competences, which may help them go through this digital transformation with relative ease. The final conclusions from all research activities presented here intend to map a broader issue of digital maturity of educational leaders. This publication also gives direct insight into changes that take place in education in the context of an unprecedented and rapid technological advancement, which requires a reorientation of goals and functions based on innovative, adaptive and flexible solutions. The book describes in detail the way to reach this reorientation and shows through thorough research how educational leaders position themselves on this path in this fast-changing ecosystem.

Accordingly, **the first chapter** of this book describes the broader socio-economic context, which requires educational institutions and educational leaders to become more innovative and, above all, to undergo digital transformation. This transition, in turn, results from unprecedented technological advancement and the need to address the requirements of the current and future labour market. The broader context of this transition is defined by three megatrends: demographic change, globalisation and technological advancement itself. All these megatrends are shaping the present and future world of work and education. The chapter also presents the concept of Industry 4.0, also called the Fourth Industrial Revolution, that is defining today's world of work together with competences 4.0, or competences of the future, and their consequences for education. All industrial revolutions and

the development of artificial intelligence are presented here from the historical point of view as well. Consequently, this discussion leads to the concept of competence-based leadership, which, according to the research presented in this book, is a key driver to organisational change resulting from the need for digital transformation. Finally, the chapter presents the idea of networked organisations from the scientific point of view on management, which provides an insight into broader ecosystems in which innovations such as digital transformation may effectively develop. The concept of relational and networking paradigms in the science of management as well as the idea of strategic management imbedded in these paradigms together with their manifestation in European cooperation projects are presented here.

The second chapter presents European digital agenda as a point of reference to various activities connected with digital transformation. The core discussion in this chapter refers to the concept of digital transformation and digital maturity as sine qua non conditions for the development of educational institutions in the era of automation of production and service processes, artificial intelligence and the integration of digital tools for better effectiveness. Finally, the chapter relates all these elements and phenomena to the research on the development of educational institutions, especially higher education institutions. This part of the discussion concentrates mainly on the idea of international networking and cooperation, creating flexible didactic offer and digitalisation itself as a solution to achieve these goals. This aspect is also presented here from a historical point of view on the development of higher education institutions.

The third chapter presents the research and its results on educational leaders' effectiveness in managing and sustaining international cooperation projects during the COVID-19 pandemic. The times of pandemic turned out to be very good testing grounds for such research, as due to restrictions and bans on travel and the possibility to cooperate in a traditional way, project leaders had to suddenly change the mode of their work and operations in order to continue successfully their projects and innovative activities in their institutions. The main tool helping them in this was the use of digital solutions on a broad scale. However, the research proves that it is not only digital competences that are crucial and fundamental in such a process. Actually, effective digital transformation, or, in other words, digital maturity, is impossible to achieve without broadly defined and understood social competences. The chapter also discusses and presents research results on how the learning potential of educational leaders affects their effectiveness in their broadly understood digital transformation. Finally, the chapter shows the level of digital maturity of educational leaders based on the research data and its interpretation.

The fourth chapter discusses the idea of the European Universities Initiative as well as the role and development of universities participating in this initiative. The digital transformation of universities within the consortia of European Universities is presented here based on the research that refers to the strategies these universities adopt in their digital transformations, management models incorporating digital tools, digital infrastructure, human capital and its digital potential, and finally digital products and services that universities can offer to their students, or even broadly to their clients. The results of this research are confronted with the results of a similar research carried out among American universities, especially Californian universities located in the broader area of the Silicon Valley. These universities and their digital transformation are treated here as sort of a benchmark. All these discussions ultimately lead to the conclusion on digital maturity of researched universities.

The fifth chapter attempts to contribute to bridging the gap between the requirements of the labour market and the educational offer at the tertiary level. The chapter presents the self-assessment tool for universities that provides them with a checklist of criteria defining universities 4.0, meaning the universities that educate and support their students in developing the competences needed in the current and future labour market. The chapter also presents a bibliometric analysis on competences 4.0 and its implications for a better understanding between the world of business and the world of education in the context of digital transformation. The discussion in this chapter also touches upon the issue of academia – business/industry cooperation and how it can be measured. The assessment tool in this respect is presented here. The whole discussion is also recapitulated here and connected to the broader idea of innovations in education and paradigm 4.0 in education.

Conclusions part of the book pulls all the presented threads of the discussion together, which allows to see digital transformation and its key role players in the broad socio-economic and educational context.

Finally, it must be noted that although the research on competences and digital transformation is quite rich, since both areas are important elements of human professional development, there are quite many and various competence models found in scientific literature, and discussions on digital transformation are nothing new. However, the literature review confirms that the very concept of competences 4.0 and their implementation in educational systems are relatively poorly recognised, and the literature on this specific aspect of competences is rather scarce. The situation is even worse when one tries to find research that combines the idea of competences 4.0 with digital transformation and, more broadly, with the labour market and implications of the Fourth Industrial Revolution. In fact, there is no book involving integrated research on these issues in reference to

educational leaders and their readiness for the current and future challenges resulting from the broader socio-economic and technological context.

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1 Digital transformation in education within a broader socio-economical context

1.1 Megatrends shaping the present and the future of the world of work and education

Digital transformation rooted in the broader term of Industry 4.0 does not function in a vacuum. There is always a broader context that must be taken into consideration in order to get a full view of the processes that take place around us, and which have a huge impact on how we work and live. The key phenomena affecting the life of modern societies are demographic change, globalisation and technological advancement itself. This technological progress defines Industry 4.0 as automation and integration of all possible processes to an unprecedented level. This involves artificial intelligence, robotics, 3D printing and blockchain, just to mention a few, and results in low-skilled jobs being automated, creating a high demand for high-skilled jobs at the same time. Accordingly, unprecedented challenges are posed on the systems of education that need to rapidly equip students with competences relevant to live and work in the digitalised world. These competences include technological skills, media literacy, creativity, social intelligence, critical analysis, virtual collaboration and intercultural skills.

The Fourth Industrial Revolution described in the subsequent subchapter, also called Industry 4.0, is very similar in its nature to the previous three industrial revolutions in that sense that it does not only bring substantial changes to the way we live and work, but it also brings the changes to the structure of work. The First Industrial Revolution, called the steam engine revolution, released workers from using muscles in the place of work to a great extent and made production processes mechanised for the first time. The Second Industrial Revolution, connected with the introduction of electricity, brought assembly lines and fostered mass production. The influence on society resulting from these two revolutions was painfully felt in the era of "fordism" which is the concept named after Henry Ford, an American car manufacturer. This concept was based on such features as the strict division of labour and automation, as well as an

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autocratic and highly disciplined style. The Third Industrial Revolution is associated with full automation of working and production processes thanks to the implementation of computers on a wide scale. The Fourth Industrial Revolution added the concept of process integration into automation.

However, before discussing the Fourth Industrial Revolution and its consequences for work, the environment in which it is blooming must be taken into consideration. As already stated, this environment is characterised by three megatrends: demographic change, globalisation and technological advancement.

As regards demography, most of the developed countries are already undergoing significant changes that will be felt in the next decades. According to the United Nations, by 2050 a sharp decline in the share of working-age population is expected in major developed economies, for example, in Japan, this decline will have reached up to −28% and in Germany and Italy −23%. At the same time, some countries will expect a substantial increase in the percentage of the working-age population, for example, +41% in Saudi Arabia, +33% in India and +27% in Australia (United Nations 2019). Accordingly, countries with ageing population will face a shortage of skilled and qualified labour force resulting from retirement and gradual withdrawal from labour market. Simultaneously, in countries with younger and growing workforce, an opposite trend will appear.

On the other hand, as trade accounts for a growing share in the GDP of developed countries, we witness the global economy becoming more and more integrated and interconnected to a level never experienced before (World Bank 2019). The rapid fall in costs of communication and transportation has fostered the integration of goods, services and markets and accelerated the pace of dissemination of innovations and technological progress.

Finally, technological progress makes an increasing number of tasks and operations automated, depriving humans of jobs performed so far. This is happening in the context of the rapid development of robotics, big data, artificial intelligence and the Internet of Things (IoT), accompanied by fast-increasing computing power. Hence, a new set of skills, attitudes and knowledge is necessary in order to be able to function in the labour market and society. It is interesting to note that during the First Industrial Revolution, when steam machines deprived humans of their jobs, a movement called "luddism" appeared. Workers started destroying machines which they perceived as a threat to their existence. Although nowadays some of the founding fathers of high technologies and artificial intelligence, such as Steve Wozniak and Geoffrey Hinton, warn the world against certain developments and opt for abandoning certain solutions

based on artificial intelligence, one thing is certain: we do not need destruction since the developments seem to be unstoppable; we need requalification and adaptation. The whole process cannot be based on deprivation or making humans redundant: it is not about replacement, but about augmentation. We need smart machines and artificial intelligence to augment our capabilities.

1.2 Industry 4.0 and competences 4.0 as a driving force behind social and educational changes

Industry 4.0, also known as the Fourth Industrial Revolution, is part of the High-Tech Strategy 2020 action plan introduced by the German Federal Government at the Hannover Fair in 2011. The aim of this action plan is "a more efficient, flexible and individual production, achieved through decentralised controls of production and completely digitally controlled or even self-organised value chains" (Priffti, Knigge, Kienegger and Kremar 2017). Yet, the very term "Fourth Industrial Revolution" was coined by Klaus Martin Schwab, the executive chairman of the World Economic Forum, four years later (Schwab 2015). The Fourth Industrial Revolution is defined by full automation of production processes, alongside with the rapid development of big data, the IoT, and increasing computing power, shaping the labour market and the world of education nowadays. Due to the main characteristic feature of Industry 4.0, which is automation, many jobs will disappear and be replaced by new ones, requiring knowledge of and skills in using high technology in most cases.

On top of this, the development of artificial intelligence is already changing the ways we operate on a daily basis within numerous spheres and areas. Although the beginnings of the development of artificial intelligence date back to the 1940s with Alan Turing's revolutionary computing machine, the creation of machines that could exhibit intelligence was still impossible, at least some foundation for the process were laid. In the 1950s, John McCarthy of Dartmouth College claimed that learning and features of intelligence could be simulated by a machine. At that time, scientists' interest was directed at the development of human speech recognition, analysing images and objects, text translation, playing games and problem solving. These attempts failed in many cases because of low computing power of computers at that time. The next turning point in the advancements of developing artificial intelligence came in 1997 when Garry Kasparow, a world chess champion, was beaten in chess by the IBM Deep Blue computer. The technology of big computing power accessible at that time allowed Deep Blue to analyse all possible moves that it had learnt from the previous master chess games at unprecedented speed. In other words, Deep Blue's mode of functioning was rather based on recreation and not creation through learning. Deep Blue did not exhibit any

creative or intuitive powers. The next advancement took two decades when AlphaGo, and then more advanced AlphaGo Zero, could beat best players in a very sophisticated Chinese board game called "go". AlphaGo was based on the network of artificial neurons. In practical terms this meant that it did not need to analyse thousands of go games to recreate the best possible moves, but with the knowledge of the game's rules, it learnt and mastered its skills in playing the game with exponential speed game after game. In the meantime, the changes that artificial intelligence has been bringing are not only limited to the domain of manufacturing, data management and system designs but also extend to such areas as the development of decision support systems, composing music, marketing, etc. (Kądzielawski 2023). It is worth noting at this stage that the works on the use of artificial intelligence also encompass areas such as training and competence development (Gladwin 1984; Harvey 1985), education and science (Husby 1990; Pelton 1990) and network management processes (Liebowitz and Prerau 1995; Qi et al. 2007). The research on this dates back as early as the 1980s and 1990s of the 20th century. The interest and research on artificial intelligence and its applications in the second decade of the 21st century practically encompass all spheres of life, with domains relevant in the context of this study, such as innovation management (Liu 2022) or processing and analysing big data in education (Aljarrah et al. 2021). Summing up this part of the discussion on artificial intelligence, it is worth to mention the recent top achievement of Industry 4.0 based on artificial intelligence which is Nvidia's (one of the leading tech companies in Silicon Valley) Omniverse. This system, which is an advanced form of a digital twin, recreates the world around us with various processes and phenomena in virtual space that allow carrying out simulations which, in turn, can deliver ready-to-use solutions. For example, thanks to these simulations and unprecedently big computational power available now a design of a fully automated factory can be created, new medicines or software for autonomous cars can be developed, etc. – the possibilities are endless. Thanks to big computational power and artificial neuron networks, the machines can learn very quickly on their own and provide us with the solutions that have not existed before. This poses a threat to maintain jobs as we know them, and the reflection on what people should be taught is of an urgent need. Susskind suggests that we should not teach people how to do routine work because machines already excel in tasks of this sort. He adds that people can still design and build machines, or set them to a proper use, for example (Susskind 2020:155). However, already existing machines can already perform coding themselves, which means that even now we can already be deprived of jobs that involve designing activities. The speed of technological advancement is really fast. On the other hand, Schatt claims that technology's impact on jobs will result in a net increase of jobs. Jobs are already and will be lost by those who perform manual labour as sensors are

replacing the need for such jobs. But Schatt expects astronomical increase in the number of IT professionals, for example, in building and managing IoT networks (Schatt 2023). His predictions on jobs increase in designing can be rather valid in short-term and not long-term perspective.

Coming back to the practical level in the light of the above discussion, new competences, referred to as competences 4.0, will be required for effective functioning in this new reality. According to the World Economic Forum 2017, up to 47% of jobs may be automated (World Economic Forum 2017). This will, and is already, influencing the systems of education, which need to rapidly and effectively equip learners with competences relevant to live and work in the digitalised world. The *Future World Skills 2020 Report* (Organisation of Economic Cooperation and Development 2019) stresses that the industrial revolution 4.0, characterised by global connectivity, intelligent machines and new media accessible to almost anyone, is fuelled by six drivers: extreme longevity, the rise of smart machines and systems, the computational world, new media, structured organisations and the globally connected world.

Current studies on the competences of the future clearly indicate the changing requirements for future jobs, where digital, cognitive and social competences become crucial. It is a step change in thinking about work, where personal flexibility, as well as project-based approaches to work, will be essential. In this new approach to the functioning of industries, a wide application of technology and instruments of the digital economy is necessary. The following aspects are important here again: advanced computing and connectivity thanks to the Internet, data analytics leading to increased business intelligence, and new ways to implement human-digital interfaces, such as touch screens or virtual reality (Dobrowolska and Knop 2020). These elements also constitute a definition of Industry 4.0. The literature review shows that researchers such as Schwab (2015); Gilchrist (2016); Sanders, Elangeswaran and Wulfsberg (2016); Jeschke, Brecher, Song and Rawat (2017); Rojko (2017); Goena, Lleo de Nalda, Diez and Garcia (2018); Tay, Chuan, Aziati and Ahmad (2018); and Górka, Thier and Łuszczyk (2020) define Industry 4.0 as a set of the following terms:

1 Smart factory: an intelligent factory that is based on the IoT and cyber-physical systems
2 IoT: advanced connectivity of systems, services and physical objects enabling object-to-object communication and data sharing
3 Cyber-physical systems: systems that integrate humans with machines
4 Big data: a huge amount of data obtained from devices connected to the Internet
5 Cloud computing: system logic that provides huge space for data storage

6 Autonomous robots: robots that interact with each other and collaborate with humans
7 Simulation: modelling real or virtual processes by using real-time data to represent the real world in a simulation model
8 Augmented reality: a reality enhanced by virtual elements
9 Additive manufacturing/3D printing: implementation of new manufacturing skills for the purpose of integrating information technologies
10 Blockchain: a decentralised and dispersed database.

Accordingly, the origins of the term "competences 4.0" must be sought in two sources. Firstly, the term stems from the general concept of Industry 4.0. Secondly, the developments within the concept of Industry 4.0 have led the researchers to draw from the discussions on what are known as the competences of the future (Dobrowolska and Knop 2020:7). From the business or industrial point of view, a good point of reference here is the model postulated by the World Economic Forum. It proposes three blocks of future skills: (1) foundational literacies, (2) competences and (3) character qualities (World Economic Forum 2015). The first block includes literacy, numeracy, scientific literacy, ICT literacy, financial literacy and cultural and civic literacy. The direct reference to this part of the model can be seen in what we might call a traditional approach to education. The second block refers to such competences as:

1 Critical thinking/problem solving – on a practical level, it means giving constructive feedback
2 Creativity – meaning opportunities to build and innovate, as well as providing autonomy to make choices
3 Ability to communicate – in other words, creating a language-rich environment
4 Ability to cooperate – based on fostering greater respect and tolerance for others and providing the opportunity for group work.

In other words, the second block reflects the ability to function effectively in society, which, in the light of the above discussion on the fast pace of technological advancements and replacing humans by machines in various spheres, is a crucial aspect of this whole discussion. The World Economic Forum model also points to character qualities as an integral part of the whole set of necessary skills. They include:

1 Curiosity – defined as encouraging questions and guessing, providing autonomy to make choices, instilling sufficient knowledge to ask questions and innovate and evoking contradiction

2 Initiative – fostered by providing long-term, engaging projects, building confidence in the ability to succeed and providing autonomy to make choices
3 Persistence – the ability to learn from failure
4 Adaptability – the ability to process emotions and practise both flexibility and structure
5 Leadership – the ability to negotiate and be empathic
6 Cultural and social awareness: greater respect and tolerance for others, empathy and cultural self-awareness.

Accordingly, the World Economic Forum periodically provides a simplified model of the top ten skills of the future. The evolution of the World Economic Forum in thinking and perceiving what the future skills are in the light of constantly changing socio-economic environment looks as follows (Table 1.1):

Table 1.1 Skills of the future

#	*2025*	*2020*	*2015*
1.	Analytical thinking and innovation	Complex problem solving	Complex problem solving
2.	Active learning and learning strategies	Critical thinking	Co-ordinating with others
3.	Complex problem solving	Creativity	People management
4.	Critical thinking and analysis	People management	Critical thinking
5.	Creativity, originality and initiative	Co-ordinating with others	Negotiation
6.	Leadership and social influence	Emotional intelligence	Quality control
7.	Technology use, monitoring and control	Judgement and decision-making	Service orientation
8.	Technology design and programming	Service orientation	Judgement and decision-making
9.	Resilience, stress tolerance and flexibility	Negotiation	Active listening
10.	Reasoning, problem solving and ideation	Cognitive flexibility	Creativity

Source: World Economic Forum (21 October 2020).

This actually aligns with most of the models of future competences. According to various researchers, these models are mainly based on three areas:

1 Digital competences – connected with the use of technology on different levels of advancement, the ability to solve problems using digital tools and knowledge about privacy and cybersecurity issues
2 Social and emotional competences – connected with interaction with others and coping with one's own emotions, as well as the ability to cooperate in a group, leadership and entrepreneurship
3 Cognitive competences – connected with the ways of thinking, including processing and verifying information, creativity and critical thinking.

(Hecklau, Galeitzke, Flachs and Kohl 2016; Pinzone, Fantini, Perini, Garavaglia, Taisch and Miragliotta 2017; Bawany 2017; Barata, Da Cunha and Stal 2018; Karabiegovic 2018; Erol, Jäger, Hold, Ott and Sihn 2018; Imran and Kantola, 2018; Włoch and Śledziewska 2019; Ellis and Van Der Merwe 2019; Makieła, Stuss and Szczepańska-Woszczyna 2019; Zabolotniaia, Cheng and Dacko-Pikiewicz 2019; Dobrowolska and Knop 2020)

This approach stems from empirical research carried out by the McKinsey Global Institute, which shows that the need for such competences of the future in the context of the industrial revolution 4.0 is on the rise in relation to the demands of the labour market (McKinsey 2018).

Fitsilis, Tsoutsa and Gerogiannis postulate a comprehensive model of what they already directly call competences 4.0:

1 Technical competences, such as state-of-the-art knowledge, process understanding, technical skills, etc.
2 Methodological competences, including creativity, entrepreneurial thinking, problem solving, conflict solving, decision-making, analytical skills, research skills and efficiency orientation
3 Social competences, such as intercultural skills, language skills, communication skills, networking skills, ability to work in a team, ability to be compromising and cooperative and ability to transfer knowledge and leadership skills
4 Personal competences, including flexibility, ambiguity tolerance, motivation to learn, ability to work under pressure, sustainable mindset and compliance

(Fitsilis, Tsoutsa and Gerogiannis 2018; Leinweber 2013)

They also add that "skills needed for industry 4.0 are numerous and diverse" and some of them, including information and communication

technology skills, have not been standardised yet (Fitsilis, Tsoutsa and Gerogiannis 2018).

Other typologies of competences 4.0, depending on the specific contexts that they address, can also be found in the literature. Geryk (2020) and Clavert (2019) provide the list of skills or, to be more precise, constituting elements of competences needed to overcome the challenges posed by Industry 4.0 from the point of view of the higher education system. According to them, universities must equip students with new qualifications needed in the new labour market, and these qualifications should be based on skills and competences 4.0. These skills are as follows: flexibility, adaptability, technological literacy, risk-taking, business thinking and abilities connected with information management, cybersecurity, quality control and sustainability (Geryk 2020; Clavert 2019). The direct link to the broader categories of digital, cognitive, social and managerial spheres can be seen here. Furthermore, Stock and Seliger, as some of the most prolific authors on Industry 4.0, according to the bibliometric analysis carried out with the use of the Scopus database (Poszytek 2021a), enumerate the human factor as one of the most important elements in sustainable manufacturing. They attach great importance to technical skills, social skills, creativity and decentralised decision-making (Stock and Seliger 2016). Here as well, a reference to digital, cognitive, social and managerial spheres is obvious. The literature review also shows that in many cases, researchers concentrate only on selected elements, namely, skills within broader categories of competences, while discussing the concept of competences 4.0 (Priffti, Knigge, Kienegger and Kremar 2017).

However, it must be noted that the above-presented models actually derive from a classical model of managerial competences, including technical, social and cognitive competences (Korzeniowski 2019). And since the study presented in this book refers to leaders, both on an individual and institutional level, the author of this study proposes the following model of competences of the future, or one can already say, competences 4.0:

1 Digital and technical competences: programming and data analysis, expertise in online privacy and cybersecurity, processing of big data sets, use of the computing clouds and the Industrial Internet of Things, integration, simulation and visualisation of processes and evaluation of technology and its products
2 Cognitive or thinking competences: creativity, logical reasoning and solving complex problems
3 Social and psychosocial competences: teamwork, team collaboration, leadership, entrepreneurship, emotional intelligence, personal flexibility, adaptability and interdisciplinarity

4 Managerial competences: team management and team coordination, financial management, business strategies, project management, psychology of work, organisation and management, public relations, marketing and media, managerial economy, management of human resources, managerial, leadership and entrepreneurship skills, quantitative methods and business statistics, ethics, risk management and changing management techniques in the context of social and technological change.

As it will be seen in the subsequent chapters of this book, possessing some of these skills and competences is a sine qua non condition that allows leaders to introduce organisational changes in their institutions.

1.3 Leadership in the context of the Fourth Industrial Revolution

In the light of the above-described competence models, competences 4.0 can be actually treated as the solid base of modern management. Moreover, this competence model has not been developed in a vacuum as a theoretical construct; it has evolved alongside changes in the social and work environment. And since contemporary authors perceive leadership as related to the work of competent managers whose aim should be to combine the efforts of many people targeted at achieving desired results by the organisation (Madalińska-Michalak 2018), then a clear link can be seen between modern leadership and competences. Although it is difficult to develop a single comprehensive definition of leadership because of the fact that this concept remains elusive and enigmatic (Avery 2009; Madalińska-Michalak 2018), a competence-based approach to leadership seems to be a proper solution. Furthermore, theories on leadership based on personal traits are becoming more popular than theories based on behaviour (Madalińska-Michalak 2018). Yet, as it will be shown further, current approaches to leadership do not entirely abstract from behavioural aspects. As presented in the previous subchapter, the competence 4.0 model has a strong social dimension, and even representatives of behavioural approach in management, such as Mary Parker Follett and Chester Irving Bernard, stressed the importance of such factors as proper work atmosphere, trust between managers and workers and proper communication and engagement (Lachiewicz and Matejun 2012). On the one hand, these factors are associated with behaviour, but on the other hand, they are also conditioned by the set of social competences. At this point Follett's idea of leadership as "power with others" completes the picture where cooperation in gaining goals and objectives is the focal element of effective management. Follett's idea with its cooperative and interactional character is well represented in the competence 4.0 model. This means that the elements of a competence-based model of leadership can be even traced in the classical approaches to

management. The next subchapter describes in detail current approaches to management whose networking and relational character is directly connected with digital and social competences.

Some of the contemporary researchers also see effective leaders from behavioural and not only competence perspective. Although competence-based approach to leadership has a sound and solid basis according to Madalińska-Michalak (2018), behavioural dimension in scientific discussions on leadership is still present in literature such as Goffee and Jones (2006), Goleman (2011), Gundling, Hogan and Cvitkovich (2011) and Hennessy (2018). Goleman maintains that what makes a leader is, first of all, emotional intelligence. The elements of this intelligence are as follows:

1 Self-awareness – knowing one's strengths, weaknesses, drives, values and impact on others
2 Self-regulation – controlling or redirecting disruptive impulses and moods
3 Motivation – relishing achievement for its own sake
4 Empathy – understanding other people's emotional makeup
5 Social skill – building rapport with others to move them in desired direction.

(Goleman 2011)

The mix of behavioural and competence approaches to leadership can be clearly seen. Yet, Goleman himself stresses that "social skill is the culmination of the other dimensions of emotional intelligence" (Goleman 2011).

From the practical perspective of the labour market, a 2019 study by Deloitte states that business needs a new leadership model, which is necessary to increase competitiveness (Deloitte 2019). Leaders nowadays are more than ever expected to be able to lead through complexity and ambiguity, to manage on a remote basis, and what is most important here is to manage workforce with a combination of humans and machines. Furthermore, modern leaders need to demonstrate sound technological skills and be able to absorb new knowledge at an unprecedented speed, which brings us back to the concept of Industry 4.0 and competences 4.0. Accordingly, today's leadership involves a combination of traditional approaches and new competences, since leaders are expected to manage effectively, solve problems creatively, maintain operational efficiency and perform risk assessment. However, due to socio-economical context described in the previous subchapter, the pace at which they are expected to do so has changed (Jeżowski, Pachocki and Poszytek 2020).

Furthermore, this paradigm shift towards leadership must be also perceived in the context of the COVID-19 pandemic which accelerated the need to develop digital skills and required social skills in the broad

understanding for better and more effective communication and collaboration. As a result of recent research, Ferrazzi, Gohar and Weyrich (2022) also stress the importance of collaboration and fast adaptability as some of the most important factors that underlie effectiveness in the new world of work. Both collaboration and adaptability are key pillars of the competence 4.0 model as shown in the previous subchapter. Furthermore, Hennessy (2018) claims that "leadership is, in fact, all about collaboration and teamwork", although both of them are not something we would associate with great leaders. Similarly, Ibarra and Hansen (2020) perceive collaboration as one of the key elements that define leadership.

Accordingly, there are two crucial aspects here. Firstly, current approaches in management base the concept of leadership on competences, especially social skills. Secondly, collaboration, which is a social skill within a broader framework of social competence, is the focal point of this concept. Thus, it is important to note at this point that research presented in this book is based on collaborative, innovative European projects (see Annex I for examples of selected projects contributing to the very digital transformation) and their leaders. This binds all crucial threads of the phenomenon in question, namely, leadership-driven digital transformation through innovations carried out within cross-European cooperation projects needs digital skills, but first of all it needs social skills. Accordingly, social competence becomes one of the most important pillars of competences 4.0 within a broader context of Industry 4.0. Maxwell (2020) claims and proves in his book that the growth of an organisation, which in fact means any sort of organisational change, is solely determined by the growth of its leader, or leaders. Thus, the concepts of leaders and their competences should lie in the heart of any discussion on organisational change.

1.4 Network and relational paradigm in management and educational projects

The underlying idea behind the general philosophy of Industry 4.0 is the creation of an ecosystem that functions on the basis of a smart network. The smart network in this context refers to the integration of processes that lead to automation in organisations. Buchelt puts it like this: "the industrial revolution 4.0 allows products, machines, components, individuals, and systems to create smart networks, which may lead to integrate cyber-physical systems and perform more quickly by linking information and physical memory to the smart network" (Buchelt, Frączkiewicz-Wronka and Dobrowolska 2020). In the case of educational institutions, it is more appropriate to state that this integration within a network should lead to better effectiveness of the operations, improved results and innovations.

Consequently, network and relational paradigms in management apply here, and their assumptions constitute a solid basis for implementing innovative organisational change.

Gaining a satisfactory level of digital maturity among universities in the context of technological advancements and lessons learnt from the COVID-19 pandemic remains a challenge worldwide. However, the idea of forming alliances supported by technology for better communication, effectiveness and synergy of processes to achieve a competitive advantage and implement innovation is not new from the perspective of management studies. This concept is based on business models dating back to the late 20th century, which laid the foundations for network and relational paradigms in management. It serves as a response to the challenge of functioning effectively, developing and implementing innovation for a competitive advantage in turbulent, uncertain and demanding times – the COVID-19 pandemic certainly constituted a testing ground for this concept. The answer to this kind of challenge so far suggests that a competitive advantage is achieved by creating a network of internationally dispersed units that complement each other with expertise and form a unique mix of competences, allowing them to build up excellence in a chosen domain. A key factor leading to success in this respect is the use of technology, providing a platform for effective communication and cooperation through knowledge sharing and enhancing organisational and innovative potential (Borgatti and Foster 2003; Czakon 2011; Wieland and Wallenburg 2012; Stańczyk-Hugiet 2012; Woźniak-Sobczak 2015). In the case of universities, this innovative potential includes administration, research and didactic spheres. The research shows that this kind of network and relational paradigm in managing innovative educational projects, with the extensive use of technology within all sectors of education, also proved effective during the COVID-19 pandemic (Poszytek 2021b). In the post-pandemic era, this relational and networking paradigm is flourishing within the world of academia and provides assumptions that underlie organisational change of modern universities.

The relations and interlinks between relational and network paradigms in management form a varied and complex realm of approaches. For the purpose of this publication, it is worth providing some of the aspects of this realm. The relational view in the science of management was introduced by Dyer and Singh (1998:660–679). As stated above, this view postulates knowledge sharing within units of an organisation and building relations inside and outside of it in order to enhance competitive potential and effectiveness. However, some researchers claim that the relational view is an integral part of the network paradigm. Thus, the relational view is classified here as a partial paradigm within the broader context of the network paradigm, where both form a certain sort of holistic paradigm.

Furthermore, the ability to create and maintain relations is a fundamental competence of network organisations (Woźniak-Sobczak 2015). Thorelli (1986) also represents this view and states that inter-organisational networks are usually defined as two or more organisations engaged in long-term relations. What is more, the use of relational and network mechanism by various sort of organisations is becoming a standard nowadays (Stańczyk-Hugiet 2012).

Accordingly, a few crucial threads of our discussion come together here. The research in this book is based on European cooperation projects within the Erasmus+ Programme. These projects form and constitute relational and network ecosystems for cooperation which is mainly based on the use of digital tools. And this cooperation usually takes the form of strategic partnerships, which on the more practical level leads us towards strategic management, which is a relatively new discipline of practice and theory in management as such. Strategic management's core assumption is that current, modern organisations cannot be competitive and effective without a strategy and plans for its realisation. What is more, organisations, which implement strategic management, usually adopt the network and relational perspective in their activities (Stańczyk-Hugiet 2012). This approach brings strategic management into line with the network and relational paradigms. Furthermore, four main approaches can be distinguished within strategic management: (1) a planning one, (2) a positional one, (3) a resource-based one and (4) an evolutionary one (Stańczyk-Hugiet 2012). The planning approach prefers a formalised planning system and SWOT analysis (Stabryła and Walas-Trębacz 2018). These two features correspond to the character of Erasmus+ projects very well because the selection and granting procedure in the Erasmus+ Programme is mainly based on the assessment of project plans and their structure. Moreover, Erasmus+ project consortia are encouraged to implement the analysis of strengths and weaknesses by various handbooks and guidelines on Erasmus+ project management in order to avoid failures. SWOT analysis aims at helping Erasmus+ project leaders to identify threats and plan remedial activities if necessary. The positional approach, on the other hand, concentrates on the need to carry out diagnostic research in order to see how an organisation places itself in reference to other organisations. Its aim is also to seek a competitive advantage (Stabryła and Walas-Trębacz 2018). In the case of Erasmus+ projects, it is the search for an organisation's own way to become innovative. The main aim in such cases is to introduce innovative solutions that others do not offer. Erasmus+ projects also well exemplify the resource-based dimension of the phenomenon in the context of inter-organisational relations as strategic resources. This aspect of strategic management refers to Erasmus+ projects as organisations composed of several various partners whose alliance is based on

complementary expertise and resources. And lastly, the evolutionary approach within the relational and network paradigms manifests itself in current business ecosystems that form complex networks and relations (Zakrzewska-Bielawska 2015), which, again, refers directly to the core feature and nature of Erasmus+ projects. For Stead and Stead (2008:66), the evolutionary perspective connected with relational and network paradigms brings modern organisations directly to strategic management. Regardless of the approach within the concept of strategic management, the landscape of scientific discussions on the very definition of the notion of strategy is also very diverse and not necessarily homogenous (Krzakiewicz and Cyfert 2020). Yet, Krzakiewicz and Cyfert (2020) list six fundamental aspects of the notion of strategy in management after Gołębiowski (2001). These are aims, a plan, relations with the environment, a business area, competitive advantage and market positioning and stakeholders. These aspects actually constitute a comprehensive definition of what Erasmus+ projects are. A successful Erasmus+ project needs to have clearly defined aims and goals, a plan specifying subsequent stages of project realisation, including task division, budget distribution, results dissemination and information strategy as well as an evaluation plan. The consortium of project partners needs to describe relations within a group, the complementarity of expertise and dissemination and information plan. The consortium also has to show how their activities or products developed within a project position them as innovative in their business area and how they engage or address various stakeholders in their field of activities.

Since the COVID-19 pandemic also constitutes a specific sort of context in this discussion, the concept of adaptability to a new challenging situation must be mentioned here. Czakon (2020) states that the fitting of an organisation to the environment is one of very few normative notions in strategic management. This notion refers to the effective use of both resources and competences regarding possible threats (Czakon 2020). The relevance of this aspect is fundamental for the research on how competences facilitate the successful realisation of Erasmus+ projects during the COVID-19 pandemic, which is presented in Chapter 3. Similarly, Dyduch (2013) points to flexibility as an important aspect of strategic management. He defines flexibility as a strategy of changing the direction of activities and a prompt adoption of activities in new conditions (Dyduch 2013; Chell 2001).

Accordingly, it should be stated that international cooperation within Erasmus+ innovative projects, including the European Universities Initiative, forms an appropriate ecosystem for implementing organisational change and achieving digital maturity. This view is supported not only by the theories drawn from the analogous area of the business world of operations but also by the research presented in this book, although the speed and level of

advancement in some aspects of this process may not necessarily be fully satisfactory. Yet, what we observe in efforts on the part of educational institutions, especially higher education ones, to become more competitive can be called a renaissance of relational and network paradigms. Modern innovative educational leaders, whether individuals or institutions, must function within international networks to be competitive in the educational market. Such networks foster the development and implementation of digital solutions, contributing significantly towards the digital maturity of educational organisations. Furthermore, functioning in these networks and performing administrative, didactic, and research operations within a relational mode make these organisations true leaders of paradigm 4.0 in education.

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2 Digital transformation as a prerequisite for creating an innovative ecosystem in educational institutions

2.1 The European Union's digital agenda for economy and education

The European Union's (EU) digital agenda refers to its comprehensive strategy, strategic plan and policies aimed at digital transformation, harnessing the potential of digital technologies to drive economic growth, maximise the benefits of digital economy and innovation and promote societal well-being across its Member States. The EU believes that the digital economy can significantly contribute to economic growth, job creation, social progress and the overall competitiveness of the EU on a global scale in the digital landscape. The digital economy is perceived here in very broad terms, including education as well. It is interesting to note that the term "digital economy" appeared for the first time in 1995. Tapscott (1995) introduced this term, stating that digital economy is an era marked by intelligent machines and people connecting through technology. In the context of this study, Tapscott's simple but comprehensive explanation of the phenomenon in question requires a little supplement. According to the OECD and the International Monetary Fund experts, digital transformation, digital products (goods and services) and networked people, machines and organisations are key elements that define digital economy (Śledziewska and Włoch 2021:3–4). In order to adopt the digital agenda, the EU involves various stakeholders such as governments, civil societies, businesses and, what is relevant here, academia. On the practical level, the EU establishes structural frameworks to implement the digital agenda through funding programmes, supporting research and innovation projects and fostering collaboration and cooperation among Member States and organisations. The agenda encompasses various areas and initiatives to address key challenges and opportunities in the digital realm. These initiatives include:

1 Digital single market: The EU aims to create a seamless digital market within its Member States by eliminating barriers to the free movement

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of digital goods, services and data. This involves harmonising rules and regulations, promoting e-commerce and ensuring fair competition in the digital sector.

2 Connectivity: The EU aims to ensure high-speed and reliable broadband Internet access for all citizens, especially in rural and remote areas. It promotes investment in broadband infrastructure and the deployment of 5G networks, fostering digital connectivity and bridging the digital divide.
3 Data economy: The EU seeks to facilitate the free flow of non-personal data across borders while ensuring the protection of personal data. It encourages the development of data-driven technologies such as artificial intelligence (AI) and the Internet of Things (IoT).
4 Digital skills and education: The EU focuses on enhancing digital literacy, skills and education to empower citizens and ensure they can fully participate in the digital society. It promotes initiatives for digital upskilling, reskilling and lifelong learning to foster a digitally competent workforce.
5 Digital innovation and entrepreneurship: The EU supports research and development in digital technologies, innovation ecosystems and startups. It aims to foster entrepreneurship, facilitate access to funding and promote collaboration between academia, industry and government to drive digital innovation.
6 Digital public services: The EU aims to improve the delivery of public services with the use of digital tools and solutions, such as e-government, digital healthcare, smart cities, etc.
7 Trust and security: The EU places importance on building trust and ensuring cybersecurity in the digital realm. It aims to strengthen the resilience of critical infrastructure, combat cyber threats and establish clear rules for data protection and privacy, including the General Data Protection Regulation (GDPR).

(European Parliament 2023)

In addition, the EU also runs the Digital Europe Programme (DEP) whose aim is to bring digital technology to businesses, citizens and public administrations. This programme aims to build the strategic digital capacities of the EU and to facilitate the deployment of digital technologies on a wide scale. This investment will cover such sectors as high-performance computing, cloud, data and AI, cybersecurity, advanced digital skills and accelerating best use of technologies. The DEP will accelerate the digital transformation of Europe and help Europe to remain globally competitive and strategically autonomous. On the individual level, the programme aims at shaping the way new technologies reflect citizens' needs and European values (https://digital-strategy.ec.europa.eu/en/activities/digital-programme).

Most of these initiatives within the EU's digital agenda are either directly or indirectly connected with the educational sector. This agenda not only targets educational sector institutions themselves but also the products and services they provide for societies. Interesting examples of how the EU seeks to leverage digital technologies to drive economic growth, improve citizens' lives and enhance Europe's competitiveness in the global digital landscape can be found among the very Erasmus+ projects whose leaders this study refers to. The Technical University in Gdańsk, Poland, together with its European partners, designs software that can read the emotions from autistic children's faces. The software is accompanied by guidelines for teachers, parents and guardians on how to handle such children. The Technical University in Łódź, Poland, together with Siemens and other European higher education institutions, creates a virtual campus for students of mechatronics. These examples are just a hint of the EU's and Erasmus+'s real contribution to digital transformation (the list of Erasmus+ projects contributing to digital transformation is in Annex I).

It is important to note at this stage that the research presented in this book is based on Erasmus+ Programme projects since the contribution of this programme to skills development and innovation is substantial, and, what is crucial here, one of the main priorities of the programme itself is digitalisation. At the same time one of the European Commission's main priorities is increasing the competitiveness of the European economy, which cannot be achieved without investments in education, especially by fostering the process of digitalising this education. Accordingly, the whole process is based on two fundamental elements: (1) contribution of education towards the development of competences indispensable for creative and innovative behaviour and (2) effective transfer of innovations and creative solutions from higher education institutions to business. Furthermore, the European Commission lists four key areas which Member States should base their policies on in order to foster this process, namely:

- Stimulating the development of entrepreneurial, creative and innovative skills
- Improving the infrastructure for the transfer of knowledge of higher education institutions and improving their engagement in such initiatives as start-up and spin-off
- Encouraging to building partnerships and undertaking co-operation with business
- Involving the higher education sector in establishing integrated local and regional development plans (European Commission 2011).

Accordingly, Erasmus+ Programme is the European Commission's main tool for the implementation of these aims. Erasmus+ Programme realises this agenda on two levels. On the one hand, it contributes to the competences development of individuals through participation in international mobility and blended learning that helps to develop digital skills, and on the other hand, it provides funds for the realisation and implementation of innovative projects and strategic partnerships either aimed at designing and implementing new digital solutions as the ones mentioned above, or using digital tools for better effectiveness.

Accordingly, the study presented in the next two chapters of this book can also be perceived from a much broader perspective: the digital maturity of educational leaders as a tangible sign of digital transformation within organisations conditions the development of digital economy, which is the EU's primary goal in its digital agenda.

2.2 Digital transformation and digital maturity

Digital transformation is a process that is characterised by the use of digital technologies to achieve better efficiency, organisational potential and business results (Liu, Chen and Chou 2011; Westerman, Calmejane and Bonnet 2011). Others add that this process is also defined by digitalisation of analogue resources, cost reduction and acceleration of processes (Collin, Hiekkanen and Korhonen 2015; Kane, Palmer and Phillips 2015). Digital transformation can also enable and enhance organisations, including universities, to expand their communication with stakeholders (Berman 2012). All these benefits of digital transformation are discussed in detail in Lis (2023).

Most scientific models point out three areas of digital transformation in organisations: (1) external – new products for customers; (2) internal – new operations, decision processes and new organisational structures; and (3) holistic – new business models (Hess, Matt and Benlian 2016; Kaufman and Horton 2015; Schuchmann and Seufert 2015). Others formulate it slightly differently but practically refer to the same areas: (1) internal efficiency thanks to digital solutions; (2) new business opportunities; and (3) digitalisation leading to the transformation of roles, functions and business models (Parvianen, Kaarianen and Tihinen 2017). Still, at the more general level, the aims of digitalisation are to (1) create values within the new frontiers of the business world; (2) make the processes more effective and efficient in client–organisation or client–product relations; and (3) build foundational digital capabilities (Dorner and Edelman 2015). Crucially, digitalisation leads to a fundamental change in the way organisations conduct business operations and introduces new business models based on new knowledge within a new digital ecosystem (Schallmo and Williams 2018). In the context

of this study, this obviously refers to educational institutions that need to transform from the organisational point of view as a result of the requirements of Industry 4.0. Moreover, as already explained, this transformation is a must, not only because of a new digital ecosystem but also due to the broader socio-economic context. Putting all these threads together, the author of this book proposes the following areas of digital transformation within educational institutions: (1) the use of technology for smoother operations and the comfort of workers (e.g. university employees: lecturers, educational project leaders, administration staff, etc.); (2) new business models, for example, blended learning, flexible didactic offers, generally new forms of governance within administration, research and didactics realised within international networks, etc.; and (3) new services for clients/students, for example, online courses, digitalised resources, virtual campuses, etc. (Poszytek 2022). These three areas are researched in the second part of this study in the context of the European Universities Initiative.

However, it must be stressed at this point that the very process of digital transformation does not necessarily lead to change (Mazurek 2020). The tangible sign of digital transformation is digital maturity, which means the extent to which organisations develop their digital potential. There are a few ways to measure digital maturity: (1) descriptive: assessment of the actual state of digital potential within an organisation measured against established criteria using a diagnostic tool; (2) prescriptive: assessment of the relations between effectiveness and organisational dimensions (e.g. digital resources); and (3) comparative: comparison between different practices in different organisations (Becker, Knackstedt and Poppelbus 2009). The study in this book follows the first and partially the third of these methods.

2.3 Higher education of the future in the context of Industry 4.0

The thinking of researchers on development of future universities reflects both competences 4.0, or competences of the future, and the idea of networks described above. The direction of the development of higher education institutions in the broader socio-economic context, as already outlined here, is presented by Ehlers and Kellermann (2019) and Ehlers (2020). It is based on four main drivers of change in the higher education sector, which are necessary for higher education institutions to adjust to the requirements of Industry 4.0. Accordingly, it is maintained that the organisational development of universities will follow such scenarios as the following:

- University based on skills of the future, assuming a paradigm shift and moving away from the transmission of knowledge towards the development of the competences of the future, including primarily the ability to solve

complex problems, dealing with uncertainty and developing a sense of responsibility. Consequently, competences 4.0 are nowadays becoming the prerequisite for success for all graduates of higher education institutions entering the labour market.

- Network-based higher education, which requires not only learning in a network of several universities but also the exchange of digital educational offerings. This also means that the higher education institutions themselves have to play a key role in this transformation. They are becoming more and more networked, creating cooperation units built from a few, often international universities. The European Universities Initiative is an example of good practice here, and the research part of this study also targets this initiative.
- Education based on a tailored offering, which involves students themselves in the process of curricula creation to give them a flexible, personalised and participatory education offer based on the use of high technology that allows this flexibility.
- Higher education as part of the lifelong learning framework, based on the assumption that many students are already active in the labour market and therefore require a teaching offer tailored to their professional needs.

Schatt goes even further and claims that a four-year college programme will not be adequate for the world of work a decade later after graduation. In order to be employable, people will need flexible, short-term learning opportunities to gain some familiarity, especially with new technologies (Schatt 2023:136).

This shift observed in the development of higher education institutions, from isolated universities towards cooperating and exchanging units with the use of technology, is indeed the answer to changing expectations from learners and the university staff and the requirements of Industry 4.0. Sułkowski calls this shift the fourth wave. According to his typology, the development of universities from a historical perspective can be perceived as the subsequent waves of change:

- First wave: in the period from the Middle Ages to the Age of Enlightenment, universities were established by kings and popes, boasting relatively high independence and were truly internationalised, with some trends to become more national during the Renaissance and the Age of Enlightenment.
- Second wave: in the period of the reforms of academic education in Germany in the 19th century, universities followed the ideas of the Age of Enlightenment, where culture-creating aspect and building national identity became two important paradigms. One of the embodiments of this approach was the Humboldtian University.

- Third wave: in the middle of the 20th century, the post-Humboldtian era brought the changes to the organisation of universities resulting from commercialisation of education and research, the development of private universities, the growing competition in the education market and closer cooperation between higher education and business for better profits from research. Accordingly, the business and management model at universities started to shift towards a corporate type. The main characteristics of such universities are entrepreneurship, effective and integrated management, competitiveness, cooperation with the broader ecosystem and innovation.
- Fourth wave: the current, modern universities in which organisational changes follow the logic of global changes connected with networking and digitalisation (Sułkowski 2022:19–34).

Accordingly, technology and digital transformation are key elements in the overall organisational changes at universities nowadays. Latusek-Jurczak (2019:169) claims that technology enhances and fosters interactions within virtual and temporary organisations. As will be shown in the research part, European collaborative and cooperation projects, which are forms of temporary organisations, are the driving forces behind the processes of organisational change. This also implies that digital competences, and consequently, the social ones, are expected to facilitate the sustainability of this transformation, for which the times of the COVID-19 pandemic were a testing ground. Again, the empirical part of this book proves it. In this sense, digital transformation is not only imposed by the requirements of Industry 4.0, but it is also urgently needed to maintain sustainability in times of crisis. Furthermore, digital transformation should lead to the adaptation of a new business model that is resilient in the context of the broader ecosystem (Mazurek 2020:71). This broader context also means the need for networking and digitalisation of whole societies resulting from the dynamics of global changes (Strielkowski and Wang 2020:1–4).

Generally speaking, the fundamental attribute of organisations of the future is the ability to change. The need for this ability results from the growing importance of gaining a competitive advantage in increasingly global and competitive environments. This context requires, first of all, technological flexibility and fast reactions to changes in the environment on the part of organisations (Barczak, Bartusik and Kozina 2018:389). This ability, as an organisational feature, is fundamental in the context of the research presented further in this book, as it refers to both competences and networking as key drivers for success.

Taking into account that the idea of competences of the future, as well as the development of effective networks depend substantially on the use of technology, we arrive at the point at which all these three domains, namely,

competences 4.0, business model based on networking and digital transformation, come together as one matrix, which is the base for the overall development of effective and successful organisations of the future. The subsequent chapters of this book will show how research proves this overarching thesis.

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3 The resilience of educational leaders during the COVID-19 pandemic

3.1 Educational leaders' effectiveness in managing and sustaining international cooperation projects during the COVID-19 pandemic

The times of the COVID-19 pandemic and the challenges connected with sustaining international cooperation within European projects, or temporary organisations as they might be called, can be treated as a unique opportunity to research on relational and network paradigms in management. Since these paradigms were implemented in the science of management as an answer to unstable socio-economic and political situations (Borgatti and Foster 2003; Stead and Stead 2008; Czakon 2011; Woźniak-Sobczak 2015), it seems plausible to test their assumptions in practice during the crisis evoked by the pandemic. The relational and network paradigms, as well as their postulates for strategic management, assume that in current and difficult-to-anticipate social, economic and political conditions, effectiveness and competitive advantage on the market can be achieved through implementing a proper organisational structure. Such a structure is based on specialist, non-hierarchical, dispersed and complementary units that work together with the use of high technology to achieve better results. The analogy to the functioning of Erasmus+ projects as temporary organisations is obvious here since the aim of Erasmus+ projects is to design, develop and implement new products and services for the educational market. Besides, Erasmus+ projects and their leaders are a perfect research target group because they fulfil all the criteria enlisted in literature (Kast and Rosenzweig 1970; Thorelli 1986; Jarillo 1988; Powell 1990; Miles and Snow 1992; Packendorff 1995; Achrol 1997; Van Alstyne 1997; Podolny and Page 1998; Palmer and Richards 1999; Birkinshaw and Hagstrom 2000; Rice and Gattiker 2000; Baker and Faulkner 2002; Czakon 2012; Wieland and Wallenburg 2012; Stańczyk-Hugiet 2012; Woźniak-Sobczak 2015; Sułkowski 2015; Beliczyński 2018; Stabryła, Tyrańska and Walas-Trębacz 2018). These criteria and organisational features are as follows:

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- Dispersed, non-hierarchical character of business partnerships, and voluntary character
- The use of digital tools connecting partners within an organisation and digital competences that allow effective communication and coordination
- Complementary mix of competences – modern international businesses and organisations use the complementarity of expertise of their constituting partners and units
- Communicative aspect of effective cooperation in which social competences play a crucial role
- Relationship between partners where social competences are the key to success;
- Adaptability and flexibility which are also elements of social competences
- Learning organisations in order to survive in a constantly changing environment, modern organisations need to learn all the time.

Erasmus+ projects are clearly formal, dispersed, networked, learning and collaborative organisations established for gaining specific social and business aims.

On a more practical level, the research in this part of the study concentrated on digital and social competences and how they enabled educational leaders and their organisations to manage, sustain their activities and gain a competitive advantage in difficult times, especially since the COVID-19 pandemic negatively impacted mobility and the ease of communication in big and dispersed organisational structures. Social competence, though considered as a contextual factor, along with digital competence, is a prerequisite for digital transformation from the skills perspective. If we treat digital competence as the technical side of this transformation, or a specific kind of "hardware" competence, then social competence should be treated as "software" and the driving force behind operations based on technology. The use of technology does not function in a vacuum – it has a purpose: more effective communication and collaboration. The communicative and collaborative aspect can be seen, for example, in reference to organising and administering online courses, virtual labs and virtual campuses, where effective communication between students, academic staff or administration, as well as communication with individuals or institutions from outside an organisation using technologies, is fundamental. Here, not only digital competences are required but also social competences connected with the ability to communicate, maintain contacts and adapt quickly to new situations and challenges if required.

This study also takes into consideration other contextual, from the point of view of this study, and typical features of networked organisations enlisted above. The research matter forms here the realm which can be depicted as follows: networked organisations need technology for more

effective operations, which results from their dispersed character. The use of technology for communication and cooperation requires both digital and social competence. Finally, achieving synergy for a competitive advantage requires complementarity of expertise and competences, which in turn is fostered by working and learning together in a flexible way. Accordingly, the following research primarily focuses on digital competence but also considers other elements that contribute to organisational effectiveness, as digital maturity is measured by the level of this effectiveness.

It is worth adding here that bibliometric analysis has proven that this part of the study fills a research gap in the following areas:

- In-depth analysis and extensive research on the management of Erasmus + projects
- The use of predictive analysis in research on Erasmus+ projects
- Verifying the thesis that competences 4.0, especially digital and social ones, facilitate the sustainability of temporary organisations such as Erasmus+ projects in difficult times.

Accordingly, the first research of this study attempted to measure educational leaders' digital maturity through their effectiveness in managing and sustaining international cooperation projects during the COVID-19 pandemic. It must be noted at this point that the data used in this research was collected for previously published research aimed at assessing European project leaders' competences 4.0 and the influence of these competences on project leaders' performance during the COVID-19 pandemic (Poszytek 2021b). In this case, this data turned out extremely useful for carrying out separate research on European project leaders' digital maturity and digital transformation within their institutions. Furthermore, in this case, different approaches, techniques and calculations were used, which contributes significantly to the validity of both studies since no contradictory conclusions could be reported as a result of these two different research activities. The research was carried out among almost 3,000 project leaders within the Erasmus+ Programme coming from public, NGO and private sectors. About 1,072 project leaders responded, out of which 990 fulfilled the criteria and were introduced into the final research group. This actually means that the research was not carried out on a sample of projects but on a substantial part of the whole "universe" of these temporary organisations. Most of the project coordinators (80%) come from the public sector. NGOs and the private sector are represented by 13% and 7% of the respondents, respectively, which reflects the participation distribution structure of Erasmus+ participants' profiles. Out of the 990 qualified respondents, 422 come from the school sector, 233 from the vocational sector, 141 from higher education

institutions, 128 from the youth sector and 98 from the adult education sector. All these respondents cover all Erasmus+ Programme actions. In most cases, projects were realised within a group of one to three international partners. 16% of the respondents confirmed that their project included over five partners from abroad. 26% of the project leaders coordinated two or three projects simultaneously, whereas 67% coordinated only one project. 52% of the respondents managed the project independently, and 48% shared coordination responsibilities. An online questionnaire (see Annex II – the full version of the survey questionnaire) in the form of computer-assisted web interviewing (CAWI) was used for the research. The online questionnaire consisted mainly of closed questions, but in some cases, there were also open-ended questions, making a total of 70 questions. The questions covered various aspects, including the process of projects' realisation during the COVID-19 pandemic, difficulties, challenges and the solutions implemented by project leaders. Some questions directly referred to the project leaders themselves and their personal features in the context of their declared level of digital, managerial, cognitive and social competences. The study showed that assessing digital maturity cannot be done by considering only digital competences and neglecting the social aspect of the phenomenon. This approach is also present in various theoretical models (Hecklau, Galeitzke, Flachs and Kohl 2016; Pinzone, Fantini, Perini, Garavaglia, Taisch and Miragliotta 2017; Bawany 2017; Barata, Da Cunha and Stal 2018; Karabiegović 2018; Erol, Jäger, Hold, Ott and Sihn 2018; Imran and Kantola 2018; Włoch and Śledziewska 2019; Ellis and Van Der Merwe 2019; Makieła, Stuss and Szczepańska-Woszczyna 2019; Zabolotniaia, Cheng and Dacko-Pikiewicz 2019; Dobrowolska and Knop 2020). Most of the questions were based on the Likert-type scale to measure the intensification and level of certain features, in this case, competences. Other questions that were not based on the Likert-type scale were mostly contextual. The research tool aimed to assess the extent to which respondents agreed or disagreed with relevant issues included in subsequent questions. All indicator questions were coded in such a way that the value 1 means the lowest level of the assessed feature, and the value 5 means its highest level. All questions with inverted scales were re-coded to maintain the cohesion of the analysis. The objective of the research was not to measure the level of each competence in an individual case of each project leader but to assess to what extent individual competences are useful in managing and sustaining projects during the COVID-19 pandemic. The research was based on declarative data, where the respondents assessed the level of their competences themselves through various indicators. Some questions aimed directly at eliciting the answer if, according to the respondents, a certain feature or competence was useful and helpful in the management of the projects. The

questionnaire also assessed the level of advancement of the project leaders, their experience in managing Erasmus+ projects and whether a given project resulted in success or was suspended or cancelled due to the COVID-19 pandemic, and to what extent their digital and social competences contributed to this process. The analysis of this research included both moderation and advanced statistical techniques, such as logarithmic regression used for prediction. In some aspects, the analysis was also based on the concept of a composite index in relation to the learning potential of educational leaders.

3.2 Digital and social competences as a protective shield against the COVID-19 pandemic

The main focus here is on digital competences directly connected with the broader notion of Industry 4.0 and digital transformation, as already explained. Although social competences are treated as contextual factors, they are an important part of this study due to the relational and networking character of Erasmus+ projects. On a practical level, digital competences in reference to the management of Erasmus+ projects are defined here by the following factors:

- Own preparation for online work
- Using e-banking services
- Filing tax returns online
- Filing an official application via an electronic system
- Making use of an electronic document workflow
- Organising one's own online work
- Starting a video conference with several people at the same time
- Protecting one's own PC from network viruses
- Sharing the screen with others during a video conference
- Being up to date with modern ICT solutions that can be used at work
- The use of web resources
- The use of text editors (e.g. Microsoft Word)
- The use of spreadsheets (e.g. Microsoft Excel)
- The use of instant messengers
- The use of e-mail
- The use of online collaboration tools
- The use of video conferencing tools
- The use of project management tools.

It must also be stressed that the indicators of these digital competences are determined by the specificity of Erasmus+ projects and the role of their

leaders. Accordingly, social competences about the management of Erasmus+ projects are defined as follows:

- Effective cooperation within a group
- Ability to establish new contacts, create a group
- Maintaining relationships and contacts
- Initiative in action
- Leadership
- Effective communication skills
- Emotional self-control
- Coping with uncertainty among group members
- Entrepreneurship and emotional intelligence, including soft competences such as personal flexibility and interdisciplinarity.

3.2.1 Study design and analysis

In light of the research questions formulated in the introduction and the definition of the competence 4.0 model with digital competences in Chapter 1, the following analysis design was proposed (Table 3.1):

Table 3.1 Analysis design

No. of research activity	*Purpose of research activity*	*Stage*
RA1	Establishing the framework of Erasmus+ project leaders' digital and social competence profile	Competences' models; factor analysis which helped to fine-tune and calibrate research competence model and questionnaire results (990 respondents)
RA2	Defining research group that is statistically meaningful, significant and valid	Dividing the research group into quartiles: the top 25% of performers and the bottom 25% of performers
RA3	Finding possible relationship between the level of Erasmus+ project leaders' digital competences and the sustainability of their projects	Data analysis

(*Continued*)

Table 3.1 (Continued)

No. of research activity	*Purpose of research activity*	*Stage*
RA4	Finding possible relationship between the level of Erasmus+ project leaders' digital competences and social competences in the context of project sustainability	Data analysis
RA5	Finding possible relationship between the level of Erasmus+ project leaders' digital competences and contextual factors in the context of project sustainability	Data analysis
RA6	Predictive analysis in relation to Erasmus+ project leaders' digital and social competences	Data analysis
RA7	Formulating conclusions	Data analysis

Source: Own work.

3.2.2 Results and discussion

3.2.2.1 Establishing the framework of Erasmus+ project leaders' digital and social competence profile

After data collection, factor analysis was performed to refine the competences model. The method used to extract factors was the Principal Component Method, and the Rotation Method used was Oblimin with Kaiser's normalisation. This analysis resulted in the identification of subsequent dimensions for digital and social competences. As a result of this analysis, the subsequent dimensions were extracted for digital and social competences (Tables 3.2 and 3.3).

For digital competence, two dimensions (factors) were extracted:

- Dimension 1: Digital competence – the use of computers in everyday work
- Dimension 2: Digital competence – work with online documents.

Table 3.2 Model matrix for digital competence

Model matrix	*Component*	
	1	*2*
Video conferencing tools	0.899	
Online collaboration tools	0.881	
Instant messengers	0.859	
Text editors (e.g. Microsoft Word)	0.806	
E-mail	0.761	
Web resources	0.756	
Please rate your overall level of proficiency in using modern technology	0.637	
Sharing the screen with others during a video conference	0.629	
Project management tools	0.614	
Starting a video conference with several people at the same time	0.612	
Please rate how up-to-date you are with modern ICT solutions that can be used in your work	0.593	
Spreadsheets (e.g. Microsoft Excel)	0.483	
Filing an official application via the ePUAP system		0.904
Filing your tax return online		0.842
Using e-banking services		0.786
Organising my own online work		0.751

Source: Own work.
Method of extracting factors – Principal Component Method.
Rotation method – Oblimin with Kaiser Normalisation.
a. Rotation converged in four iterations.

R2 (percentage of variance explained) = 57.5%

Four dimensions (factors) were extracted for social competence:

- Dimension 1: Social competence – relationship and emotions
- Dimension 2: Social competence – adaptability and managing stress during the pandemic
- Dimension 3: Social competence – maintaining contacts, cooperation
- Dimension 4: Social competence – communication.

Table 3.3 Model matrix for social competence

Model matrix	*Component*			
	1	*2*	*3*	*4*
I am a person who maintains relationships with others	0.699	N/A	N/A	N/A
Noticing co-workers' problems, including those concerning their private lives, socio-economic situation, etc.	0.632	N/A	N/A	N/A
I like cooperating with others, completing tasks in a team	0.616	N/A	N/A	N/A
I can identify emotions that accompany me in a given moment	0.610	N/A	N/A	N/A
I can feel what emotional state my interlocutor is in	0.587	N/A	N/A	N/A
Create an atmosphere of effective cooperation within the team	0.583	N/A	N/A	N/A
Mitigating possible conflicts between co-workers	0.555	N/A	N/A	N/A
I have a wide network of friends	0.545	N/A	N/A	N/A
I can control my negative emotions	0.506	N/A	N/A	N/A
I can alleviate the stress of online work for others	0.488	N/A	N/A	N/A
I can separate people from their views	0.446	N/A	N/A	N/A
Situation of risk to the health of co-workers	N/A	0.903	N/A	N/A
Situation of risk to my own health and the health of those close to me	N/A	0.891	N/A	N/A
General pandemic uncertainty	N/A	0.781	N/A	N/A
Adapting the way project activities are implemented to the pandemic period	N/A	0.569	N/A	N/A
I have my own contact network of persons with whom I can carry out joint projects	N/A	N/A	0.827	N/A
I have a sense of systematic cooperation with a permanent group of institutions	N/A	N/A	0.743	N/A

(*Continued*)

Table 3.3 (Continued)

Model matrix	*Component*			
	1	*2*	*3*	*4*
I have initiated cooperation within the project by myself on at least one occasion	N/A	N/A	0.715	N/A
Assertive refusal	N/A	N/A	N/A	−0.725
Communicating difficult messages	N/A	N/A	N/A	−0.696
Clear and precise communication	N/A	N/A	N/A	−0.686
Moderating discussions	N/A	N/A	N/A	−0.572
Actively listening to others	N/A	N/A	N/A	−0.537
Adjusting communication style and language to the audience and circumstances	N/A	N/A	N/A	−0.507
Accepting praise, compliments	N/A	N/A	N/A	−0.501

Source: Own work.
Method of extracting factors – Principal Component Method. Rotation method – Oblimin with Kaiser Normalisation.
a. Rotation converged in five iterations.

R2 (percentage of variance explained) = 45%

Next, the Cronbach's alpha value was calculated. It was assumed that if this value is over 0.7, the reliability of the scale in subsequent dimensions of competences can be guaranteed. Table 3.4 presents the result of this analysis.

3.2.2.2 Defining research group that is statistically meaningful, significant and valid

At this stage, the level of Erasmus+ project leaders' digital competences was calculated. The data shows that the respondents assessed their digital competences as relatively high, with an average score of 4.33 on the five-point Likert-type scale (Table 3.5).

3.2.2.3 Finding possible relationship between the level of Erasmus+ project leaders' digital competences and the sustainability of their projects

Further analysis resulted in distinguishing two groups of Erasmus+ project leaders: worst performers in digital competences (lowest quartile;

Table 3.4 Cronbach's alpha value for digital and social competences' dimensions

Competences	*Dimensions*	*Cronbach's alpha*
Digital	The use of computers in everyday work	0.91
	Work with online documents	0.85
Social	Relationship and emotions	0.81
	Adaptability and managing stress during the pandemic	0.80
	Maintaining contacts, cooperation	0.72
	Communication	0.74

Source: Own work.

Table 3.5 Distribution of Erasmus+ project leaders' digital competences in percentiles

No. of respondents		990
Average score		4.3316
Median		4.3750
Minimal score		2.06
Maximum score		5.00
Percentiles	25	4.0000
	50	4.3750
	75	4.7500

Source: Own work.

N = 220) and best performers in digital competences (upper quartile; N = 255) in order to compare how these two groups performed during the COVID-19 pandemic in relation to their projects' sustainability. Overall, 21% of the best digital performers suspended or prolonged their Erasmus + projects. In the group of worst digital performers, this value rose up to 29%. This observation addresses the main issue of Erasmus+ projects' sustainability during the COVID-19 pandemic and is reflected in Table 3.6.

Table 3.6 Status of the Erasmus+ project in distinguished quartiles of the opinions of the project leaders on their digital competences

Digital competences	*Project status*	*N*	*%*
Worst digital performers: below first quartile	Project finished or ongoing	156	70.9
	Project suspended or prolonged	64	29.1
Best digital performers: above third quartile	Project finished or ongoing	201	78.8
	Project suspended or prolonged	54	21.2

Source: Own work.

3.2.2.4 Finding possible relationship between the level of Erasmus+ project leaders' digital competences and social competences in the context of project sustainability

The next step was to establish the relationship between the level of Erasmus + project leaders' digital competences and the levels of their social competences in the context of Erasmus+ projects' sustainability (Table 3.7).

These results lead to the following conclusions: in both groups, low digital competences correlate with low social competences, and high digital competences correlate with high social competences. This correlation is not surprising since Erasmus+ projects are typical temporary international

Table 3.7 Worst and best digital performers among Erasmus+ project leaders and their social competences

Digital competences	*Social relationship and emotions (dimension 1)*	*Social adaptability and managing stress during the pandemic (dimension 2)*	*Social maintaining contacts, cooperation (dimension 3)*	*Social communication (dimension 4)*
Worst digital performers: below first quartile	3.7236	1.7080	3.7015	3.3942
Best digital performers: above third quartile	4.1073	1.8559	4.1190	3.7922

Source: Own work.

organisations of a relational and networking character. It also indicates that during the times of the COVID-19 pandemic, which posed challenges in relation to effective cooperation and communication, maintaining contacts, cooperation, communication and the ability to adapt quickly were facilitated by a broadly understood digital competence. Both digital and social competences enabled effective collaboration in the case of a breakdown in personal contacts. Accordingly, digital and social competences, as reflected in the data presented above, provide a specific protective shield for educational organisations against the negative effects of the COVID-19 pandemic.

3.2.2.5 Finding possible relationship between the level of Erasmus+ project leaders' digital competences and contextual factors in the context of project sustainability

Competences as such do not function in a vacuum, and the assessment of how Erasmus+ project leaders' competences facilitate the sustainability of their projects should also consider other contextual factors, such as the age of a project leader, sex, work experience, type of institution, number of partners in a project or project budget. The retrieved and processed data in this respect shows that the above-mentioned moderators have almost identical distributions in both researched groups. However, slight differences were observed in relation to project leaders' age. The young leaders and men declared slightly higher digital competences, but there was no significant relationship with projects' sustainability.

For a better insight into other possible contextual factors that may have an influence on Erasmus+ projects' sustainability during the COVID-19 pandemic, the respondents' answers to questionnaire have been used once again. In Table 3.8, the distribution of answers in both analysed categories

Table 3.8 Distribution of answers to the questions on contextual factors of the project sustainability in both categories of Erasmus+ project leaders

Contextual factors of the project sustainability	*Quartile*	*Answers*	*N*	*%*
The effectiveness of conducted projects during the COVID-19 pandemic	Question 1: In your opinion, to what extent the project activities conducted during the COVID-19 pandemic were implemented successfully?			
	Worst digital performers: below first quartile	Maximum in 25%	88	40.0
		Maximum in 50%	53	24.1

(*Continued*)

Table 3.8 (Continued)

Contextual factors of the project sustainability	*Quartile*	*Answers*	*N*	*%*
		Maximum in 75%	28	12.7
		Between 75% and 100%	51	23.2
	Best digital performers: above third quartile	Maximum in 25%	93	36.5
		Maximum in 50%	45	17.6
		Maximum in 75%	43	16.9
		Between 75% and 100%	74	29.0
The quality of management	Question 2: Please, undertake a self-evaluation and generally rate your work as a project coordinator.			
	Worst digital performers: below first quartile	3 Sufficient	23	10.5
		4 Good	144	65.5
		5 Very good	30	13.6
		Difficult to say	23	10.5
	Best digital performers: above third quartile	1 Very poor	1	.4
		3 Sufficient	5	2.0
		4 Good	111	43.5
		5 Very good	114	44.7
		Difficult to say	24	9.4
The quality of management Development of human capital Adaptability	Question 3: With regard to yourself, do you have a sense of continuous learning, or do you tend to rely on previously acquired knowledge and skills?			
	Worst digital performers: below first quartile	Yes, I'm still developing	105	47.7
		I'm still developing, but more slowly than I used to	114	51.8

(*Continued*)

Table 3.8 (Continued)

Contextual factors of the project sustainability	*Quartile*	*Answers*	*N*	*%*
		I have no need for development – I rely on previously acquired knowledge and skills	1	0.5
	Best digital performers: above third quartile	Yes, I'm still developing	223	87.5
		I'm still developing, but more slowly than I used to	32	12.5
Development of human capital Adaptability	Question 4: Do you have a planned path for your own development, career?			
	Worst digital performers: below first quartile	Yes, I have a clearly defined path	51	23.2
		Yes, but the path is rather general	122	55.5
		No, I do not currently have such a plan	47	21.4
	Best digital performers: above third quartile	Yes, I have a clearly defined path	132	51.8
		Yes, but the path is rather general	104	40.8
		No, I do not currently have such a plan	19	7.5
Emotional engagement	Question 5: To what extent, in your own estimation, are you emotionally and personally involved in the project?			
	Worst digital performers: below first quartile Best digital	1	1	0.5
		2	3	1.4
		3	23	10.5

(*Continued*)

Table 3.8 (Continued)

Contextual factors of the project sustainability	*Quartile*	*Answers*	*N*	*%*
	performers: above third quartile	4	70	31.8
		5	123	55.9
	Worst digital performers: below first quartile	2	2	0.8
		3	6	2.4
		4	47	18.4
		5	200	78.4

Source: Own work.

of project leaders has been grouped according to contextual factors related to the projects' sustainability.

The following conclusions can be drawn from these results:

- About 45.9% of the best digital performers and 35.9% of the worst digital performers stated that their project activities were realised successfully in 75% or more during the COVID-19 pandemic. This indicates that Erasmus+ project leaders with higher digital competences turned out to be more effective in the management and sustainability of their projects. Consequently, the observed relationship here is that the higher the digital competences, the higher the effectiveness in project sustainability.
- Best digital performers evaluate themselves better as project leaders. In the group of best digital performers, 44.7% of project leaders assessed themselves as very good, whereas in the worst digital performers group, it is only 13.6%. This suggests that the quality of project management is significantly affected by the level of digital competences.
- According to 87.5% of the best digital performers and only 47.7% of the worst digital performers, they are still developing. This implies that there is a relationship between the level of digital competences and the quality of project management, as well as the development of human capital within a broader lifelong learning concept. Reference is made to the latest studies emphasising that future competences, including digital ones, can effectively develop within the lifelong learning process (Ehlers and Kellermann 2019; Ehlers 2020). This data also proves that the best digital performers adapt better in relation to the external conditions in which their projects function. This brings the discussion back to the issue

of networking and relational character of modern organisations and the role of flexibility and adaptability that influence project sustainability previously described.
- The relationship between the level of digital competences and the development of human capital can also be observed. According to 51.8% of the best digital performers and only 23.2% of the worst digital performers, they have a planned development path.
- Emotional engagement also turned out to be a significant contextual factor contributing to Erasmus+ projects' sustainability in the times of the COVID-19 pandemic, as 78.4% of the best digital performers and only 55.9% of the worst digital performers declared the highest level of their engagement.

Since the contextual factor of learning potential that appeared here constitutes a separate realm, very characteristic for technology-bound networked organisations, it will be additionally analysed in detail further on in this book using other research techniques.

3.2.2.6 Predictive analysis in relationship to Erasmus+ project leaders' digital and social competences

In the next stage, predictive analysis in the form of logarithmic regression was carried out to determine if higher levels of Erasmus+ project leaders' digital and social competences could possibly influence their projects' sustainability. Accordingly, the underlying question referred to what relationships could be observed between a dependent binary variable, meaning a successful continuation of a project or its suspension, and independent variables, which in this case are Erasmus+ project leaders' digital and social competences. In practical terms, it means checking by how many percentage points the chances of project continuation or suspension decrease or increase if the value of Erasmus+ project leaders' digital or social competences increases by 1. The levels of Erasmus+ project leaders' digital and social competences were established on the basis of model matrixes for these competences (Table 3.2 and 3.4) and data obtained from the questionnaire (Annex II). The obtained detailed values referring to competences' dimensions were as follows (Table 3.9):

The data shows that the respondents assessed their digital competences as relatively high, with an average score of 4.33 on the five-point Likert-type scale. It shows the natural fluency with which project coordinators already find themselves in the digital world and the online mode of work. The digital competence in this research had two dimensions: using computers in everyday work and working with online documents – both were assessed as relatively high by the majority of respondents. The social

Table 3.9 The Erasmus+ project leaders' digital and social competence profile

Competences	*Dimensions*	*Average level of competences (scale 1–5)*
Digital	The use of computers in everyday work	4.37
	Work with online documents	4.18
Social	Relations and emotions	3.94
	Adaptability and managing stress during the pandemic	1.74
	Maintaining contacts, cooperation	3.96
	Communication	3.63

Source: Own work.

competence is more complex and sophisticated, including four different dimensions. The highest one was assessed at 3.96, as a dimension of maintaining contacts with others and cooperation. Furthermore, the dimension related to creating relationships and managing emotions (personal as well as team members' emotions) by project leaders was assessed at the level of 3.94. The third dimension referred to communication skills and abilities was also highly rated: on an average level of 3.63. However, Erasmus+ project leaders scored very poorly in the dimension of adaptability and managing stress during the pandemic. This dimension of social competence was the weakest according to project leaders' judgements, reaching a remarkably low level of 1.74. This shows how unusual and stressful the environment was due to the COVID-19 pandemic in which coordinators had to function in order to deliver results in their projects.

Having obtained the values of Erasmus+ project leaders' digital and social competences, the core part of a predictive analysis using logarithmic regression could be carried out. The digital and social competences of Erasmus+ project leaders, along with selected contextual factors, served as independent variables, and the suspension of a project was the dependent variable as explained above. At this point, the significance of Erasmus+ project leaders' digital competence, social competence and some of the contextual factors as predictors was assessed. Two dimensions of digital competence were analysed: using a computer in everyday work and working with online documents, and the following four dimensions of social competence were considered: relations and emotions; adaptability

and managing stress during the pandemic; maintaining contacts and cooperation; and communication. The subsequent dimensions of digital and social competences, as well as some of the contextual factors, can be treated as significant predictors in the logarithmic regression analysis only if the obtained value is lower than 0.05. This, in turn, allows the parameter Exp(B), the exponentiation of the coefficients that shows the odds ratios for a given predictor, to be calculated. The obtained results were as follows:

As can be seen from Table 3.10, the obtained data can be translated into the value of (Exp(B)1)*100%, which shows by how many percent the chances

Table 3.10 Significance of digital competence, social competence and contextual factors as predictors on the basis of logarithmic regression analysis and their Exp(B) value

Predictors	*B*	*Significance*	*Exp(B)*
Social competence: relationships and emotions	−0.069	0.758	0.933
Social competence: adaptability and managing stress during the pandemic	−0.578	<0.001	0.561
Social competence: maintaining contacts and cooperation	−0.036	0.731	0.965
Social competence: communication	0.038	0.829	1.038
Digital competence: using computers in everyday work	−0.297	0.107	0.743
Digital competence: work with online documents	0.038	0.744	1.039
Only person managing the project	0.409	0.006	1.505
Professional time spent on project management		0.005	
Professional time spent on project management: 20–75%	−0.432	0.007	0.649
Professional time spent on project management: more than 75%	−1.001	0.009	0.367
Length of service at the institution where the surveyed project was implemented: 10 years and more	0.462	0.005	1.587
Project budget: more than EUR 200,000	−1.422	<0.001	0.241
Constant	1.352	0.123	3.867

Source: Own work.

of project suspension decrease or increase if the value of a given independent variable – in this case, the level of project leaders' digital competence and social competence – increases by 1 on the Likert-type scale (see Table 3.9). For example, this data means that if the value of project leaders' social competence in the dimension of adaptability and managing stress during the pandemic was 2.74 instead of 1.74 as assessed by the leaders themselves on the Likert-type scale from 1 to 5 (Table 3.9), then the chances of suspending their projects would decrease by 44%. This indicates that social competence in the dimension of adaptability and managing stress plays a significant role in effective management and sustainability of projects (Table 3.11).

Table 3.11 The chances of project suspension/continuation in relationship to a significant predictor

Predictor	*Decrease of a chance to suspend a project*	*Increase of a chance to suspend a project*
Social competence: relationships and emotions	7%	–
Social competence: adaptability and managing stress during the pandemic	44%	–
Social competence: maintaining contacts and cooperation	3%	–
Social competence: communication	–	4% (reverse tendency)
Digital competence: using computers in everyday work	26%	–
Digital competence: working with online documents	–	4% (reverse tendency)
Only person managing the project	51%	–
Professional time spent on project management: 20–75%	35%	–
Professional time spent on project management: more than 75%	63%	–
	–	

(*Continued*)

Table 3.11 (Continued)

Predictor	*Decrease of a chance to suspend a project*	*Increase of a chance to suspend a project*
Length of service at the institution where the surveyed project was implemented: 10 years and more		59% (reverse tendency)
Project budget: more than EUR 200,000	76%	–

Source: Own work.

In the case of contextual factors, the independent variables were as follows:

- Only person managing the project: a nominal variable with two values: 0 – "NO", 1 – "YES"
- Professional time spent on project management: a nominal variable with three values: 0 – "less than 20%", 1 – "between 20% and 75%", and 2 – "more than 75%"; (0 as the reference point)
- Seniority of the coordinator: a nominal variable with two values: 0 – "less than 10 years", and 1 – "10 years and more"
- Project budget: a nominal variable with two values: 0 – "less than EUR 200,000" and 1 – "at least EUR 200,000".

In detail, the data shows that:

- Higher level of social competence (except for dimension 4) decreased the chance of project suspension
- Using computers in daily work decreased the chance of project suspension
- Working with online documents slightly increased the chance of project suspension
- Independent project management increased the chance of project suspension
- Greater project leader personal engagement decreased the chance of project suspension
- Longer work experience of the coordinator increased the chance of project suspension
- Higher project budget decreased the chance of project suspension.

Table 3.11 presents the chances to suspend or continue a project expressed in percentage in relation to the above predictors.

It must be noted that among all the competences included in the model, only the second dimension of social competence, namely, adaptability and

managing stress during the pandemic, significantly affects the project status. Additionally, digital competence in the dimension of using a computer in everyday work is also an influential factor that determines the status of projects. Regarding contextual factors, the project budget and the time spent on project management are the most powerful determinants for the continuation of projects. Interestingly enough, a longer service at the institution where projects are realised and managed leads to a higher chance of suspending these projects (reverse tendency). Previous research that also included the analysis of cognitive and managerial competences, published by Poszytek (2021b), yielded very similar results, although slightly different methods and statistical models were used. This means that both research results have been successfully cross-validated.

Furthermore, the data obtained and presented in Tables 3.9, 3.10 and 3.11 lead to the conclusion that even if Erasmus+ project leaders' digital competence reached the maximum value of 5 on the used Likert-type scale, it would not significantly affect the chances of continuation or suspension of the projects. This predictive analysis treats Erasmus+ project leaders as a group and does not undermine the results presented in the initial stages of this study, which show differences in effective performance between low and high performers among Erasmus+ project leaders concerning their digital competences. This also proves that while differences in projects' sustainability between these two extreme groups of Erasmus+ project leaders can be observed, the entire examined population of 990 Erasmus+ project leaders is relatively homogenous in terms of their levels of digital competence. This leads to the conclusion that Erasmus+ project leaders' digital competences are high enough to sustain their projects in difficult times. The predictive analysis proved that even higher digital competence would not influence their effectiveness in this respect.

To guarantee the validity of the predictive analysis, the research model for prediction underwent quality assessment with the following tests (Table 3.12):

Table 3.12 Omnibus tests of model coefficients

Omnibus test of model coefficients				
		Chi-square	*df*	*Significance*
Step 1	Step	79.475	11	<0.001
	Block	79.475	11	<0.001
	Model	79.475	11	<0.001

Source: Own work.

Table 3.13 Hosmer and Lemeshow test

Hosmer and Lemeshow test			
Step	*Chi-square*	*df*	*Significance*
1	3.796	8	0.875

Source: Own work.

This test assesses whether the used research model differs from a model based only on a constant variable (without predictors). A significant result is expected, and it has been obtained (Table 3.13).

This test assesses whether the data recreated based on the research model differs from the actual data. An insignificant result is expected, and it has also been obtained. The result of the goodness-of-fit test is not statistically significant, which indicates that the model is a good fit to the data. The critical significance level is "better" than for the "base" model (Table 3.14).

The assessment of classification quality using the area under the ROC curve checks whether the research model differs from a random model. A significant result is expected here, with a random model having an area of 0.5. In this case, the result is even higher, which proves the validity of the model. The model has a relatively high predictive ability (the percentage of correct classifications was 71.4). The model is significantly different from the random model. In addition, the area under the ROC curve in this model is smaller compared to the "base" model by 0.003, so there is no difference in the predictive ability of the two models.

Table 3.14 Test result variable(s): predicted probability. Area under the ROC curve

Test result variable(s): predicted probability				
			Asymptotic 95% confidence interval	
Area	Std. error	Asymptotic significance	Lower bound	Upper bound
0.673	0.018	0.000	0.637	0.709

Source: Own work.
The test result variable(s): Predicted probability has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.
Under the nonparametric assumption.
Null hypothesis: true area = 0.5.

3.2.2.7 Formulating conclusions

To sum up, the following findings from this part of the study must be stressed. Firstly, initial part of the study shows that there is a significant difference in the ratio of suspended Erasmus+ projects between the best and worst digital performers groups of Erasmus+ project leaders. The former group is more effective in their operations within their projects than the latter one. Secondly, the analysis demonstrates that Erasmus+ project leaders' digital competences, as a whole, are high enough to form a protective shield against the COVID-19 pandemic in European transnational cooperation. Potentially higher digital competences among Erasmus+ project leaders would not have a significant impact even on the lower proportion of suspended projects. Thirdly, social competence in the dimensions of adaptability and managing stress plays a significant role in effective project management and sustainability, as a contextual but relevant factor. Finally, it must be concluded that the effectiveness of educational leaders in sustaining their projects, using digital tools for maintaining contacts and cooperation within a broader social context, confirms the assumptions of the modern relational and network paradigms in management. And since Erasmus+ projects fulfil the criteria of being temporary organisations, this research may contribute to wider discussions on sustainability issues of modern organisations in line with the relational and networking view on management.

3.3 Educational leaders' learning potential and its influence on the sustainability of their activities

Not only does the social aspect constitute a broader ecosystem in the context of the discussion on digital maturity, but another crucial element in this discussion is the learning potential of organisations functioning within networks and basing their operations on new technologies. This aspect is often referred to by researchers who deal with relational and network paradigms in management. In the context of gaining a competitive advantage, these researchers also point out that access to information, expertise and knowledge resources, which could be difficult to obtain outside of the network of organisational units, fosters performance and innovation in various businesses and undertakings (Anand and Khanna 2000; Ilinitch, D'Aveni and Lewin 1996; Kale, Singh and Perlmutter 2000; Kogut 2000; Kraatz 1998; Oliver 2001; Powell, Koput and Smith-Doerr 1996; Rindfleisch and Moorman 2001; Rosenkopf and Nerkar 2001; Zabolotniaia, Cheng and Dacko-Pikiewicz 2019). What is also important here is that the creation of this self-learning ecosystem requires substantially developed social competences. Learning from each other and forming synergies in expertise cannot function without the ability to cooperate and maintain contacts.

This part of the study is also based on the questionnaire described in the previous section of this chapter. On the basis of survey questions, the lifelong learning composite indicator was constructed using individual indicators that are compiled into a single index. Such an index can measure multi-dimensional concepts. In this case, it is the lifelong learning dimension that cannot be captured by a single indicator or variable. Theoretical foundations for this approach were followed here after Organisation of Economic Cooperation and Development (2004). Accordingly, the lifelong learning composite index used here is a single combined measure constituted by separate, individual and independent measures.

3.3.1 Results and discussion

Table 3.15 shows the scales used for individual variables constituting the lifelong learning index.

Table 3.15 Lifelong learning index: Erasmus+ project leaders' learning potential

Questionnaire item or question	*Scale type*	*Index points (min)*	*Index points (max)*
Every crisis situation can teach you something	Likert 1–5	1	5
I like to bring ideas to life	Likert 1–5	1	5
Implementing project activities during the pandemic allowed me to test myself in completely new circumstances	Likert 1–5	1	5
How important is it for you to introduce elements of interdisciplinarity or combining disciplines and fields when implementing a European project?	Likert 1–5	1	5
I like to explore new things	Likert 1–5	1	5
I analyse my failures and setbacks	Likert 1–5	1	5
I need to know all the pros and cons before making an important decision	Likert 1–5	1	5
I can apply innovative solutions in my work	Likert 1–5	1	5
Recognise areas for change that will help to better implement the project	Likert 1–5	1	5

(*Continued*)

Table 3.15 (Continued)

Questionnaire item or question	*Scale type*	*Index points (min)*	*Index points (max)*
Identify my own strengths and weaknesses	Likert 1–5	1	5
I am aware of my own strengths and weaknesses	Likert 1–5	1	5
In connection with the ongoing pandemic, are you familiar with the frequently changing regulations and recommendations concerning work and social functioning?	Likert 1–5	1	5
The pandemic period forced me to start using new tools/software	Likert 1–5	1	5
Please rate how up-to-date you are with modern ICT solutions that can be used in your work?	Likert 1–5	1	5
Have you participated in any training courses (class-based or online) on the use of modern technology in the last six months?	Binary 0–1	1	5
How often do you participate in training courses to improve competences used at work?	Binary 0–1	1	5
Due to the COVID-19 pandemic, did you attend any training courses that would be useful in carrying out your tasks as a project leader at these unusual times?	Binary 0–1	1	5
Have you conducted any training courses in the past year?	Binary 0–1	1	5
With regard to yourself, do you have a sense of continuous learning, or do you tend to rely on previously acquired knowledge and skills?	Binary 0–1	1	5
Do you have a planned path for your own development career?	Binary 0–1	1	5
TOTAL		20	100

Source: Own work.

Table 3.16 Lifelong learning index: general statistics

No. of respondents (N)		*990*
Mean		82.61
Minimum		61
Maximum		100
Percentile	25	78.00 (N = 232)
	50	83.00 (N = 485)
	75	88.00 (N = 273)

Source: Own work.

Table 3.16 presents the obtained results in relation to Erasmus+ project leaders' ability to learn within an organisation.

The lifelong learning index values extend from 20 (min.) to 100 (max.) points (Table 3.15). The higher the value of the index, the higher the level of Erasmus+ project leaders' learning potential. The obtained standard deviation value of 7.415 indicates that the distribution of results is relatively consistent. The first percentile of worst lifelong learning performers and the third percentile of best lifelong learning performers are similar in numbers, with 232 points for worst and 273 points for best (Table 3.16). These performers have lifelong learning index values of 78 and 88 points, respectively. The lack of strong discrimination in the obtained results is natural, considering that even within such a large sample of Erasmus+ project leaders, they form a highly homogenous group by their nature. This homogeneity results from the fact that they are selected leaders undertaking voluntary innovative projects in their organisations. They undergo thorough scrutiny before receiving European grants for their projects, ensuring their capability to run such projects. This also means that they must have certain features, qualities and competences highly developed, including the ability to learn and adapt in case something goes wrong with their projects. Nonetheless, some differences can still be observed, enabling further analysis directly connected to establishing the links between Erasmus+ project leaders' learning potential and the sustainability of their projects during the COVID-19 pandemic.

Table 3.17 shows that in the group of Erasmus+ project leaders with the lowest lifelong learning index value, 30.6% of projects were suspended or prolonged. In the group with the highest lifelong learning index, this value was only 20.1%. This means that Erasmus+ project leaders with high learning potential suspended or prolonged their projects more seldom during the COVID-19 pandemic.

Table 3.17 Projects' status in relationship to Erasmus+ project leaders' lifelong learning index

Lifelong learning index (LLL index)	*Project status*	*N*	*%*
LLL index below first quartile – less than 78 points (N = 232)	Project finished or ongoing	161	69.4
	Project suspended or prolonged	71	30.6
LLL Index over third quartile – more than 88 points (N = 273)	Project finished or ongoing	218	79.9
	Project suspended or prolonged	55	20.1

Source: Own work.

3.3.2 Conclusions

The data obtained in this part of the study proves that organisational learning potential within Erasmus+ projects, manifested by the activities and attitudes of their leaders, is an influential factor contributing to the sustainability of Erasmus+ projects during the COVID-19 pandemic. This finding supports the theoretical assumptions presented earlier that functioning within a relational and network mode of work, which is characteristic of Erasmus+ projects, fosters the organisational ability to learn. It also leads to the conclusion that the turbulent and unstable conditions caused by the COVID-19 pandemic motivate organisations and their leaders to learn in order to sustain their networks, which faced potential communication and cooperation breakdowns and disruptions due to the pandemic.

The COVID-19 pandemic, as an unexpected event that created extreme conditions for business and educational activities, formed a specific testing ground for the already known and extensively researched concept of communities of practice with their learning potential. The data obtained proves that such communities, like Erasmus+ projects, achieved a competitive advantage and resilience. Many researchers claim that such a phenomenon is manifested by the need to learn and develop within networks, which consist of partners who are usually homogenous in terms of their beliefs, practices and attitudes (Brown and Duguid 1991; Rice and Aydin 1991; Lave and Wenger 1991; Rogers 1995; Orr 1996; Tyre and von Hippel 1997; Wenger 1998; Friedkin and Johnsen 1999).

3.4 Towards digital maturity of educational leaders

The analyses presented in the previous section of this chapter show that educational leaders included in the research boast a relatively high level of digital maturity, as evidenced by their effectiveness in managing and

sustaining Erasmus+ projects. The data obtained not only confirms this from the perspective of the digital skills of these leaders but also from the perspective of their social and learning potential, which are integral domains of digital transformation. Yet, for the higher validity of the study, one more research activity in the form of a digital maturity index is proposed here. The methodology used here is the same as the one described in the previous section of this chapter in relation to lifelong learning index (Table 3.18).

Table 3.18 Variables constituting the digital maturity index of Erasmus+ project leaders

Questionnaire items or questions on Likert-type scale (1–5)
Please rate how easy or difficult you find the following situations: own preparation for online work
Please rate how easy or difficult you find the following situations: adapting the way project activities are implemented to the pandemic period
Please rate how easy or difficult you find the following situations: team's preparation for online work
Please rate how much do you agree or disagree with the following statements: implementing a project during a pandemic requires special digital skills
Please rate how much do you agree or disagree with the following statements: the pandemic period forced me to start using new tools/software
Please rate how much do you agree or disagree with the following statements: educational activities can be conducted remotely without any loss in quality
Please indicate to what extent the following statements describe you: I can apply innovative solutions in my work
I believe I can: coordinate the work of a dispersed team (e.g. working remotely)
Please rate how easy or difficult you find the following tasks: using e-banking services
Please rate how easy or difficult you find the following tasks: filing your tax return online
Please rate how easy or difficult you find the following tasks: filing an official application via the ePUAP system
Please rate how easy or difficult you find the following tasks: making use of an electronic document workflow
Please rate how easy or difficult you find the following tasks: organising my own online work

(*Continued*)

Table 3.18 (Continued)

Questionnaire items or questions on Likert-type scale (1–5)
Please rate how easy or difficult you find the following tasks: starting a video conference with several people at the same time
Please rate how easy or difficult you find the following tasks: protecting my PC from network viruses
Please rate how easy or difficult you find the following tasks: sharing the screen with others during a video conference
Please rate how up-to-date you are with modern ICT solutions that can be used in your work?
I believe I have no problems using: web resources
I believe I have no problems using: text editors (e.g. Microsoft Word)
I believe I have no problems using: spreadsheets (e.g. Microsoft Excel)
I believe I have no problems using: instant messengers
I believe I have no problems using: e-mail
I believe I have no problems using: online collaboration tools
I believe I have no problems using: video conferencing tools
I believe I have no problems using: project management tools
Please rate your overall level of proficiency in using modern technology
How often do you participate in training courses to improve competences used at work?
Questionnaire item or questions on binary scale
Have you participated in any training courses (class-based or online) on the use of modern technology in the last six months?

Source: Own work.

The above compilation of 28 questions of the questionnaire constitutes the digital maturity index of project leaders. In order to make this index easier to interpret, some quantitative transformations have been made to arrive at the index values ranging from 0 to 100. The higher the value of the index, the higher the level of digital maturity and digital literacy among targeted Erasmus+ project leaders, which can be seen in Table 3.19 and Figure 3.1.

For further analysis, two groups of Erasmus+ project leaders were distinguished: worst digital performers (digital maturity index, lowest quartile) and best digital performers (digital maturity index, upper quartile).

Table 3.19 General statistics on digital maturity index

N	*990*	
Mean		76.15
Min.		36.61
Max.		98.21
Percentile	25	70.54
	50	76.79
	75	83.04

Source: Own work.

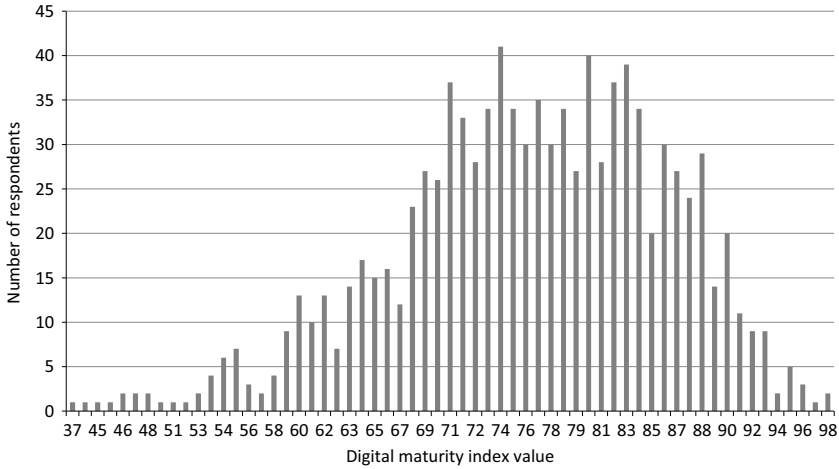

Figure 3.1 Digital maturity index of Erasmus+ project leaders (scale: 0–100).
Source: Own work.

Next, a comparison was made on how these two groups performed during the COVID-19 pandemic in relation to the sustainability of their projects.

The results' distribution, with a standard deviation value of 9.69, indicates that both groups of best and worst digital maturity index performers (first and third quartiles) are similar in numbers: worst performers (N = 280) and best performers (N = 240). The average score in the digital maturity index for worst performers is 64.15 points out of 100 points, and for best performers, it is 87.85 points.

Table 3.20 shows that in the group of respondents with the lowest digital maturity index value, 29.3% of projects were suspended or prolonged. In

Table 3.20 Project status in relation to digital maturity index of Erasmus+ project leaders

Digital maturity index	*Project status*	*N*	*%*
Index below first quartile (N = 280)	Finished/ongoing	198	70.7
	Suspended/prolonged	82	29.3
Index over third quartile (N = 240)	Finished/ongoing	192	80
	Suspended/prolonged	48	20

Source: Own work.
(correlation statistically significant, p-value = 0.018)

the group of respondents with the highest digital maturity index score, only 20% of projects were suspended or prolonged. This means that Erasmus+ project leaders who show a higher level of digital maturity less frequently suspended or prolonged their projects during the COVID-19 pandemic.

To sum up the research results from this first part of the whole study, it must be stated that the data obtained and the analyses carried out on the basis of different methodologies and from different angles prove that Erasmus+ project leaders' digital maturity is relatively high. This digital maturity is manifested through their effectiveness in sustaining and managing project activities during the times of the pandemic.

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4 Universities participating in European Universities Initiative as digital hubs

4.1 European Universities and their networking and relational character

The European Universities Initiative aims to contribute to one of the European Commission's key ideas: creating a common European Higher Education Area. As previously explained, European Universities are consortia of several higher education institutions that operate based on collectively established rules and procedures in areas such as teaching, administration and research. This collaboration should ultimately result in the establishment of a single legal entity: a European university. What we are dealing with here is a form of university merger at the European level. Sułkowski outlines the aims of universities as follows: (1) strengthening research positioning, (2) greater visibility nationwide and worldwide, (3) pursuing excellence in didactics and (4) strengthening internationalisation (Sułkowski 2017). On the practical level, a European university could offer a unified European degree or joint degree during the intermediate phase of network development. According to American researchers, Europe is a global leader in implementing such solutions, evident through the introduction and continued operation of previous European initiatives like the Erasmus Mundus Programme and Joint Master Degree Framework (Hoseth and Thampapillai 2020). For students and academics, this should provide one platform for developing an educational path and carrying out research on a broader scale. For universities themselves, the aim is to enable and foster the creation of centres of excellence in both didactic and research areas. All of this is achieved through enhanced mobility, access to resources and the use of technology, including the establishment of virtual campuses to implement the concept of blended learning – a hybrid of traditional and online methods. As previously explained, the entire idea is actually built upon existing business models that have proven highly effective. Specifically, it's the notion that a competitive advantage can be achieved by establishing a network of

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internationally dispersed units that complement each other with their expertise, forming a unique blend of competences that allows them to cultivate excellence in specific domains. One of the key factors for the success of such endeavours is the use of technology, which provides a platform for effective communication and cooperation through knowledge sharing, thereby enhancing organisational and innovative potential. However, research on university mergers yields varied results. Harman and Harman state that well-planned and executed mergers contribute to universities' development (Harman and Harman 2003), whereas others report negative effects of such mergers (Marks and Mirvis 1998; Larsson and Finkelstein 1999). Since the concept of European Universities is very new and still in the initial implementation phase, assessing the overall results thus far is challenging. Yet, initial attempts have been made to rank European Universities as entities. However, these efforts have not yet provided a clear answer regarding whether these mergers strengthen universities' research positioning or enhance their visibility and outreach. This is why it is worth remembering at this stage that some researchers point out that striving for a better position in rankings through mergers might potentially be harmful to academic tradition and academic society (Aula and Tienari 2011; Välimaa, Aittola and Ursin 2014).

Digital transformation in higher education institutions, as a fundamental factor underlying the functioning of networks, is a global trend aimed at harnessing technology to enhance teaching, learning, research and administrative processes. Many universities across Europe have proactively embraced digital transformation initiatives to adjust to the evolving educational landscape and address the changing needs of students and faculty. European Universities alliances, including the European University Initiative, aim to foster collaboration among higher education institutions in Europe, with the goal of promoting excellence, innovation and digital transformation in teaching and research. In practical terms, the reflection of the relational and networking character of European University Alliances within the context of digital transformation can be seen through common activities, practices and solutions such as the following:

- E-learning and online education: integration of digital tools and platforms to deliver shared online courses, virtual classrooms and distance learning programs
- Common digital resources and libraries: access to digital libraries, open educational resources (OER) and online research databases
- Common collaborative platforms: adoption of collaborative platforms and tools for research collaboration, knowledge sharing and project management

- Student support services: implementation of digital solutions to enhance student services, such as online enrolment, virtual counselling and career guidance across an alliance of universities
- Data analytics and learning analytics: utilisation of data-driven insights to improve teaching effectiveness, identify trends in student performance and personalise learning experiences.

It must be stressed at this point that the concept of networking within European Universities alliances aligns seamlessly with Sułkowski's (2022) definition of the fourth wave of organisational changes in universities, as previously presented in Chapter 1. This change is purposeful and project-based in nature, propelled by digital transformation (Gehrke 2014; Hazemi, Hailes and Wilbur 2012; McCluskey and Winter 2012). Furthermore, European Universities alliances are built either around a certain topic such as sea, space, sustainability and entrepreneurship, or around certain values such as inclusion and social equality. The full list of 18 alliances to which 18 universities researched in this study (one university per alliance) belong can be found in Annex III. The current total number of European Universities alliances is 50.

4.2 Digital transformation of universities within European Universities alliances – a diagnostic study

This part of the study also used a distinct questionnaire. As explained in the introduction, the questionnaire pertained to three primary areas, which, in scientific literature, are presented as the fundamental aspects and foundational elements of the digital transformation concept within an organisation, namely, management models, infrastructure and the product. Additionally, the questionnaire delved into the formulation of digital transformation strategies within universities and the aspect of human capital.

As a follow-up, a bibliometric analysis of the SCOPUS database was carried out on 8 June 2023, focusing on the following phrases: "European Universities Initiative", "EUI", "European Universities Initiative" + "digitalisation" and "European Universities Initiative" + "digital transformation". The search included academic article titles, abstracts and keywords. Additionally, an analysis was conducted for the phrases "higher education institution" + "digital transformation" or "digitalisation" to gauge the general coverage of the topic of universities' digital transformation, not confined solely to the European Universities Initiative. Concerning the European Universities Initiative, a total of 12 documents were identified: 7 academic articles, 3 book chapters and 2 conference papers. All these publications fell within the subject area of social sciences. The publication timeline ranged from 2019 to 2023, with eight of them originating from 2022. One of these

documents was published by Frame and Curyło (2022) in Poland which is one of the most active countries in the European Universities Initiative. Common keywords associated with the phrase "European Universities Initiative" included "higher education", "university alliances", "Europe" and "European Commission". The combined searches for "European Universities Initiative" + "digitalisation" and "European Universities Initiative" + "digital transformation" yielded no results in the SCOPUS database as of 8 June 2023. However, the combination of "higher education institution" + "digital transformation" or "digitalisation" generated a total of 447 documents: 220 academic articles, 149 conference papers, 43 book chapters, 17 reviews, 10 conference reviews, 3 editorials, 2 books, errata and 1 note. Among these, 11 documents were published in Poland, primarily within the fields of computer science, business, management, accounting and social sciences. The results of the bibliometric analysis indicate that the topic of digital transformation and digitalisation within higher education institutions is extensively covered in academic literature. Nevertheless, research specific to digital transformation within the context of the European Universities Initiative remains absent. Consequently, the research presented in this study addresses this gap.

4.2.1 Theoretical model

As there are no reference models that could be directly used here, this research employs a model that has already been explained for studying digital transformation within organisations. This research model, designed for the evolution of organisations towards Industry 4.0, has previously been refined within a broader study concerning the digital maturity of leaders — both individual and institutional — conducted by Poszytek (Poszytek and Budzanowska 2023). It is founded on five pillars representing the primary domains of change within the digital transformation process. These pillars encompass (1) strategy, (2) management model, (3) human capital, (4) infrastructure and (5) product.

The digital transformation strategy of the university involves deliberate and well-considered actions aimed at implementing a comprehensive digital transformation across the university. This strategy is devised and endorsed as a binding document. In practical terms, this implies a shift from strategies centred on the use of basic technological tools that support educational management processes (e.g. MS Office) towards initiatives that incorporate new technologies into their design.

Management model: anchoring the university's management processes and staff operations through the integration of digital tools, adeptly incorporating cutting-edge technologies to manage geographically dispersed teams.

In practical terms, it refers to (a) transition from traditional organisational model to a more adaptable model that heavily leverages digital tool functionalities (employing platforms for real-time data collection and analysis); (b) integrating novel technologies into the management of teaching, research and administrative activities; and (c) deploying inventive methods and solutions for team management and activity scheduling.

Infrastructure: providing access to contemporary technological tools, addressing cybersecurity considerations, conducting advanced data analysis and ensuring the secure processing of personal information for both staff and students. This encompasses (a) facilitating access to cutting-edge technological tools and developing the proficiency to effectively employ their functionalities; (b) fostering awareness of cybersecurity vulnerabilities; (c) promoting familiarity with protocols concerning the safeguarding of personal data; and (d) transitioning towards intelligent solutions founded on data collection and analysis, often executed fully or partially through automated means, in real time.

Human capital: nurturing competences 4.0 among teaching, academic and administrative staff. This can be achieved through (a) evolving educators and researchers towards Education 4.0 practices; (b) evaluating the prospective skill levels within administrative staff; and (c) scrutinising the requirement for training across educators, researchers and administrative staff.

Product: signifying a substantial shift in the teaching, academic research and university management paradigms, while preparing students for the competences of the future – competences 4.0. This involves (a) transitioning towards pioneering teaching methods (e.g. classes, workshops); (b) assimilating innovative research techniques; (c) skilfully using tools to disseminate research results and engage socio-economic stakeholders through dialogue; and (d) integrating contemporary projects management methodologies and introducing innovative approaches into the learning process.

4.2.2 Methodology

4.2.2.1 Research sample

The research was conducted using a sample of 18 higher education institutions. This sample consisted of seven universities, seven technical universities, three life sciences universities and one economic university. Based on the online survey, four higher education institutions were invited to participate in the qualitative part of the study – individual in-depth interviews. The interviewees comprised representatives from universities who held responsibilities for instigating and overseeing digital transformation

initiatives within their institutions or possessed informed insights into these processes. These included deans for digitalisation and heads of digitalisation centres, among others.

4.2.2.2 Research tools

The study was performed according to mixed-methods approach methodology, consisting of two major parts: a quantitative approach (online questionnaire) and a qualitative approach (individual in-depth interviews).

The Computer-Assisted Web Interviewing (CAWI) questionnaire included 22 questions (see Annex IV), covering all five research areas mentioned earlier: digital transformation strategy for universities, management model, infrastructure, human capital and product. The questions were primarily closed-ended queries, supplemented by a few questions that required responses on a specified scale to gauge the intensity of particular phenomena.

The individual in-depth interviews were structured based on the questionnaires. These interviews aimed to delve into particularly intriguing subjects and acquire deeper insights into the ongoing digital transformation processes within the respective universities. The interviews included the following issues:

Please elaborate on the advancement of your university's digital transformation. In which of the following areas does your university use digital tools?

- Management of the university
- Administration of the university
- Teaching
- Research

Who decides on the pace and direction of digital transformation of your university?

How would you describe the management model adopted at your university? (Traditional model, based on direct communication, advanced model, supported by digital tools)

How would you evaluate the level of digital competences of the following university staff?

- Managerial staff
- Administrative staff
- Teaching staff
- Research staff

How would you describe the overall level of digital advancement of your university's infrastructure?

Do students benefit from digital transformation of your university? If yes, how exactly? If not, why not?

What are three key challenges related to digital transformation at your university?

What are three key opportunities related to digital transformation at your university?

4.2.2.3 Data analysis

Initially, the quantitative data was analysed to gain an overarching perspective of the measured phenomenon and identify potential trends within the data. Unfortunately, due to the nature of the study and therefore a low number of universities involved, only analyses relying on average and frequency measures could be conducted. Nevertheless, the qualitative data analysis contributed significant insights into the subject matter. Following the qualitative analysis of the interviews, particularly noteworthy statements were incorporated into the study to underscore key discoveries.

4.2.3 Research results

4.2.3.1 Digital transformation strategy for universities

All the universities that participated in the study are relatively advanced in their digital transformation endeavours, as indicated by their engagement in various initiatives in this realm. More than half of them have already incorporated modern digital solutions to some extent; however, in some areas, they are still in the early stages of implementation. Nevertheless, over one-third of them assert that they have achieved an advanced stage of digital transformation. This can be discerned from the responses to the survey question provided in Table 4.1.

Table 4.1 How would you describe the level of advancement of your university's digital transformation?

Answer	*Frequency*
Our university has not yet embarked on a holistic digital transformation	0
Our university has already introduced modern digital solutions in some areas	10
Our university's digital transformation is already at an advanced stage	8

Source: Own work based on survey results. N = 18.

The process of digital transformation within researched European universities is realised through the following activities: (a) implementation of electronic circulation of documents and information systems, digitalisation of university resources, including libraries; and (b) use of digital tools for educational purposes (MS Teams and Zoom) and digital project management tools (Moodle). Some universities are still in the process of digitally transforming their student-related systems, while one university reported having developed its own tools and systems and infrequently relies on external support in this regard. Notably, technical universities exhibited a greater inclination to create their own customised IT solutions and systems due to evident reasons. Findings from the in-depth interviews revealed the following statements regarding this matter:

> *We have fully implemented the electronic circulation of documents. All documents are accepted electronically. We also have an e-students' track record book – all grades are online.* [dean for foreign relations, university]
>
> *Some of our administrative tools are not yet fully digitalised – especially with regards to human resources. We still encounter difficulties with GDPR in this respect.* [dean for digitalisation, university]
>
> *Our administrative and academic staff represent different level of digital tools advancement. Administrative workers use our digital documentation system, while academic staff is more familiar with tools for remote work – MS teams, Zoom, virtual classrooms etc.* [head of digitalisation centre, technical university]
>
> *We have developed our own student-relations system. It is very convenient because it is adjusted exactly to our needs and not the other way round. However, to be compliant with our external partners, we are thinking of buying another system. We were also one of the first ones in Poland to give up paper course records.* [dean for education, technical university]

It is important to highlight that in half of the surveyed cases, the course of digital transformation is determined by the highest governing bodies of the university. One out of three universities implements a pre-arranged digital transformation strategy that is enforced and approved centrally. The digital transformation process and its trajectory are integrated into the overarching developmental strategy of the university (Table 4.2).

Individual interviews with university representatives provide further insight into how this process unfolds in practice. In reality, it frequently involves a fusion of a bottom-up approach (geared towards addressing the requirements of university staff and students) with a top-down strategy established by the highest authorities of a given higher education institution, as elucidated during the in-depth interviews:

Table 4.2 How would you describe the ongoing digital transformation process at your university?

Answer	*Frequency*
The direction of our university's digital transformation is set on a top-down basis, e.g. by the Rectors Committee.	9
The digital transformation of our university takes a continuous, bottom-up approach through the implementation of good practices at the unit and employee levels.	3
Our university is consistently implementing a pre-planned digital transformation strategy, enacted and adopted centrally.	6

Source: Own work based on survey results. N = 18.

> *Digital transformation is a multi-track process: some of its aspects might be initiated and executed by the rector's college, however, some others, come from employees themselves. Some solutions are a result of international cooperation with other institutions. As you can see, it is a multi-layered and multi-track process.* [head of digitalisation centre, technical university]
>
> *Most of the processes are conceived to answer the needs of middle management staff of the university. Our digitalisation council is in charge of preparing solutions to make their work easier.* [dean for digitalisation, university]

The results of the research (Tables 4.3 and 4.4) showed that the principal challenges in the digital transformation process include (a) lack of financial resources necessary to carry out systemic changes within the university; (b) lack of support from the state/public administration; and (c) inability to adjust university's adopted management model to the ongoing technological changes.

What is important here is that the lack of financial resources turned out to be a systemic problem. The higher education sector has been deemed underfinanced, with even the most renowned European universities grappling with financial limitations. Nevertheless, some of the universities are at risk of falling behind their European University partners from abroad unless they allocate more resources to digital transformation processes. "Research universities" appear to be in a better financial condition, yet they still recognise the need for systemic changes. This challenge is also related to the lack of support from the state. In most cases, universities cannot afford to hire digital transformation specialists, as their budgets are simply not competitive enough to hire top experts. This has been expressed quite often, as follows:

Table 4.3 What do you think is the biggest challenge in your university's digital transformation process?

Answer	*Frequency*
Lack of financial resources needed to carry out systemic changes at the university	12
Lack of support from the state/public administration	8
Failure to adjust the university' s adopted management model to the ongoing technological changes	7
Resistance/passivity on the academic part of staff	6
Lack of experience in the digital transformation process of the university	5
Lack of competences among managerial staff needed to carry out systemic changes at the university	5
Lack of knowledge/reliable sources of information on the digital transformation of the university	4
Lack of need for organisational changes at the university	4
Lack of well-conceived strategy for the university's digital transformation	3
Lack of faith in the success of the university's digital transformation	2
Resistance/passivity on the managerial part of staff	1

Source: Own work based on survey results. N = 18.

We simply cannot afford to hire the best IT and digitalisation specialists. [dean for foreign relations, university]

Our IT specialists and developers often quit for financial reasons – they can make much better money working for a private company. [dean for education, technical university]

Academic and administrative staff is not always willing to learn or to change something in their everyday working routine. It depends on the age, of course, and on a general openness. [dean for digitalisation, university]

We need to jump on this high-speed train of digital transformation if we don't want to stay behind our European partners. [dean for education, technical university]

Other significant challenges include resistance of the university staff, primarily of an academic nature as opposed to managerial, along with a deficit of competences within the managerial cadre to proficiently

Table 4.4 Primary challenges in the digital transformation process

Answer	*Frequency*
Lack of financial resources	12
Lack of support from the state	8
Failure to adjust the management model	7
Resistance/passivity (academic staff)	6
Lack of competences (managerial staff)	5
Lack of experience	5
Lack of knowledge/sources of information	4
Lack of need for organisational changes	4
Lack of strategy for the transformation	3
Lack of faith in the process	2
Resistance/passivity (managerial staff)	1

Source: Own work based on survey results. N = 18.

implement and execute digital transformation endeavours. This challenge can be addressed by training managerial staff, which is perceived as time-consuming and not always prioritised:

> *We need to focus more on training our staff. We do not have a training unit that would be responsible for assessing training needs, designing and carrying out trainings. Such unit, in my opinion, is very much needed at our university.* [head of digitalisation centre, technical university]

4.2.3.2 Management model of the university

Two-thirds of the surveyed universities are progressively aligning their organisational processes towards intelligent management, based on Education 4.0 solutions and new digital technologies. However, this model is predominantly perceived as traditional, as it is based on the direct supervision of employees by superiors (Table 4.5).

This traditional management style is understood as being very direct and top-down. It uses several digital tools to facilitate the processes. In some cases, these tools were introduced as a necessity during the pandemic and continue to be used regularly, despite the end of the pandemic.

The electronic documentation system increased our effectiveness and it made it easier to identify management-related problems. Moreover, during

Table 4.5 How would you describe the management model adopted at your university?

Answer	*Frequency*
Our university follows a traditional organisational model based on personal team management and ongoing task delegation. Currently, we do not use any systems to monitor staff activity or optimise the use of resources.	3
Our university is gradually streamlining organisational processes towards intelligent management based on the use of new digital technologies and Education 4.0 solutions. So far, management at our university is still largely traditional, through direct supervision of employees by superiors.	12
In many areas, our university has already introduced automated and flexible organisational processes that minimise the need for direct supervision of employees by superiors (e.g. systems for monitoring work activity, systems for remote management of assigned tasks). We are currently conducting further process changes and improvements.	3

Source: Own work based on survey results. N = 18.

the pandemic, we had to find a solution how to gather the key employees and how to vote. We implemented an online system for that and it has been used since then on a daily basis. No one wants to vote in person anymore, it is much more convenient to do it online. [head of digitalisation centre, technical university]

The process of staff management and task delegation is predominantly conducted through direct personal interactions, with limited reliance on digital tools (Table 4.6). It should be noted that all the surveyed universities use digital tools within these processes, and none of the institutions solely follows a fully personal, non-digital approach in managing and planning team/employee/project work. Simultaneously, none of the universities reported using solely digitised tools for staff management.

Generally, the surveyed higher education institutions demonstrate a willingness to engage in partnerships with both foreign universities and universities from their own country. Only two institutions admitted that they enter into partnerships mostly with universities from their own country rather than with foreign ones (Table 4.7).

4.2.3.3 Infrastructure

One-third of universities that took part in the survey declared to use advanced technological solutions to optimise teaching, research and administrative tasks. Most of the institutions still use basic software and

Table 4.6 How is the process of managing staff and delegating tasks/reviewing the performance of tasks assigned to staff carried out at your university?

Answer	*Frequency*
The management of the work of staff is carried out in a purely direct, personal way, without the use of digital tools dedicated to managing and planning the work of teams/employees/projects.	0
The management of the work of university staff is largely done in a direct, personal way, with little support from a variety of digital tools (various software and applications for managing and planning the work of teams/employees/projects).	13
The management of the work at our university is largely done through the use of digital tools (dedicated software and applications for managing and planning the work of teams/employees/projects).	5
Only digitised tools for managing staff work are used at the university (including dedicated software and applications for managing and planning the work of teams/employees/projects), we avoid any form of micromanagement.	0

Source: Own work based on survey results. N = 18.

Table 4.7 How would you define the level of networking of your university regionally and globally?

Answer	*Frequency*
Our university operates to a large extent on its own, without close cooperation with other similar institutions.	0
Our university enters into partnerships primarily with other Polish universities.	2
Our university enters into partnerships primarily with foreign universities.	3
We are open to partnerships with both Polish and foreign universities.	13

Source: own work based on survey results. N = 18.

tools, although there is a growing trend towards the implementation of more intricate and intelligent systems. These advanced systems facilitate the alignment of teaching and academic research methods with the demands of the evolving educational landscape. None of the institutions classified their solutions as basic (Table 4.8).

In most of the surveyed cases, intelligent systems for data processing and analysis have been partially implemented in order to improve teaching, research and administrative processes. However, these implementations

Table 4.8 How would you rate the overall level of technological advancement of your university?

Answer	*Frequency*
Our university uses basic technological solutions and underlying software to maintain the continuity of teaching, research and administrative processes in the era of ongoing technological change.	0
Our university is still using basic software and tools, although advanced, intelligent systems are increasingly being introduced, allowing us to adapt the way we conduct teaching and academic research to the requirements of the evolving educational reality.	12
Our university uses advanced technological solutions to optimise and streamline the way teaching, academic research and administrative services are carried out in times of digital revolution.	6

Source: own work based on survey results. N = 18.

Table 4.9 Which of the following statements best describes the data collection and analysis policy adopted at your university?

Answer	*Frequency*
Data collected at our university in the different areas of its operation (teaching, research and administration) is processed and analysed selectively for the needs of individual offices and administrative divisions. We do not use an integrated data analysis system.	5
Intelligent systems for data processing and analysis have already been partially implemented at our university in order to improve the teaching, research and administrative processes, but these are still piecemeal solutions that do not cover the entirety of the processes carried out.	12
Data collected in different areas of our university's operations is integrated into comprehensive analysis systems (conducted in real time), which allows for faster reactions and efficient strategic decision-making even in unforeseen circumstances.	1

Source: own work based on survey results. N = 18.

remain fragmented, addressing only specific aspects of the operations. In only one instance, various operational domains are integrated into comprehensive analysis systems, conducted in real time. This integration facilitates swifter responses and effective strategic decision-making, even in unforeseen circumstances (Table 4.9).

4.2.3.4 Human capital

In over half of the cases, only basic training programmes for academic and administrative staff are provided. Merely seven institutions have stated their provision of comprehensive training programmes for academic staff, intended to cultivate knowledge, competences and skills necessary to adapt to the evolving conditions of the education system. As for administrative staff, such diverse and complex trainings were offered only in three cases (Table 4.10).

Regarding the competency level of administrative staff, their proficiency in transitioning between traditional, remote and hybrid work environments was regarded as the highest. Administrative personnel also exhibited strong skills in remote work using digital tools, along with adeptness in employing digital software and tools. However, proficiency in working with systems based on artificial intelligence was rated relatively low (Table 4.11).

AI tools are far from being perfect and most of the staff are not familiar with them. On the other hand, people are afraid of what they don't know, and they really don't know much yet about artificial intelligence tools. [dean for education, technical university]

The distribution of results is practically the same for both administrative and academic staff. Among the latter group, the highest performance was

Table 4.10 How does your university prepare staff for the ongoing digital transformation and the technological changes that come with it?

Answer	*Academic staff*	*Administrative staff*
We do not provide systematic training programmes for academic staff at our university; we leave the acquisition of new skills and competences (including digital) to their own discretion.	0	1
Basic training programmes for academic staff are provided at our university, primarily focused on preserving the standard and quality of conducted research projects.	11	14
Comprehensive programmes of various training courses for academic staff – both mandatory and optional – are conducted at our university, aimed at developing their knowledge, competences and skills in the changing conditions of the educational ecosystem.	7	3

Source: Own work based on survey results. N = 18.

Table 4.11 How would you rate the level of competence of the administrative staff?

Answer	*High level*	*Medium level*	*Low level*
Switching between traditional, remote, hybrid work	9	9	–
Remote teamworking using digital tools	8	8	2
Remote learning using digital tool	7	7	2
Managing remotely working team	5	5	8
Ability to use digital software and tools	5	10	2
Willingness and openness to work with AI solutions	4	4	8
Solving complex problems using digital tools	3	7	6
Working, interacting with systems based on AI	1	1	12

Source: Poszytek and Budzanowska 2023.

observed in remote learning and team collaboration using digital tools. The ability to use digital software and tools was also rated equally high. However, the ability to work with systems based on artificial intelligence is low among this group (Table 4.12).

Regarding the training requirements of the staff, respondents highlighted that managerial personnel would derive the greatest advantage from training in data collection and analysis, as well as the management of dispersed teams. Conversely, academic staff would benefit from training in collaborating within dispersed teams and enhancing their digital competences. For administrative staff, the need for training in data collection and analysis was identified, along with workshops focused on internal communication (Table 4.13).

All interviewees emphasised the paramount importance of staff training in the digital transformation process of their institutions. The training process is two-fold: on the one hand, employees are trained in external digital tools, such as MS Teams, Zoom and Moodle. On the other hand, the training concerns internal digital solutions prepared within the university: the digital documentation system, e-students' book, digital invoice systems, etc. The interviewees also stressed the role of the COVID-19 pandemic in accelerating both the digital transformation and training processes:

Table 4.12 How would you rate the level of competence of the academic staff?

Answer	*High level*	*Medium level*	*Low level*
Remote learning using digital tools	10	8	–
Remote teamworking using digital tools	10	7	1
Switching between traditional, remote, hybrid work	8	8	2
Managing remotely working team	6	6	5
Solving complex problems using digital tools	4	10	2
Ability to use digital software and tools	4	13	1
Willingness and openness to work with AI solutions	2	9	4
Working, interacting with systems based on AI	1	3	9

Source: Poszytek and Budzanowska 2023.

Table 4.13 Which training courses would you find attractive to support your university's digital transformation process?

Answer	*Administrative staff*	*Academic staff*	*Managerial staff*
Data collection and analysis	16	12	14
Internal communication	15	10	9
Management/working in dispersed teams	15	17	13
Advanced digital competences	12	13	12
Working with specific digital tools	8	6	2
Business strategy management/ planning	–	–	11

Source: Poszytek and Budzanowska 2023.

Since 2019 we have made a huge step forward. Our staff had no other choice during the pandemic but to train themselves in using digital tools. Transformation is always a process, but as it turned out, it was not so hard. It is not cheap either. Let's be honest – digital transformation is a costly

process, but it is worth it. It is an investment in our staff and in our university. [dean for digitalisation, university]

It is important to communicate the new tool to the employees. We offer training videos, in-person training and training handbooks available online. But the best training is through practice. You must not be afraid of the new tool, you have to start using it, make mistakes and learn from them. [head of digitalisation centre, technical university]

Among the various activities that could be beneficial to support the university's digital transformation process, the respondents listed actions related to networking and inter-institutional cooperation. Special emphasis was put on international relationships and collaborative project implementation between similar research institutions.

Once again, the distribution of results is relatively similar in relation to all groups of staff (Table 4.13). However, the courses for data collection and analysis were found to be more important for administrative staff than academic staff, whereas the courses for internal communication and working with specific digital tools were significantly more important for administrative staff compared to managerial staff.

Cooperation with foreign universities enhances our digital transformation greatly. We can observe what solutions work abroad and try to implement theme here, in Poland. Besides, universities with a strong international exchange and relations have always been more open to new solutions. [head of digitalisation centre, technical university]

We have two POWER projects with foreign universities. They both concern IT solutions. In this respect, we can say, that international cooperation truly contributes to the digital transformation of our university – both in terms of financing and know-how. [dean for foreign relations, university]

In general, a greater need was reported here (Table 4.14) for different forms of networking and peer activities that could potentially enhance and

Table 4.14 What other activities would you find attractive to support your university's digital transformation process?

Answer	*Frequency*
Observing good practices at other universities	16
Networking meetings for universities	16
Opportunity to consult on the direction of changes with experts	7
Access to online materials and guides for managerial staff	6

(*Continued*)

Table 4.14 (Continued)

Answer	*Frequency*
Mentoring of managerial staff about changes in HE	5
Access to training materials for academic and administrative staff	5

Source: Poszytek and Budzanowska 2023.

foster the process of digital transformation, rather than just access to training materials of different kinds.

4.2.3.5 Product

The universities have also declared that they have introduced a wide array of innovative teaching solutions, such as 3D printers, digital production and manufacturing equipment and Mixed Reality devices (Table 4.15).

Regarding students' digital competences, the respondents underlined the importance of courses taught by practitioners and experts from outside of academia, supporting students' research initiatives and alumni relationships. Strengthening cooperation with socio-economic environment and its role in consulting the curriculum was assessed as valuable (Table 4.16).

Table 4.15 What innovative teaching solutions has your university introduced?

Answer	*Frequency*
Media laboratories (allowing people with different skills to work and learn together on projects using new media and technologies, e.g. recording studios, sound laboratories)	13
Business incubator/start-up incubator	12
Fabrication laboratories (providing the opportunity to implement own projects and ideas using digital production and manufacturing equipment, including 3D printers, 3D scanners, CNC machines, laser cutters, laser plotters, CNC embroidery machines, sewing machines and others)	10
Simulation spaces (with VR, AR and mixed reality equipment)	8
Makerspaces (creative *garages*)	7
Science and technology park	5
Innovation studies (space for testing and developing cross-industry cooperation)	3

Source: Own work based on survey results. N = 18.

Table 4.16 Which of the activities towards supporting the development of students' competences of the future does your university undertake?

Answer	*Frequency*
Courses taught by practitioners and experts	15
Supporting student research initiatives	14
Cooperation with graduates	14
Strengthening cooperation with socio-economic environment	13
Consultations with socio-economic environment	12
Additional courses and programmes	12
Supporting student implementation activities	9
Integration of educational offers with staff development programmes	9
External e-learning platforms	9
Dedicated laboratories	9
Cooperation with leading content providers	7
Optional classes oriented towards competences of the future	6
Integrating the offer with managerial staff development programmes	4

Source: Poszytek and Budzanowska 2023.

The survey results show that the curricula offer a moderate level of adjustment. They are also continuously modified after consultation with student representatives and provide the freedom for students to choose their subject path/module and optional courses based on their preferences. Only in fewer than one-third of universities are curricula updated less frequently than once every few years. In general, universities support students in their educational, research and interpersonal growth, but not always in developing future-oriented skills (Table 4.17).

4.2.4 Conclusion

The summative observations from the detailed analysis of the obtained results are as follows:

In relation to digital transformation strategy, most of universities have already implemented modern digital solutions in some areas, with technical universities leading in this aspect. The central and traditional top-down approach is taken by the supreme university bodies, playing a leading role

Table 4.17 To what extent do students at your university have a say in the individual design of the curriculum and the selection of individual subjects/courses?

Answer	*Frequency*
Due to complex procedures and formal requirements, curricula at our university are not updated more than once every few years. They include small blocks of optional classes to be chosen by students individually.	4
The curricula at our university are modified on an ongoing basis in consultation with student representatives and guarantee a free choice of subject path/module and optional courses selected by students according to their preferences.	12
The framework curricula at our university are modified on an ongoing basis in consultation with student representatives and guarantee a high degree of freedom to construct the course of study and the modules/subjects pursued.	2

Source: Own work based on survey results. N = 18.

in this process. The main obstacle to this process is the lack of finances and support.

Concerning the management model, there is a move towards streamlining organisational processes through intelligent management, relying on Education 4.0 solutions and new digital technologies. The traditional management paradigm is gradually being replaced by initial steps towards incorporating automated and flexible organisational processes to reduce the need for direct supervision, which still largely relies on personal interactions with limited use of digital tools.

One-third of the universities declare upgrades and investments in new infrastructure. Advanced technological solutions for optimising teaching, research and administrative tasks are progressively being adopted. However, there is practically no integration of the implemented technological solutions that have been identified.

Concerning human capital, in most cases, only basic training programmes are provided for research, teaching and administrative staff. However, seven institutions have declared that they offer comprehensive training programmes for their research and teaching staff aimed at developing the knowledge, competence and skills required in the changing conditions of the education system. Such diverse and complex training programmes were offered to administrative staff in only three cases. Both academic and administrative staff are open to developing their data collection and analysis skills. On a practical level, managerial staff are willing to enhance their ability to organise teamwork, while academic staff

are eager to learn how to effectively collaborate in such teams. Almost all institutions express the desire to observe best practices at other similar universities and to exchange experiences and ideas during networking meetings with other universities. All these initiatives and identified needs directly related to one of the pillars of the universities of the future presented in Chapter 1, namely, the development of competences of the future, or competences 4.0.

Referring to the product aspect, universities have declared the implementation of a wide range of innovative teaching solutions, such as 3D printers, digital production and manufacturing equipment and mixed reality tools. The majority of these institutions offer courses delivered by professionals and experts from outside academia, maintain alumni relationships and provide support for student research initiatives to enhance the development of future-oriented competences among their students. In most cases, students are given the freedom to choose optional courses, allowing them to tailor their curriculum according to their needs. Once again, the reference to the definition of universities of the future can be observed in relation to both the development of competences 4.0 and education based on personalised offerings described in Chapter 1.

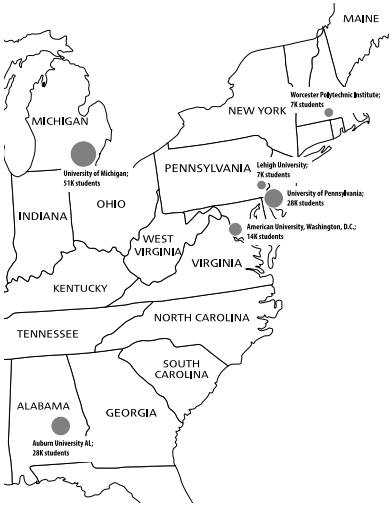
4.3 Digital transformation of universities from American perspective – a comparative study

Map 4.1 Participating universities from the United States

This part of the study aimed at measuring the level of digital transformation of North American universities. The quantitative survey as in the case of universities allied within European Universities networks was completed using an online questionnaire. The study was conducted between October and November 2023 on a sample of the following US universities:

- UC Berkeley
- Worcester Polytechnic Institute
- Stanford University
- University of Pennsylvania
- Auburn University AL
- American University Washington, DC
- Northern Arizona University
- University of California San Diego
- University of California, Riverside
- Lehigh University
- University of Michigan (Maps 4.2 and 4.3)

Map 4.2 Participating universities from West Coast



Map 4.3 Participating universities from East Coast

The respondents were represented by:

- Seven professors
- Two lecturers
- One assistant
- One research fellow

As in the case of European Universities, the questions referred to five main areas, namely, digital transformation strategy of the university, management model of the university, its infrastructure, human capital in the university and product meant as the university's offer for students. Additionally, two in-depth individual interviews were conducted with the representatives of Stanford University and UC Berkeley, which are treated here as special points of reference on the one hand because of their proximity to Silicon Valley and also as a driving force behind technological innovations defining Silicon Valley on the other hand. The online survey results are presented in the following paragraphs.

4.3.1 Digital transformation strategy

Out of 11 surveyed universities, eight claimed that their digital transformation is already at an advanced stage, which shows a high level of self-evaluation in this area (Table 4.18). Of the remaining institutions, three stated that they have already introduced modern digital solutions in some areas, but are still in the early stages of the transformation towards Education 4.0. What is significant, none of the respondents admitted that his or her university has not yet embarked on a holistic digital transformation (Table 4.18).

The strategy of the process of implementation of digital transformation was seen differently by different institutions. The group of respondents has split here almost equally among three possible answers (Table 4.19).

Table 4.18 How would you describe the level of digital transformation at your university?

Answer	*Frequency*
Our university has not yet embarked on a holistic digital transformation.	0
Our university has already introduced modern digital solutions in some areas, but we are still in the early stages of the transformation towards Education 4.0.	3
Our university's digital transformation is already at an advanced stage.	8

Source: Own work based on survey results. N = 11.

Table 4.19 How would you describe the ongoing digital transformation process at your university?

Answer	*Frequency*
The direction of our university's digital transformation is set continuously by the Rectors Committee.	3
The digital transformation of our university takes a continuous, bottom-up approach through the implementation of good practices at the unit and employee levels.	4
Our university is consistently implementing a pre-planned digital transformation strategy, enacted and adopted centrally (in the form of a government regulation, resolution or other document). In order to properly implement the change, an appropriate body (team, working group) has been established to oversee the process.	4

Source: Own work based on survey results. N = 11.

The biggest challenge while introducing digital transformation at the university at this point (Table 4.20) was the lack of competences among managerial staff needed to carry out systemic changes at the university. Furthermore, equally important were (1) lack of financial resources needed to carry out systemic changes at the university, (2) resistance on the part of staff and (3) lack of a well-thought-out strategy for the university's digital transformation.

Table 4.20 What do you think is the biggest challenge in digital transformation process at your university?

Answer	*Frequency*
Lack of competences among managerial staff needed to carry out systemic changes at the university	4
Lack of financial resources needed to carry out systemic changes at the university	3
Resistance/passivity on the part of staff	3
Lack of a well thought-out strategy for the university's digital transformation	3
Lack of experience in the digital transformation process of the university	2
I do not see any challenges in the digital transformation process of our university	2

(*Continued*)

Table 4.20 (Continued)

Answer	*Frequency*
Lack of knowledge/reliable sources of information on the digital transformation of the university	1
Resistance/passivity on the part of managerial staff	1
Failure to adjust the university's adopted management model to the ongoing technological changes	1
Lack of support from the state/public administration	0
Lack of faith in the success of the university's digital transformation	0
Lack of need for organisational changes at the university	0

Source: Own work based on survey results. N = 11.

None of the respondents reported at this point: (1) lack of support from the state administration, (2) lack of faith in the success of the university' s digital transformation and (3) lack of need for organisational changes at the university.

Other responses on key challenges included (respondents' quotes):

Access to higher education in the US is limited by wealth and upbringing. Professors are evaluated primarily on indirect cost return from research grants.

Students abusing the trust.

The staff actually implementing digital transformation processes, once those have been put into place, is excellent. The top-level university officials in charge of putting these processes into place seem, from the results, very unevenly competent. Everything has major glitches!

The biggest challenge at my university is the security of the system.

4.3.2 Management model of the university

While asking about the management model adopted at the university, two models seemed to be equally and most popular: the model based on personal team management and ongoing task delegation as well as the model based on automated and flexible organisational processes that minimise the need for direct supervision of employees by superiors. This shows that almost half of the surveyed universities are following the traditional model, while the second, equal part, is introducing modern and digital aspect to management tasks (Tables 4.21 and 4.22).

In more than half of the cases (6 out of 11), the management of the work at our university is largely done through the use of digital tools (dedicated

Table 4.21 How would you describe the management model adopted at your university?

Answer	*Frequency*
Our university follows a traditional organisational model based on personal team management and ongoing task delegation. At this point in time, we do not use any systems to monitor staff activity or optimise the use of resources.	5
Our university is gradually streamlining organisational processes towards intelligent management based on the use of new digital technologies and Education 4.0 solutions. So far, management at our university is still largely traditional, through direct supervision of employees by superiors.	1
In many areas, our university has already introduced automated and flexible organisational processes that minimise the need for direct supervision of employees by superiors (e.g. systems for monitoring work activity, systems for remote management of assigned tasks). We are currently conducting further process changes and improvements.	5

Source: Own work based on survey results. N = 11.

Table 4.22 How is the process of managing staff and delegating tasks/reviewing the performance of tasks assigned to staff carried out at your university?

Answer	*Frequency*
The management of the work of staff is carried out in a purely direct, personal way, without the use of digital tools dedicated to managing and planning the work of teams/employees/ projects.	1
The management of the work of university staff is largely done in a direct, personal way, with little support from a variety of digital tools (various software and applications for managing and planning the work of teams/employees/projects).	2
The management of the work at our university is largely done through the use of digital tools (dedicated software and applications for managing and planning the work of teams/ employees/projects).	6
Only digitised tools for managing staff work are used at the university (including dedicated software and applications for managing and planning the work of teams/employees/ projects), we avoid any form of micromanagement.	2

Source: Own work based on survey results. N = 11.

Table 4.23 How would you define the level of networking of your university regionally and globally?

Answer	*Frequency*
Our university quite rarely cooperates with other universities.	1
Our university enters into partnerships primarily with other American universities.	0
Our university enters into partnerships primarily with foreign universities.	0
As a university, we are open to partnerships with both American and foreign universities.	10

Source: Own work based on survey results. N = 11.

software and applications for managing and planning the work of teams/employees/projects). Only in one surveyed university is the traditional path, namely, based on the direct, personal way, without the use of digital tools dedicated to managing and planning the work, followed (Table 4.22).

Almost all surveyed universities claimed that they are open to partnerships with both American and foreign universities. Only one admitted that it quite rarely cooperates with other universities (Table 4.23).

4.3.3 Infrastructure

The overall level of technological advancement of the surveyed universities was seen differently by different universities, as almost equal distribution of answers can be observed. All answers were evenly represented in this case (Tables 4.24).

More than half of the surveyed universities claimed that intelligent systems for data processing and analysis have already been partially implemented at university in order to improve the teaching, research and administrative processes, but these are still piecemeal solutions that do not cover the entirety of the processes carried out. This shows that most of the universities are in the halfway while talking about data collection and analysis policy (Table 4.25).

All respondents claimed that their institutions provide some trainings for teaching staff about the ongoing digital transformation and technological changes. Slightly more respondents claimed that their university prepares comprehensive programmes of various training courses for teaching staff, which are both mandatory and optional (Table 4.26).

Very similar answers were obtained while asking for administrative staff (Table 4.27). All respondents claimed that their institutions provide

Table 4.24 How would you rate the overall level of technological advancement of your university?

Answer	*Frequency*
Our university uses basic technological solutions and underlying software to maintain the continuity of teaching, research and administrative processes in the era of ongoing technological changes.	3
Our university is still using basic software and tools, although advanced, intelligent systems are increasingly being introduced, allowing us to adapt the way we conduct teaching and academic research to the requirements of the evolving educational reality.	4
Our university uses advanced technological solutions to optimise and streamline the way teaching, academic research and administrative services are carried out in times of digital revolution.	4

Source: Own work based on survey results. N = 11.

Table 4.25 Which of the following statements best describes the data collection and analysis policy adopted at your university?

Answer	*Frequency*
Data collected at our university in the different areas of its operation (teaching, research and administration) is processed and analysed selectively for the needs of individual offices and administrative divisions. We do not use an integrated data analysis system.	2
Intelligent systems for data processing and analysis have already been partially implemented at our university in order to improve the teaching, research and administrative processes, but these are still piecemeal solutions that do not cover the entirety of the processes carried out.	6
Data collected in different areas of our university's operations is integrated into comprehensive analysis systems (conducted in real time), which allows for faster reactions and efficient strategic decision-making even in unforeseen circumstances.	3

Source: Own work based on survey results. N = 11.

some trainings for administrative staff about the ongoing digital transformation and technological changes. Slightly more respondents claimed that their university prepares basic programmes for various training courses and that the acquisition of new skills and competences,

Table 4.26 How does your university prepare teaching and academic staff for the ongoing digital transformation and the technological changes that come with it?

Answer	*Frequency*
We do not provide systematic training programmes for teaching staff at our university; we leave the acquisition of new skills and competences (including digital) to their own discretion.	0
Basic training programmes for teaching staff are provided at our university, primarily focused on preserving the standard and quality of teaching.	5
Comprehensive programmes of various training courses for teaching staff both mandatory and optional are conducted at our university, aimed at developing their knowledge, competences and skills in the changing conditions of the educational ecosystem.	6

Source: Own work based on survey results. N = 11.

Table 4.27 How does your university prepare administrative staff for the ongoing digital transformation and the technological changes that come with it?

Answer	*Frequency*
We do not provide systematic training programmes for administrative staff at our university; we leave the acquisition of new skills and competences (including digital) to their own discretion.	0
Basic training programmes for administrative staff are provided at our university, primarily focused on preserving the standard and quality of the university's administrative service.	6
Comprehensive programmes of various training courses for administrative staff both mandatory and optional are conducted at our university, aimed at developing their knowledge, competences and skills in the changing conditions of the educational ecosystem.	5

Source: Own work based on survey results. N = 11.

including digital ones, is mostly left to the discretion of administrative staff.

4.3.4 Human capital

Generally, the level of competence of the teaching and academic staff at the surveyed universities was rated on high or medium level. The highest-rated

Table 4.28 How would you rate the level of competence of the teaching and academic staff at your university?

Answer	*High level*	*Medium level*	*Basic level*	*Hard to say*
Ability to use digital software and tools	5	5	0	1
Willingness and openness to work with AI solutions	2	4	2	3
Smooth transitioning between modes of work (traditional, remote, hybrid)	5	5	0	1
Remote teamworking using digital tools	5	5	0	1
Managing people who work remotely using digital tools	5	4	1	1
Remote learning using digital tools and online platforms	5	4	0	2
Working and interacting with systems based on artificial intelligence	1	4	2	4
Solving complex problems using digital tools	3	3	2	3

Source: Own work based on survey results. N = 11.

competences were: (1) ability to use digital software and tools; (2) smooth transitioning between modes of work (traditional, remote, hybrid); and (3) remote teamworking using digital tools (Table 4.28).

Accordingly, the level of competence of the administrative staff was rated slightly higher. The highest rated competences were (1) ability to use digital software and tools, (2) remote teamworking using digital tools and (3) managing people who work remotely using digital tools (Table 4.29).

The most attractive training courses for managerial staff would be those regarding business strategy management and planning (Table 4.30).

The most attractive training courses for teaching and academic staff would be those regarding internal communication and data collection and analysis (Table 4.31).

The most attractive training courses for administrative staff would be those regarding working in diverse dispersed teams (Table 4.32).

Table 4.29 How would you rate the level of competence of the administrative staff at your university?

Answer	*High level*	*Medium level*	*Basic level*	*Hard to say*
Ability to use digital software and tools	6	3	1	1
Willingness and openness to work with AI solutions	2	4	1	4
Smooth transitioning between modes of work (traditional, remote, hybrid)	5	4	1	1
Remote teamworking using digital tools	6	2	2	1
Managing people who work remotely using digital tools	6	2	2	1
Remote learning using digital tools and online platforms	4	1	2	4
Working and interacting with systems based on artificial intelligence	3	2	3	3
Solving complex problems using digital tools	5	2	3	1

Source: Own work based on survey results. N = 11.

Table 4.30 Which training courses for managerial staff would you find attractive to support your university's digital transformation process?

Answer	*Frequency*
Business strategy management and planning	4
Management of dispersed teams	3
Data collection and analysis	3
Internal communication	3
Advanced digital competences	2
Working with specific digital tools (e.g. CAD and SAP)	2
None of the above	2

Source: Own work based on survey results. N = 11.

Table 4.31 Which training courses for teaching and academic staff would you find attractive to support your university's digital transformation process?

Answer	*Frequency*
Internal communication	5
Data collection and analysis	4
Advanced digital competences	3
Working with specific digital tools (e.g. CAD and SAP)	3
Working in diverse dispersed teams	3
None of the above	1

Source: Own work based on survey results. N = 11.

Table 4.32 Which training courses for administrative staff would you find attractive to support your university's digital transformation process?

Answer	*Frequency*
Working in diverse dispersed teams	7
Internal communication	6
Data collection and analysis	5
Advanced digital competences	2
None of the above	2
Working with specific digital tools (e.g. CAD and SAP)	1

Source: Own work based on survey results. N = 11.

Other most attractive activities aiming to support university's digital transformation process were (1) observing good practices at other universities with similar characteristics/educational profile and (2) mentoring of managerial staff in the context of organisational and process changes in higher education (Table 4.33).

4.3.5 Product

While asking about the innovative teaching solutions introduced by the university, two were the most important: fabrication laboratories and

Table 4.33 What other activities would you find attractive to support your university's digital transformation process?

Answer	*Frequency*
Observing good practices at other universities with similar characteristics/educational profile	7
Mentoring of managerial staff in the context of organisational and process changes in higher education	6
Access to training materials for teaching, academic and administrative staff (traditional materials)	5
Networking meetings as a space for exchanging experiences and ideas among representatives of other universities undergoing digital transformation (lessons learned)	5
Opportunity to consult on the direction and course of organisational and business changes with experts in Education of the Future	2
Access to profiled information materials and guides for managerial staff of the educational ecosystem (online materials)	2
None of the above	1

Source: Own work based on survey results. N = 11.

media laboratories. In the second place, makerspaces (creative garages) and simulation spaces were mentioned (Table 4.34).

Surveyed universities have undertaken many of the listed activities towards supporting the development of students' competences of the future. The most popular were (1) creating dedicated laboratories for learning selected competences of the future; (2) providing additional courses and programmes to develop the competences of the future; (3) integration of educational offers with staff development programmes of business entities outside the university; (4) providing courses taught by practitioners and experts from outside the academy; (5) supporting student research initiatives; and (6) supporting student implementation activities (Table 4.35).

Surveyed universities showed different approaches in the area of students' engagement in the design of the curriculum and the selection of individual subjects/courses. The answers were distributed almost evenly between all three options (Table 4.36).

Additional in-depth interviews were based on the following questions:

- Please elaborate on the advancement of your university's digital transformation. In which of the following areas does your university

Table 4.34 What innovative teaching solutions has your university introduced?

Answer	*Frequency*
Fabrication laboratories (providing the opportunity to implement own projects and ideas using digital production and manufacturing equipment, including 3D printers, 3D scanners, CNC machines, laser cutters, laser plotters, CNC embroidery machines, sewing machines and others)	8
Media laboratories (allowing people with different skills to work and learn together on projects using new media and technologies, e.g. recording studios and sound laboratories)	8
Makerspaces (creative garages)	6
Simulation spaces (with VR, AR and mixed reality equipment)	6
Business incubator/start-up incubator	5
Innovation studies (space for testing and developing cross-industry cooperation)	4
Science and technology park	4

Source: Own work based on survey results. N = 11.

Table 4.35 Which of the activities towards supporting the development of students' competences of the future does your university undertake?

Answer	*Frequency*
Creating dedicated laboratories for learning selected competences of the future	7
Providing additional courses and programmes to develop the competences of the future (including digital and social competences)	6
Integration of educational offers with staff development programmes of business entities outside the university	6
Providing courses taught by practitioners and experts from outside the academy	6
Supporting student research initiatives	6
Supporting student implementation activities	6
Cooperation with leading specialist content providers	5
Cooperation with graduates of our university	5

(*Continued*)

Table 4.35 (Continued)

Answer	*Frequency*
Providing optional classes oriented towards learning the competences of the future	5
Providing students with external e-learning platforms for the development and verification/certification of acquired competences	4
Taking measures aimed at strengthening cooperation with the university's socio-economic environment	4
Integrating the offer with managerial staff development programmes	3
Conducting consultations with the university's socio-economic environment on newly opened courses and specialisations	2
None of the above	1

Source: Own work based on survey results. N = 11.

Table 4.36 To what extent do students at your university have a say in the individual design of the curriculum and the selection of individual subjects/courses?

Answer	*Frequency*
Due to complex procedures and formal requirements, curricula at our university are not updated more than once every few years. They include small blocks of optional classes to be chosen by students individually.	4
The curricula at our university are modified on an ongoing basis in consultation with student representatives and guarantee a free choice of subject path/module and optional courses selected by students according to their preferences.	4
The framework curricula at our university are modified on an ongoing basis in consultation with student representatives and guarantee a high degree of freedom to construct the course of study and the modules/subjects pursued.	3

Source: Own work based on survey results. N = 11.

use digital tools? (management of the university; administration of the university; teaching; research)

- Who decides on the pace and direction of digital transformation of your university?

- How would you describe the management model adopted at your university? (traditional model, based on direct communication; advanced model, supported by digital tools)
- How would you evaluate the level of digital competences of the following university staff? (managerial staff; administrative staff; teaching staff; research staff)
- How would you describe the overall level of digital advancement of your university's infrastructure?
- Do students benefit from digital transformation of your university? If yes, how exactly? If not, why not?
- What are three key challenges related to digital transformation at your university?
- What are three key opportunities related to digital transformation at your university?

Key quotes coming from these individual interviews are as follows:

Stanford University:

We have transitioned over to a lot of digital tools for managing workflows at the university, whether that's HR, whether that is looking at paperworks approvals, finance, business affairs, all of it has shifted to fully online, fully online and digital tools. That was happening before the pandemic. But of course the pandemic fully shifted us over to digital tools looking to manage the university.

We've also shifted over to full digital tools to manage research administration. So there isn't anything that happens at the university from a research funding standpoint that doesn't use an online digital platform to move through every single stage of the of the research progress and from an administration standpoint.

Everything has gone digital for student applications, student and matriculation, everything there. I think the place that we still have yet to have full digitalization is in student degree progress.

I would say that that much like in any every organization the most effective staff members tend to be those that are not incredibly senior – for them the digital piece is a struggle. (…) And so for many of our more senior folks it's not that that they can't learn new technology, they're very smart and they do it. It's just been a change in the job and the chances to interact with the people that they like to interact with and that that is hard.

It is hard for us to recruit and retain really good tech people. When you sit in the middle of the tech world, because there is no way for us to compete on salary. You know, maybe you're connected to the mission, the teaching and research mission of the university. OK, that can be true.

Classes that even before pandemic, were completely asynchronous, but only for students who were on campus. Videotaped. I went into the studio. It's not like me in my basement, right? It's highly produced, small segments, modules where they can watch them. And the reason we created those digital assets was to allow our students who are, just like every young person around the world, feared of missing out on everything, they're over scheduled, they can't seem to fit any classes anywhere and also they like to take classes late at night.

When pandemic came for those classes that did that, like my class. People were asking – oh, how's your class going? Perfectly fine – all my videos were already there, everything was already set. It was great.

[university professor, head of one of university's centres]

UC Berkeley:

We use digital tools and all of those: management, administration, teaching, research. Some are specific to the Business School and then some are at the larger university level. UC Berkeley is part of, there's multiple University of California Campuses, so we do also have some systems that span across all of the different view seeking places.

They generally function OK. For online training we're required to do a lot of certification requirements. Those generally don't work very well. So they're not very good. Like you go halfway the training and then the system crashes.

For managing our classes we use a tool called Canvas and it's OK. It's not perfect, but it's pretty widely used, I think in most universities in the US. So, you know, all of us are kind of on the same system.

There is a system wide strategy decided at the office of the President for all of the UCS. It generally focuses mostly on things like cyber security, because that's the biggest concern. But they have also tried to standardize some of the systems for things like databases, and then the systems we use for HR, and probably also for the class management.

For technology specifically – I would say it's pretty traditional, right? You have a chief Information Officer and that person overseas technology at the university level, but then at least here within the Business School, we also have our IT department. And that's true for most of those locals. And then at the university system level there's also a chief Information Officer as well as the chief like information security officer that oversee the whole system.

The place where it became really obvious where many of us were not adept was when we had to teach online at COVID. Many people hadn't really used zoom before. They didn't know how to teach online. They didn't really know how to handle recording and then when we came

back. Sometimes we had to do hybrid where we'd have some people that, offline and some in the classroom. The technology just did not work very well.

There are trainings offered. I think the faculty is probably divided on how good they are, technology, usually their faculty (…). The staff is generally pretty good, they have to be because they interact with all the student facing and back office systems. And then I think the management for the most part has to be pretty, pretty competent.

The overall level of digital advancement I think, is still pretty far behind. My guess is it's far behind Stanford. You know, it's a public university, so there's always not much funding and the system upgrades oftentimes (…) and again they focus on areas of risk more than innovation, when it comes to providing access.

Key challenges: one would be implementation. Sometimes things are launched and then they don't actually work all the time, so you know they can't trust that the system is reliable.

Key opportunities: one would be more advancement around online course development and hybrid development classes. Like even when I have guest speakers and they want to join by zoom in the classroom, a lot of times it doesn't work very well, or like acoustics in the room, like they can't hear.

[university business school faculty member]

Accordingly, the comparison between European and American perspective can be summarised as follows:

Overall, Table 4.37 shows that the processes connected with digital transformation are similar both from European and American perspectives. However, some differences can be observed, namely, (1) American

Table 4.37 Comparison of European and American perspectives on digital transformation at universities

	European perspective	*American perspective*
I. Digital transformation strategy	Most of researched universities have the strategy and the plan for digital transformation, but the level of their digital advancement is rather moderate. Digital transformation is most often	Most of researched universities declare that they are advanced in digital transformation. Digital transformation is most often implemented centrally with top-bottom approach. The biggest obstacle to

(*Continued*)

Table 4.37 (Continued)

	European perspective	*American perspective*
	implemented centrally with top-bottom approach. The biggest obstacle to digital transformation is lack of finance and lack of public administration support.	digital transformation is lack of adequate competences of managerial staff but similarly to Europe lack of finance is also reported.
II. Management model of the university	Most researched universities undergo organizational change towards Education 4.0. However, digital tools rarely support the work of staff. Researched universities are very open to partnerships and networking.	Organizational change at universities manifests itself in introducing automated and flexible processes that minimise the need for direct supervision of employees by superiors. Digital tools support the work of staff. Researched universities are very open to partnerships and networking.
III. Infrastructure	Most of researched universities use advanced technological solutions to optimize teaching, research and administration. Overall, basic software and tools are used but advanced and intelligent systems are increasingly implemented. Intelligent systems for data processing and analysis have already been partially implemented to improve the teaching, research and administrative processes, but these solutions that do not	Most of researched universities use advanced technological solutions to optimize teaching, research and administration. The implementation of advanced and intelligent software and tools prevails. Intelligent systems for data processing and analysis have already been partially implemented to improve the teaching, research and administrative processes, but these solutions that do not cover the entirety of the processes carried out.

(*Continued*)

Table 4.37 (Continued)

	European perspective	*American perspective*
	cover the entirety of the processes carried out.	
IV. Human capital	Most of researched universities provide basic trainings in the use of technology. Administration staff is most competent in using technologies. Most needed trainings refer to data collection and analysis. Peer learning and networking support the processes of digital transformation most.	Most of researched universities provide various trainings in the use of technology. Administration staff is most competent in using technologies but teaching and research staff also have a good command of technologies. Most needed trainings refer to internal communication and working in diverse dispersed teams Peer learning supports the processes of digital transformation most.
V. Product	Most commonly various types of labs using high technologies have been created. Courses taught by practitioners and experts from outside of academia are most valuable for the development of students' competences. Curricula are usually updated in consultations with students' representatives.	Most commonly various types of labs using high technologies have been created. Creating dedicated laboratories for learning selected competences of the future is most valuable for the development of students' competences. Curricula are usually updated in consultations with students' representatives.

Source: Own work.

universities are overall slightly more advanced in their digital transformation, and (2) American universities apply digital solutions in a more integrated way. Yet, it can also be concluded that digital transformation at universities is still a challenge worldwide, and there is a need for various supportive instruments and initiatives to boost the process.

4.4 Digital maturity of universities within European Universities alliances

And finally, in this study, the digital transformation is represented as a three-step ladder that leads to achieving digital maturity and unlocks the potential that new technologies can provide. This ladder starts from the organisations operating under a traditional model (step 1 – beginner), then progresses to organisations using certain digital solutions in a sporadic and non-integrated manner based on individual needs and contexts (step 2 – transitional), and finally reaches the stage where organisations use integrated digital solutions across all aspects of their operations (step 3 – advanced).

In general terms, the study's results show that universities taking part in EUI alliances are most frequently positioned at the second, transitional level according to the aforementioned three-step ladder model. This suggests a gradual streamlining of organisational processes towards intelligent management based on the adoption of new digital technologies and Education 4.0 solutions. These universities also demonstrate an increased use of various digital tools, despite the fact that personnel management is still largely conducted through direct means. Lastly, they are adapting their teaching and academic research to the demands of evolving educational realities through the continuous implementation of advanced, intelligent systems.

It is important to note that the initial research of this study presented in Chapter 3 proved that the digital competences of educational leaders, including those from higher education sector, are sufficient for effective management and sustainability of international collaboration projects. This second part of the study shows that, given technological advancements and challenges like the COVID-19 pandemic, these leaders still need further personal development within the context of the ongoing organisational changes at universities. Generally, these inevitable organisational changes occurring within universities, encompassing governance, didactics and research, due to factors like the COVID-19 pandemic, have been emphasised by Ahrens and Zascierinska (2020), Rohman et al. (2020) and Velásquez and Lara (2021). The research presented above provides evidence that this perspective might indeed be valid. However, in-depth interviews with representatives of Californian universities have proved that what contributes most to the digital maturity of a university is not an ad hoc digitalisation resulting from unexpected situations such as COVID-19 pandemic, but rather long-term digitalisation strategy, plan and its implementation.

As regards American experiences, it must be stressed that the study results are relatively similar to the ones obtained from universities participating in European Universities alliances. However, taking into account the three-step ladder concept described above, it should be noted

that researched American universities position themselves somewhere between the second and third steps, or at least at the top of the second one. This means that their digital maturity is slightly higher than the digital maturity of universities participating in European Universities alliances.

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5 Ecosystem for sustainable change

Bridging the gap between the world of business and the world of education – towards the paradigm of Education 4.0

5.1 The common understanding of competences 4.0

Regarding competences 4.0, an analysis of the Scopus database reveals that scientific discussions primarily take place within technical and industrial fields, as well as in the world of business, with a focus on practical applications of the discussed concepts. Accordingly, Table 5.1 shows in detail that discussions on competences 4.0, as defined in Chapter 1, are held in specific functional contexts rather than being widely discussed in the broader context of education.

On a more precise level, Table 5.2 shows the landscape of scientific discussions on digital and social competences across the top five areas.

Table 5.2 shows that even social competences, as part of a broader concept of competences 4.0, are mainly discussed within technical areas. It is also interesting to note that the authors deliberate more often on social than digital competences. This finding corresponds very well with McKinsey's research, which substantiates the necessity to transition from hard skills to soft skills, predominantly encompassed within the broader category of social competences, to address the demands and challenges brought about by the Fourth Industrial Revolution (McKinsey 2018). Moreover, there is a need to proliferate the discussion on competences 4.0 beyond business and technical fields. Social sciences and the education sector should engage with the subject of competences 4.0, conduct research on it, and more extensively incorporate it to bridge the gap between the education and business/industry sectors. Furthermore, the concept of competences 4.0 possesses a generic nature and is applicable across various contexts. Practitioners from diverse fields can draw from it as a wellspring of inspiration for research. Consequently, the concept of competences should be used for curriculum development at universities and for recruiting processes in companies.

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Table 5.1 Number of publications on competences 4.0 by countries, document types and subject areas

Country	*Number of publications* *	*Document type*	*Number of publications* *	*Subject area*	*Number of publications* *
Germany	3,560	Conference Paper	11,078	Engineering	14,901
Italy	2,166	Article	10,728	Computer Science	12,834
United States	2,118	Book Chapter	2,266	Business, Management and Accounting	5,111
China	1,647	Review	1,271	Decision Sciences	3,728
United Kingdo-m	1,603	Conference Review	617	Social Sciences	3,633

Source: Own work.

Notes

* *Set of publications at a current time (21 June 2023).*

Table 5.2 Digital and social competences across the top five scientific areas

Digital competences (total 25 publications)		*Social competences (total 674 publications)*	
Scientific area	*Number of publications*	*Scientific area*	*Number of publications*
Engineering	15	Engineering	388
Computer Science	14	Computer Science	289
Business, Management and Accounting	13	Business, Management and Accounting	185
Social Sciences	10	Decision Sciences	113
Decision Sciences	5	Social Sciences	92

Source: Own work.

5.2 The development of competences 4.0 at universities – agenda for the future

In reference to the theoretical assumptions of universities of the future presented in Chapter 2, and the common understanding of competences 4.0 across various scientific fields, this section of the chapter aims to present practical solutions that might help universities embark on the path towards Education 4.0. This is a crucial issue in the light of the research findings presented in Chapter 4, which indicate that universities, allied within European Universities consortia, are generally supportive of their students but not necessarily effective in developing the competences of the future, i.e. competences 4.0.

Based on the competences of the future, the research group, of which the author of this study was a member, established by the Platform for the Industry of the Future – a Polish NGO – designed a certification system for universities. This system assists universities in assessing and reflecting on the extent to which they are fostering the development of future-oriented competences among their students. The certification system presents and defines the standards that should be followed and respected by the universities of the future. These are (1) curriculum, (2) internal university ecosystem, (3) cooperation with the external ecosystem, (4) the teaching staff and (5) university infrastructure. Additionally, the certification system provides and defines detailed criteria for each element of the aforementioned standards. The system also includes indicators that measure the fulfilment of these criteria. The certification system is presented in Table 5.3.

Table 5.3 Universities certification system standards: towards Education 4.0

Curriculum	
Criteria	*Indicators of compliance*
The curriculum is oriented towards the goals of developing the competences of the future. (MANDATORY)	[D] The learning objectives and learning content of the course syllabuses go beyond the knowledge of the subject and include most of the competences identified in Chapter 1 as the competences of the future. [D] The individual courses combine the objectives of the knowledge of the subject and the competences of the future, allowing students to pursue them concurrently. [O] Students and educators spontaneously identify some of the competences of the future when describing the objectives of the courses they are taking.
The curriculum engages students in solving practical problems and supports them in finding the uses for the competences they acquire. (MANDATORY)	[D] The curricula in the area covered by the Standard include a variety of forms that bring students into contact with the practical challenges of industry (e.g. internships, implementation projects, consultations, study trips). [O] Students can see how the competences developed during their studies can be used and believe that these studies provide an opportunity to be in touch with the practical challenges of the economy of the future. [O/D] Employers employing graduates of the course covered by the Standard are positive about their preparation to take on practical professional challenges OR the university has results of the track survey of the graduates that lead to such conclusions.
3. The curriculum is delivered in a way that fosters collaboration and communication.	[D] The forms and methods of education included in the curriculum covered by the Standard provide numerous opportunities to work in task groups and project teams. [O] Students in the courses covered by the Standard recognise that their studies provide them with numerous opportunities to communicate and collaborate on tasks related to their curriculum.

(*Continued*)

Table 5.3 (Continued)

Curriculum	
Criteria	*Indicators of compliance*
4. The curriculum is agreed internally and regularly updated.	[D] The university monitors student satisfaction and regularly examines the results of the curriculum covered by the Standard. [D] The area covered by the Standard includes courses that have been developed or significantly modified in the last three years as a result of evaluation or to better meet the needs of students and other stakeholders. [O] Syllabuses for new courses are developed through consultation with other instructors and correspond with the rest of the curriculum.
Internal environment	
Criteria	**Indicators of compliance**
5. The university provides an environment for students to develop their own potential and shape their individual development path. (MANDATORY)	[D] Students have influence on the selection of a significant part of the courses and shaping the learning pathway. [D] Students have access to educational offers that go beyond the strict course of study and help them develop the competences of the future (e.g. certification training, acquisition and validation of micro-qualifications, dedicated courses, study visits). [D] There are numerous examples of university-supported activities that develop the individual potential of students (e.g. participation in competitions, conferences, development of prototypes and inventions) that took place during the last academic year. [D] Students can benefit from individual support (e.g. counselling, coaching, tutoring) in shaping their course of study and career planning. Access to development services is simple and equal for all students interested in them. [O] Students recognise the variety of development opportunities offered by the university and find them valuable.

(*Continued*)

Table 5.3 (Continued)

Curriculum	
Criteria	*Indicators of compliance*
6. The university teaches interdisciplinary collaboration and creates the conditions to develop it. (MANDATORY)	[D] There are active academic clubs or other student organisations within the university providing opportunities for joint projects (including those related to the needs of the industry of the future). [D] The university runs or supports and co-finances cyclical events that foster interdisciplinary collaboration between students (e.g. hackathons, workshops, do it yourself environment, business hubs, incubators and entrepreneurial academies). [O] Students perceive the forms of collaborative activity available to them as part of their studies as diverse, valuable and supported by the university.
7. The university creates an environment that is open to diversity and encourages exchange and dialogue.	[D] The university participates in student and faculty exchange programmes with foreign universities. [O] Foreign students studying at the university (including international exchange students) perceive and positively evaluate the development opportunities provided by the university and the support in integrating into the academic community. [D] The university takes active steps to promote student diversity and to counteract stereotypes or exclusion. [O] Students believe that the university environment is safe and offers support for all, or perceive strong efforts on the part of the university to do so.
Cooperation with the surrounding environment	
Criteria	**Indicators of compliance**
8. The university supports the professional development of its students and graduates.	[D] Student placements co-organised by the university are mostly carried out in organisations which provide opportunities for the development of competences in line with the field of study.

(*Continued*)

Table 5.3 (Continued)

Curriculum	
Criteria	*Indicators of compliance*
	[D] The university maintains contact with its graduates, offering them further support in their professional development and inviting them to make contact and pass on their experience to students. [O] Students declare that in the course of their studies so far, they have had the opportunity to attend an event with graduates of the university.
9. The university acts for the benefit of its environment and provides opportunities for students to get involved.	[D] The university collaborates with companies in the industrial sector (e.g. by conducting research and development projects or providing consultancy services) and provides students with the opportunity to participate in these collaborations. [D] The university engages students in projects and events aimed at different groups from its social environment, using the available educational and creative infrastructure in a way that promotes the use and development of acquired competences. [O] Students are able to list activities related to the university's cooperation with its environment, and know of opportunities to get involved.
The university tracks, anticipates and responds to changes in the world surrounding it. (MANDATORY)	[D] The university has a mechanism or team in place to monitor and anticipate changes in the environment, diagnose the resulting needs and use the findings to develop the educational offer. [O] Educators are able to point to an example of the use of the above mechanism to modify educational offers.
Educators	
Criteria	**Indicators of compliance**
11. The university employs people with the competences of an Educator of the Future.	[D] At least 30% of permanent teaching staff in the area covered by the Standard are certified as Educators of the Future or meet their criteria at the time of review of the Standard for institutions.

(*Continued*)

Table 5.3 (Continued)

Curriculum	
Criteria	*Indicators of compliance*
12. For its employees, the university is a place of real collaboration and mutual learning. (MANDATORY)	[D] The university offers educators requirements and conditions that foster collaboration and information sharing within teams. [O] Educators feel that they have peer support and the opportunity to share work-related information on a regular basis.
13. The university supports the development of its employees.	[D] The university offers educators support in the development of competences that go beyond academic work activities, including the improvement of competences in methodology and the organisation of work in an educational-creative environment. (O) Educators are able to identify examples of development activities that the university has offered them or enabled them to do.
Infrastructure	
Criteria	**Indicators of compliance**
14. A unit covered by the Standard has an educational and creative infrastructure for the competences of the future (hereinafter referred to as the infrastructure) or has access to it. (MANDATORY)	[D] The infrastructure includes: specialised industrial equipment suitable for the specific nature of the studies, a multimedia projector or screen with touchscreen function, internet access with a minimum bandwidth of 300 MB/s and furniture to enable individual and group work in workshops. [D] The infrastructure allows the interior to be freely arranged and adapted to changing forms of work, as well as giving users freedom of movement. [D] The educational and creative infrastructure meets the conditions of Accessibility Plus specified by the Act on Ensuring Accessibility for Persons with Special Needs of 19 July 2019.
15. The unit covered by the Standard makes effective	[D] The unit has and implements a plan for the use of the infrastructure, making it

(*Continued*)

Table 5.3 (Continued)

Curriculum	
Criteria	*Indicators of compliance*
use of the infrastructure for teaching activities or additional learning activities related to the development of the competences of the future. (MANDATORY)	available to students, academic staff and selected groups from the social environment. [D] The infrastructure is used for purposes beyond the strict curriculum (e.g. to organise training courses, workshops, hackathons or industrial process demonstrations). [D] The educational and creative infrastructure was used for min. 70% of the working days on which full-time teaching was conducted at the university during the last academic year. [O] Students are able to list educational activities exploiting the infrastructure and indicate how their effectiveness has been affected.
16. The unit covered by the Standard monitors the use of the infrastructure and upgrades it regularly.	[D] The unit has data to assess the effectiveness of infrastructure use. [D] Over the past three years, the unit has upgraded selected elements of the infrastructure to match changing needs or to increase efficiency of use.

Source: Strojny, Nowak, Hetmańczyk, Malaka and Skrzek 2021.

In order for an organisational unit of a higher education institution (e.g. an institute or a department) to meet the Standard, it must demonstrate fulfilment of a minimum of 12 out of the 15 criteria listed above, including all mandatory criteria. The satisfaction of individual criteria is assessed qualitatively through a comprehensive evaluation of indicators related to each criterion.

The [D] indicators (documentation) are evaluated through interviews with representatives of the institution involved in the certification process based on the documentation collected by them. In the case of indicators related to infrastructure, verification may also involve visual inspections. In most cases, [D] indicators should not require the preparation of new material but only the collection and analysis of existing material (e.g. course syllabuses).

The [O] indicators (opinions) are assessed based on individual and group interviews with selected stakeholders (in particular students and educators). Essentially, [O] indicators are used to check whether the solutions described

in the documentation are effectively implemented, visibly observable and positively evaluated by the stakeholders. Therefore, a positive evaluation for a [D] indicator and a negative one for an [O] indicator mean that the criterion is not met. Conversely, a consistently positive outcome in [O] assessment when a [D] indicator is not fulfilled implies the necessity of completing the documentation. [O] indicators have a subjective nature; hence, if discrepancies or contradictions arise in the gathered data, conducting interviews with different individuals is a viable option.

The above assessment scheme checks if universities are cooperating and exchanging organisations as well as if they react to changing expectations from learners and the university staff. It is also an awareness-raising tool pointing to what is known as the third mission of universities, realised as the knowledge network of universities and labour market institutions serving the local community and economy. This tool also proposes a unified methodology of measuring the readiness of an institution to develop the competences 4.0 among students and staff – higher quality of education and better response to the labour market demands.

The experience so far has revealed that encouraging universities to engage in an official certification procedure, like the one described above, is exceedingly challenging due to their existing involvement in various certification schemes. As a result, it is suggested that they could use the proposed model in an informal capacity, functioning as a self-evaluation tool. Additionally, it should be noted that the model mentioned above aligns with the concept of the future university, whose comprehensive definition is provided in Chapter 2. In short, according to this definition, the future university is based on four pillars: competences of the future, networked university, flexible didactic offer and lifelong learning scenario. All these aspects find their reflection in the proposed certification standard.

It is also interesting to note that the above-described scheme addresses the techniques suggested by the World Economic Forum (Gray 2016) in order to provide an effective platform for the development of new skills, or competences 4.0. Among various elements, these techniques refer to the creation of a safe environment for learning, developing a growth mindset, nurturing relationships, fostering reflective reasoning and analysis, providing clear learning objectives targeting explicit skills and using a hands-on approach. All these elements are imbedded in already-used didactic approaches and methods such as constructivism, autonomous learning or problem/task-based learning.

5.3 Academia – business collaboration

It can be generally assumed that human capital, for example, people's competences, constitute a conveyer belt of knowledge, experience, attitudes

and know-how in the dialectical process between academia and business, or industry. Leadership-driven digital transformation within organisational change through innovation can be successfully realised in such a dialectical environment, or ecosystem. In order to understand the state of university-business/industry cooperation, the Index of Higher Education-Business Engagement (HEBE Index) was created by the research group led by the author of this book. It is a measure that may be used as a universal, self-evaluation, analytical tool. The aim of this Index is to capture the attention of leaders in academia, government, business and society to (1) illustrate the current situation, highlighting good policy and practice in order to enable informed policy choices, and (2) inspire a new policy focus among decision-makers by demonstrating the importance of university-business/industry cooperation in stable and prosperous societies.

The main distinctive feature of the HEBE Index is that it is a descriptive awareness-raising tool, at both the public and political macro-level, which presents descriptive indices per strand and per country or a region in order to reflect the degree of adherence to European or global benchmarks in terms of European or global guidelines or recommendations. These recommendations, derived from the documents, set the standards in the following relevant areas:

- Provisions for university-business cooperation
- Promoting university-business cooperation solutions
- Establishing clear aims of university-business cooperation
- Promoting the idea of industry engagement in higher education
- Establishing a transparent system of the cooperation
- Acknowledgement of relevant solutions
- Contribution of university-business cooperation to growth and development.

The HEBE Index allows to identify drivers and obstacles to this cooperation and to inspire different activities that may result in boosting the university-business cooperation. The Index covers five areas of university activities, such as research and development, mobility, improving the educational offer, commercial activities and public engagement. It is composed of 184 indicators in total, which makes it complex and multidimensional. However, it is also a very flexible and adjustable tool that may be used as a standard model framework. Having reviewed typologies, the following areas of cooperation together with proposed indicators have been established for this Index:

- Joint R&D: R&D projects revenue, number of R&D contracts, number of staff dedicated to joint R&D activities

- Personal mobility: number of university staff working for business, number of business staff working for academia
- Student mobility: number of students in job placements and internships, number of scholarships funded by business
- Competences and education: number of students in joint study programmes, number of students who find jobs in their field of study
- Commercial activities: number of licenses and patents, number of spin-offs and start-ups and their revenue
- Public engagement: number of joint non-profit activities in public spheres.

(Higher Education-Business Collaboration Index 2017; Jelonek, Strycharz, Strzebońska and Szczucka 2017)

Competences 4.0 can be identified and measured in the first four mentioned areas. In the area of joint research and development activities, competences 4.0 can be identified especially within the number of students and researchers involved in projects carried out in cooperation with business, and the number of new technologies, patents, methods and procedures developed together with business partners. In the area of personnel and student mobility, competences 4.0 can be developed especially through participation in internships, job placements and scholarships carried out in collaboration with business partners. As far as competences and education are concerned, competences 4.0 can be assessed through the number of students participating in trainings and courses organised by business and by the number of business representatives delivering classes for students. At this stage, the Index is still undergoing a pilot phase, which revealed certain difficulties in obtaining the data. Finally, on the average, 63% of the indicators related to the area of "Competences and education" and "Joint R&D activities" were collected against 61% in "Personnel and student mobility", 23% in the area of "Commercial activities", and 5% in the area of "Public engagement". Still, this tool can be used by universities themselves as a self-evaluation reference framework (see Annex V), just as the certification tool for universities presented in the previous subchapter, in order to check on one's own ecosystem in which leaders can easily realise their innovative projects, for example, contributing to digital transformation, as the ones in Annex I.

To sum up, higher education institutions are becoming hubs of knowledge, competences and human resources of the future. They are also an efficient combination of enterprises and scientific research environment, which is a sine qua non condition for the growth of innovativeness and competitiveness in modern, knowledge-based economy (Bryła 2014:95–112). By playing the role of centres of knowledge, know-how

and learning, universities can drive economic development in their neighbouring areas, which also helps them to fulfil the third mission of academia. Universities can also provide talented people with an innovative environment, harness regional strengths on a global scale and foster an open exchange of knowledge, staff and expertise. They can also act as the hub of a knowledge network or cluster serving the local economy and community, on the provision that local and regional authorities implement intelligent specialisation strategies that facilitate focus of resources on priorities and maximise the impact of these institutions. However, they do not act in void, and their interactions with the outside world, namely with the private sector, are a fact that needs a deeper analysis. Consequently, university-business cooperation is nowadays the focal point of public debate within governments, international organisations and researchers themselves.

5.4 Towards innovation in education

Education does not function in a void, so in order to have a better insight into the processes connected with its development a reference to a broader socio-economic context must be made. Having in mind that the projects researched in Chapter 3 have Polish educational institutions as coordinators working together with a huge range of other European partners, it is proposed to relate the findings to external data on innovation both for Poland and Europe. And since research presented in Chapter 4 refers to European University alliances coordinated by universities from different European countries, it is also proposed to see the findings of this research in the context of innovative potential of Europe. This allows us to see the whole phenomenon from the broader point of view. According to the Global Innovation Index 2022, Poland is ranked 36th overall in the world and 24th in Europe. However, with a score of selected parameters connected directly with the research and discussion area in this book, namely, 31 for education, 70 for tertiary education, 32 for research and development and 22 for new technology infrastructure, Poland's score is somehow representative for European average. The detailed sub-parameters for these categories mentioned above for Poland and Europe respectively are presented in Table 5.4 and Table 5.5. The selected data from Global Innovation Index, relevant to this study, provides an overview of the broader national context of the country's potential for innovation. This data indicates that Poland is not particularly innovative in this regard, especially concerning research and development. However, in terms of investments and developments in tertiary education, the country does possess some potential to address challenges associated with technological waves and revolutions.

Table 5.4 Selected innovation parameters and their value for Poland

Human capital and research	
Education	**31**
Expenditure on education, % GDP	58
Government funding/pupil, secondary, % GDP/cap	49
School life expectancy, years	36
PISA scales in reading, maths and science	9
Pupil-teacher ratio, secondary	20
Tertiary education	**70**
Tertiary enrolment, % gross	35
Graduates in science and engineering, %	72
Tertiary inbound mobility, %	58
Research and development (R&D)	**32**
Researchers, FTE/mn pop.	29
Gross expenditure on R&D, % GDP	31
Global corporate R&D investors, top 3, mn USD	30
QS university ranking, top 3	41
Infrastructure	
Information and communication technologies	**22**
ICT access	42
ICT use	48
Government's online service	22
E-participation	9

Source: Dutta, Lanvin, León and Wunsch-Vincent 2022.

Although European average value for investments in research and development as well as in information and communication technology development is higher than for Poland, the investments and developments in tertiary education in Poland are substantially higher than on average in Europe. This generally means that Polish educational institutions participating in European innovative projects presented in this book function in a promising and developing national innovative ecosystem and in a relatively

Table 5.5 Selected innovation parameters and their value for Europe

Human capital and research	
Education	**36**
Expenditure on education, % GDP	52
Government funding/pupil, secondary, % GDP/cap	37
School life expectancy, years	34
PISA scales in reading, maths and science	31
Pupil-teacher ratio, secondary	31
Tertiary education	**37**
Tertiary enrolment, % gross	36
Graduates in science and engineering, %	46
Tertiary inbound mobility, %	36
Research and development (R&D)	**40**
Researchers, FTE/mn pop.	28
Gross expenditure on R&D, % GDP	33
Global corporate R&D investors, top 3, mn USD	27
QS university ranking, top 3	44
Infrastructure	
Information and communication technologies	**38**
ICT access	40
ICT use	33
Government's online service	42
E-participation	41

Source: Dutta, Lanvin, León and Wunsch-Vincent 2022.

well-developed European innovative ecosystem. On the one hand, it also means that there are some conditions for implementing innovations, and on the other hand, Erasmus+ projects presented and researched in this book can contribute greatly to the process of making a country and the entire Europe more innovative.

To provide a comprehensive view, it's crucial to highlight two observations from the Global Innovation Index 2022:

- Innovation investments flourished during the peak of the COVID-19 pandemic and experienced significant growth in 2021. However, their ongoing resilience for 2022 remains uncertain due to new global challenges.
- Technological progress, adoption and the socioeconomic impact of innovation all display indications of fragility. The future of growth driven by innovation is under question.

(Dutta, Lanvin, León and Wunsch-Vincent 2022:21)

Yet, at this point, it must be stressed that both Erasmus+ partnership projects and European Universities alliances described above may contribute significantly to the development process and may be real innovation drivers. The Global Innovation Index also lists several factors that underlie and contribute to the development based on innovations. Among many others, these are:

- Expenditure on education and research
- Cooperation between business and academia
- Investments from abroad
- New businesses
- Work productivity and competitive advantage
- Patents
- Access to technology
- Industry diversification
- Export of high technologies.

This brings us back to the Erasmus+ programme and European Universities Initiative with their transversal priority of digitalisation and the creation of virtual educational and research hubs. Within both initiatives, universities enhance their education and research budgets and potentials, cooperate with business while developing innovative solutions for managing or running their educational and research activities, bring investments from abroad in the form of European Union's donations, create new business solutions, improve effectiveness of their operations, gain competitive advantage on educational and research markets and so on. Eventually, these projects may lead to gaining new patents, developing new technologies and commercialising them. The examples of such projects are numerous, and their descriptions can be found in Annex I.

All this process is crucial, especially for countries like Poland. According to European Commission's Digital Economy and Society Index (DESI

2022), Poland is below EU's average in this index (European Commission 2022). Digital Economy and Society Index is European Union's main tool to monitor closely the progress of digital modernisation and transformation of respective Member States, both from economic and social point of view. The full data of this Index is presented in Table 5.6.

Table 5.6 Digital Economy and Society Index (DESI) 2022

Country	*Index*
Finland	69,6
Denmark	69,3
Netherlands	67,4
Sweden	65,2
Ireland	62,7
Malta	60,9
Spain	60,8
Luxembourg	58,9
Estonia	56,5
Austria	54
Slovenia	53,4
France	53,3
Germany	52,9
Lithuania	52,7
European Union	52,24
Portugal	50,8
Belgium	50,3
Latvia	49,7
Italy	49,3
Czechia	49,1
Cyprus	48,4

(*Continued*)

Table 5.6 (Continued)

Country	*Index*
Croatia	47,5
Hungary	44,3
Slovakia	43,4
Poland	40,5
Greece	38,9
Bulgaria	37,7
Romania	30,6

Source: European Commission.

All this enables us to place the discourse on educational leaders within a wider national and European context, and subsequently, to conclude potential advancements in the future.

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Conclusions

In light of the presented study and the corresponding discussion, the answers to the research questions are as follows:

The levels of digital competences among Erasmus+ project leaders are relatively high, which is not surprising considering the inherent homogeneity within the group of educational leaders in this regard. This level of digital competence enables them to function within networked, international projects or organisations in order to achieve planned goals and effects even in the context of the COVID-19 pandemic. Consequently, digital competence empowers them with resilience to adeptly manage and sustain their projects during difficult times. The overall resilience and efficacy are further facilitated by their social competences, which are essential within the context of networked activities and projects. Researched educational leaders have benefited from their adeptness in maintaining contacts and communicating effectively. However, they did display shortcomings in stress management and adapting swiftly to new environments. As the digital maturity of educational leaders cannot be analysed and assessed solely in connection with digital competence, it is imperative to consider both digital and social competences as interconnected elements that together form a distinct amalgamation. Despite certain deficiencies in social competence, the general evaluation of researched educational leaders' digital maturity, as reflected in their effectiveness in steering and sustaining projects during the pandemic, is affirmative. Overall, it can be concluded from the research results that project leaders' social competences are one of the most influential driving forces behind the need for organisational change and eventually digital transformation. Furthermore, their high learning potential has also proven useful and effective, enhancing their overall digital maturity. Despite their self-assessment indicating a lack in stress management and adaptability to novel conditions, their cumulative lifelong learning index remains relatively high. This implies that their awareness of the ongoing process during the pandemic, along with their strengths and weaknesses, is reasonably well

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developed. Additionally, their willingness to learn and discover new strategies for successfully continuing their projects has bolstered their resilience.

Regarding universities participating in the European Universities Initiative, the situation is more complex, as we are dealing with institutional leaders. Research findings prove that their level of digital maturity is between basic and advanced. In this context, "basic" refers to the conventional use of technology, while "advanced" denotes the integration and use of technology that includes automation, including technology based on artificial intelligence. It has been observed that in many cases, these universities, operating within European Universities alliances, have adopted digital strategies and implemented high technology solutions for administration, supporting the educational process and facilitating research activities. Awareness of the necessity for continuous enhancement of competences, particularly digital ones, is relatively high among various university staff. University authorities support their staff in this regard by providing relevant courses. However, this is not entirely aligned with the level of investments made in digital infrastructure. The inadequacy of investments in technological infrastructure is also apparent in the aforementioned Global Innovation Index, which goes in line with the findings of this research. It is also worth noting that universities frequently report their extensive efforts to update their educational offerings to cultivate competences 4.0 among their students.

Apart from the Global Innovation Index, the comparison to experiences with digital transformation of American universities also constitutes a valuable point of reference. Although digital transformation at universities is a global challenge, American universities are more advanced in implementing new technologies in all spheres of activities, namely, teaching, research and administration. Their organisational change in the context of Industry 4.0 has been more substantial. Among all the American higher education institutions researched, Stanford University is an example of good practice and its success results, first of all, from the fact that it has a coherent digital transformation strategy that was initiated years before the COVID-19 pandemic. Accordingly, the university was prepared to go online when the pandemic hit, and the whole process of digital transformation has not been driven by ad hoc and unforeseen situation. The process has been gradual and systematic.

Yet, it can be asserted that Erasmus+ and European Universities Initiative educational leaders, both at the individual and institutional levels, possess a sufficient level of digital maturity. This maturity enables them to actively participate in innovative educational European projects and initiatives, as well as to confront challenges arising from global technological advancements. While their digital maturity may not be at

an advanced stage, it is adequate for modernising their institutions and facilitating their effective engagement within intricate networks, thereby positioning them for future competitive advantage. Furthermore, it can be affirmed that the level of digital maturity demonstrated by researched educational leaders facilitates organisational transformation towards the vision of future universities, as defined in Chapter 2. At the very least, it can be confidently stated that the level of digital maturity among researched educational leaders does not hinder the progression towards Education 4.0. The paradigm of Education 4.0 is built upon key elements, including digitalisation, networking (particularly on an international scale) and flexibility in governance and didactics.

Research findings also prove that this process of organisational change is highly likely to be continued in the mode of exchanging experiences and good practice on the European level among European leaders, although the broader context depicted by the Global Innovation Index 2022 for both Poland, Europe, and worldwide is not very much favourable. What is more, Poland's score in the Digital Economy and Society Index in general is not satisfactory either in relation to its European counterparts. However, according to some researchers, in the post-pandemic era, an organisational, cultural and mental change will likely and permanently lead to the development of digital universities (Davey and Galan-Muros 2020:599–617; Sangster, Stoner and Flood 2020). While Ferrazzi, Gohar and Weyrich's (2022:9) research shows that the COVID-19 pandemic accelerated digital transformation in companies significantly. The research presented in this book also shows the signs of such acceleration in universities. Consequently, the development of digital universities that might be witnessed in the near future is possible. However, there is a threat that technological gap will increase, and it will be more and more difficult for educational sector as such to catch up with all possibilities offered by technology, especially the ones based on artificial intelligence. For example, none of researched universities reported the use of advanced tools and applications in administration and didactics based on artificial intelligence. Neither do they use complex data warehouses that provide a platform for highly sophisticated data processing – for example, such a service is delivered by Silicon Valley's Snowflake, which is a world-leading provider in this respect, and its solutions are already used by the merchandise sector. Accordingly, there is a need for further research so that the possible proliferation of this technological gap could be monitored. Regardless of what happens and which direction digital transformation in educational sector goes, one can be sure that in all walks of life people will live and work alongside machines and sophisticated technology. Hopefully, this coexistence will have a complementary and not a harmful substituting character (Susskind 2020:28–30), where machines and technology will augment people's capabilities and not replace them (Harvard Business

Review 2019:109–110). In the case of educational institutions, this should lead to better effectiveness in educational activities and will help prepare students better for the new socio-economic reality. This, in turn, will provide a platform to create new leaders who will continue digital transformation intelligently and sustainably.

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Appendices

Annex I

Examples of innovative Erasmus+ projects contributing to digital transformation

Themes of projects:

A. Digital competences
B. Innovative education programmes or practices in education
C. Open and remote learning

Innovative Learning Approaches for Implementation of Lean Thinking to Enhance Office and Knowledge Work Productivity
2016-1-PL01-KA203-026293, 01.10.2016-30.09.2018
Themes: A, B, and C

Partners:
POLITECHNIKA RZESZOWSKA IM. IGNACEGO ŁUKASIEWICZA (Poland)
PRZEDSIĘBIORSTWO PRODUKCJI I HANDLU "RESTOL" SP. Z O.O. (Poland)
CENTOFORM SRL (Italy)
OULUN YLIOPISTO (Finland)
LATINO-CONFECCOES LDA (Portugal)
SALTE AS (Norway)
UNIVERSITETET I STAVANGER (Norway)
UNIVERSIDADE DO MINHO (Portugal)

ILA-LEAN project aimed at developing didactic materials that improve knowledge on the implementation of Lean Thinking in Office and Knowledge Work. While the knowledge concerning Lean Thinking is

expected by companies, in practice, it is mainly used in the production area. However, companies realised that much waste also exists in Office and Knowledge Work, and hence skills concerning identification and elimination of waste in these areas are desirable.

The three outputs of the project were (1) Tablet Course on Lean Office and Knowledge Work (Leading Organisation: University of Stavanger); (2) a set of games on Lean Office and Knowledge Work (Leading Organisation: Rzeszów University of Technology); and (3) Teachers/Trainers manual (Leading Organisation: University of Minho).

All partners participated in the development of outputs. Companies contributed practical knowledge concerning problems existing in Office and Knowledge Work in the industry they operate in; other partners contributed their knowledge concerning didactic methods and training experiences, including games development.

Framework for Gamified Programming Education
2018-1-PL01-KA203-050803, 01.09.2018-31.05.2021
Themes: A, B, and C

Partners:
UNIWERSYTET SZCZECIŃSKI (Poland)
AALBORG UNIVERSITET (Denmark)
UNIVERSITA DEGLI STUDI DI NAPOLI PARTHENOPE (Italy)
INESC TEC – INSTITUTO DE ENGENHARIADE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA (Portugal)

The project aimed at providing the necessary specifications, toolset and programming exercise base for an effective application of gamification in programming education, primarily in higher education institutions. The aim was to deliver six intellectual outputs: two specification documents (gamification scheme and format specification), two types of software (tools for authoring and conversion of exercises, gamified interactive learning environment) and at least four collections of gamified programming exercises (each one available in English and in selected national languages). All the project outputs are freely available on the Internet under open-source licenses. The project consortium has involved partners with extensive and versatile experience in the domain of programming education.

Digital Orchestra
2019-1-PL01-KA203-065521, 01.09.2019-31.08.2022
Themes: A and B

Partners:
EESTI MUUSIKA- JA TEATRIAKADEEMIA (Estonia)
STOWARZYSZENIE PASSIONFRUITS (Poland)
UNIWERSYTET MUZYCZNY FRYDERYKA CHOPINA (Poland)
CONSERVATORIO DI MUSICA DI LECCE - TITO SCHIPA (Italy)

The Digital Orchestra partnership was formed by four organisations from three different countries – Poland, Estonia and Italy. Three of these organisations are musical universities, and the fourth one is an association.

The partners wanted to create open-source educational resources that would be used during Orchestral Studies in the educational process of instrumentalist musicians. They prepared a common list of fragments of musical pieces on which both the educational process and the future recruitment to orchestra spots are based. Pieces from this list were recorded using a virtual orchestra, and on that basis, partners generated various versions in which parts of certain instruments are muted. This way, for example, a violinist preparing his part is able to stop duplicating recordings of the piece, instead downloading a fitting version of the piece from the online website and playing his own part using a generated file in which only the part of the violin is muted.

The partners believe that this new model for individual practice will greatly increase the effectiveness of the orchestral studies courses, allowing to go through more material (more various pieces of music). The designed tool will also be a valuable resource while looking for employment. It will increase the success rate of students and graduates who use the tool during studies in recruitment processes for spots in orchestras and philharmonics.

Due to the fact that both the material and the methodology of teaching orchestral studies in musical universities across Europe are very similar, potential for implementing the tool in a wide range of institutions is enormous.

Mediation in Language Learning and Teaching
2019-1-PL01-KA203-065746, 03.11.2019-02.11.2021
Themes: A and B

Partners:
UNIWERSYTET WARSZAWSKI (Poland)
UNIVERZITA KARLOVA (Czech Republic)
HELSINGIN YLIOPISTO (Finland)
VYTAUTO DIDZIOJO UNIVERSITETAS (Lithuania)

The MiLLaT Project (Mediation in Language Learning and Teaching) has been initiated as a response to the most recent innovative developments

in the field of language teaching, learning and assessment refined in Common European Framework of Reference for Languages (CEFR, 2018). The project aims to reinforce the main methodological message of the CEFR, which implies that the learner is to be viewed as a social, plurilingual and pluricultural language user, whose learning process has to be driven by action and task, and whose assessment is to be guided by their communicative ability in real-life situations.

The key position in the action-oriented approach is held by MEDIATION, the notion that constitutes the focus of the project. The needs analysis conducted prior to the project has demonstrated a considerable need for further exploration of mediation, the importance of collaborative research into the state-of-the-art mediation activities and strategies, and a great demand for educational materials, which could offer practical mediation guidelines for teachers and to assure the development of students' mediation activities and strategies. In view of this, MiLLaT has been created to raise the teachers' and learners' awareness of the mediated and complex nature of language learning, to highlight the importance of incorporating mediation (linguistic, cultural, social and pedagogic) into the curriculum development, and designing teaching materials and courses based on real-world communicative needs.

E-Learning Prospects for Humanities
2020-1-PL01-KA203-081599, 01.12.2020-30.11.2022
Themes: A and C

Partners:
UNIWERSYTET ŚLĄSKI (Poland)
ZÁPADOČESKÁ UNIVERZITA V PLZNI (Czech Republic)
UNIVERSITA DEGLI STUDI DI SALERNO (Italy)
KAZIMIERO SIMONAVICIAUS UNIVERSITETAS, UAB (Lithuania)
PRESOVSKA UNIVERZITA V PRESOVE (Slovakia)

The main objective of the project was to strengthen the cooperation between the five partner institutions and increase their internationalisation through the development and dissemination of new educational tools and the exchange of good practices in the area of distance learning. The project helped to overcome prejudices against e-learning, showing that the tools it offers can be very effective. Understanding new forms of didactics and their implementation in humanities by various European universities not only contributed to the evaluation of the present condition of e-learning but also inspired the participants of the project to develop certain recommendations and good practices for distance learning. By adopting modern teaching methods to the requirements of students, academic

teachers can develop and respond more adequately to the changing expectations of young people.

BOT-Learning as a Modern Teaching Method of GEN-Z
2020-1-PL01-KA203-081777, 01.09.2020-30.06.2023
Themes: A and B

Partners:
AKADEMIA MORSKA W SZCZECINIE AM (Poland)
SCIENCE4PEOPLE SP. Z O.O. (Poland)
TAMPEREEN AMMATTIKORKEAKOULU OY (Finland)
UNIVERSIDADE DE AVEIRO (Portugal)
VELIKO TURNOVO UNIVERSITY ST. CYRIL AND METHODIUS (Bulgaria)
UNIVERSITAET LEIPZIG (Germany)

The purpose of the project was to develop and test, using specific learning content (entrepreneurship course), an innovative educational BOT-learning method based on the use of tools such as chatbot (virtual educator) and chat (text conversation with a real educator). The partners adapt channels widely used by GEN-Z and fill them with verified and useful content.

The main output of the project is the chatbot and chat tool for entrepreneurship education. The implementation of MELES-BOT outputs fits directly into the main features of the transformation of education systems to Education 4.0, which essentially uses technology-based tools and resources to drive education in non-traditional ways. MELES-BOT objective is to deliver basic skills and key competencies to the students who will form Industry 4.0 staff. Designing, developing and using MELES-BOT in education process will accelerate and scale-up the digital transformation. The digital competencies obtained by teachers will help them equip young people with digital skills. MELES-BOT is also addressing differences concerning education access by underrepresented groups. Thanks to distant access, all, who from different reasons, cannot attend direct classes, will have an equal education opportunity.

Development of the Master level of Sports Management with Special Emphasis on the Field of Sports
2020-1-PL01-KA203-081993, 01.09.2020-31.08.2023
Theme: A

Partners:
PAŃSTWOWA SZKOŁA WYŻSZA IM. PAPIEŻA JANA PAWŁA II W BIAŁEJ PODLASKIEJ (Poland)
UNIVERZITET U NOVOM SADU (Serbia)
PECSI TUDOMANYEGYETEM – UNIVERSITY OF PECS (Hungary)

The aim of the project is to incorporate six priority courses in English into the sports management education of the three participating universities, using innovative e-learning techniques that provide students and teachers with important and useful knowledge in sports science education. As a result of the project, curricula are created that can be used immediately by the participating institutions and can be published as an optional lecture, enriching their education portfolio. The project is also the first step in a long-term process in which a full curriculum of a complex four-semester master's degree programme will be developed, with additional curricula for sports manager education that are not the subject of the project. This allows the Polish and Serbian partners involved in the project to accredit the programme, as well as to upgrade the Hungarian partner's existing sports manager education in Hungarian and to launch the same education in English. It will also enable the three partner institutions to play a decisive role in the field of sports manager education in the region, and niche education can be launched especially in Serbia and Poland.

A long-term goal is also to develop double-degree educational programmes among partner institutions whereby students in sports management education study in different institutions during their educational period, earning a diploma issued jointly by the partner institutions. The main task of the project is to establish a strategic partnership within the three universities for the purpose of unified sports management education. In fact, developing the curriculum for sports manager education, preparing e-learning materials, educating teachers and creating an e-learning platform are priorities of the project.

The project's e-learning platform not only includes open-access knowledge shared among partner institutions and other institutions that may become involved, as well as flexible learning opportunities for students, but also prioritises learning opportunities for people with disabilities.

Mixed Reality Supporting Advanced Medical Education – A New Method of Teaching Medical Skills
2020-1-PL01-KA203-082077, 01.09.2020-31.08.2023
Theme: A

Partners:
UNIWERSYTET JAGIELLOŃSKI (Poland)
UNIVERSITA CATTOLICA DEL SACRO CUORE (Italy)
STICHTING KATHOLIEKE UNIVERSITEIT (Netherlands)
UNIVERZITA PALACKEHO V OLOMOUCI (Czech Republic)
ERASMUS UNIVERSITAIR MEDISCH CENTRUM ROTTERDAM (Netherlands)
UNIVERSITA DEGLI STUDI DI FERRARA (Italy)

The primary goal of the project is to allow organisations to develop and reinforce their networks, increase their capacity to operate at transnational level, share and confront ideas, practices and methods in an innovative field, which is Mixed Reality (MR) for educational purpose. The simulation of medical procedures through the MR system offers an opportunity to train medical students, paramedics and doctors across a range of specialists in a safe (risk-free), realistic and repeatable environment. It eliminates harmful consequences to patients and offers repeatable procedures.

The project can use mobility opportunities for students and staff to help the participating medical schools develop as organisations and increase their ability to work on international projects. The horizontal priorities of the project are (1) supporting opportunities for all medicine students (who cannot participate in on-site exercises for personal or health reasons and, for example, due to social isolation during a pandemic) in acquiring and developing key competencies, including clinical skills, for example, history-taking, physical examination, clinical investigations, using diagnostic reasoning, procedural perfection, effective communication, team work and professionalism; and (2) supporting teachers, medical doctors working with students, educational leaders and medical staff in the use of advanced teaching and e-learning methods using MR (VR and AR).

The Future Professionals
2020-1-PL01-KA226-HE-095164, 01.06.2021-30.11.2023
Themes: A and C

Partners:
UNIWERSYTET EKONOMICZNY WE WROCŁAWIU (Poland)
AIKUISKOULUTUS TAITAJA (Finland)
PANNON EGYETEM (Hungary)
PANEPISTIMIO DYTIKIS ATTIKIS (Greece)

The main objective of the project is to support universities and academic teachers in providing distance learning by means of developing solutions that will permanently improve the quality of this type of teaching. The

target groups of the project include universities, academic teachers and students. The problems that partners are experiencing as a result of the COVID-19 pandemic have exposed many weaknesses of the higher education system. In many cases, distance learning has been, and still is, of poor quality. This is the result of the weakness of the system in three areas – hardware and equipment, skills of academic teachers in using modern technologies and unethical behaviour of students in relation to remote evaluation of their acquired knowledge and skills.

The project relates directly to the horizontal priority assigned to the call. It is an example of an action supporting innovative practices in the digital era. Its implementation will make it possible to fully use various forms of distance learning within university education. As part of the project, it is planned to develop a remote tool to assess the competency gap of students of selected fields of study (management, tourism, economic analytics, logistics and automotive). It will be possible by evaluating the level of their competencies in various areas and comparing it with the desired level for typical occupations in a given industry (the project assumed the development, in cooperation with experts, of a competency matrix for selected occupations and the use of multidimensional comparative analysis tools to compare the obtained results with the model – linear ordering). Another planned outcome will be a manual for academic teachers on the development and management of remote courses along with the creation of model courses for the indicated fields of study. The final outcome will be a modern tool enabling the remote assessment of knowledge and skills of students in a specific subject within the study programme through the use of games and other modern solutions.

Advanced Digital Design Course on Modern Buildings Developing SKILLS for Young Engineers
2020-1-PL01-KA226-HE-095244, 01.06.2021-31.05.2023
Themes: A and C

Partners:
POLITECHNIKA BIAŁOSTOCKA (Poland)
UNIVERSIDAD DE CORDOBA (Spain)
REZEKNES TEHNOLOGIJU AKADEMIJA (Latvia)
UNIVERSITA DEGLI STUDI DI FIRENZE (Italy)
POLSKI ZWIĄZEK INŻYNIEROW I TECHNIKÓW BUDOWNICTWA, ODDZIAŁ W BIAŁYMSTOKU (Poland)
VILNIAUS TECHNOLOGIJU IR DIZAINO KOLEGIJA (Lithuania)

ADD-ON_SKILLS project was a response to an increasing need for taking up new challenges in digital and remote times that set a high bar for

teachers and trainers in technical universities. The pandemic situation made students stay home or participate in blended learning, which created requirements for educators. Modern lessons would thus move from an approach centred on the teacher's performance to one based on the construction and development of new students' skills, guided by the teacher working with them on the evaluation and clarification of content, comparing results and developing new ideas.

To achieve the aim of the project, a cohesive consortium with active involvement of five HEIs and one association of engineers has been established. The partners have created an innovative learning module for a blended mobility course, taking into account that the full course could be done remotely if necessary. The innovative ADD-ON_SKILLS module has been included in HEIs programmes and has been offered to students from various universities as a facultative subject (four ECTS) or/and as a course to upskill young engineers. The implementation of this module allowed to enhance the attractiveness of the studies and complement the programme with modern IT technology achievements, as well as made the teaching content more consistent with the practical aspects in order to prepare graduates to enter the demanding international labour market.

iSurvive: Digital Roadmap for Designing Online Interactive Content
2020-1-PL01-KA226-HE-095331, 01.06.2021-31.05.2023
Themes: A and B

Partners:
SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO (Poland)
DIMITRA EDUCATION & CONSULTING SA (Greece)
INSTITUT ZA PODGOTOVKA NA SLUJITELIV MEJDUNARODNI ORGANIZACII ZDRUZHENIE (Bulgaria)
UNIVERSITA TELEMATICA INTERNAZIONALE-UNINETTUNO (Italy)
UNIVERSITY OF NATIONAL AND WORLD ECONOMY (Bulgaria)
STIFTELSEN KURSVERKSAMHETEN VID U-AUNIVERSITET (Sweden)
CRES CENTRO DI RICERCHE E STUDI EUROPEI – FUTURE BUSINESS (Italy)

How can someone reap the benefits of distance learning without having to suffer the consequences and struggle to "survive" day by day in an online classroom? The project iSurvive assumes that the answer is to prepare academics to be able to develop online content that will actually achieve the expected learning outcomes by keeping students interested and involved. To achieve this purpose, the *iSurvive: Digital Roadmap for*

Designing Online Interactive Content project is aimed to develop the competencies of HE lecturers and academics that allow them to transform their lectures and in-class activities to online activities that keep their students motivated and foster their own well-being.

In order to accomplish the above, the iSurvice project includes four intellectual outputs (IOs): (1) a comparative study that identifies the current needs and gaps for boosting the effectiveness of online HE learning; (2) Guide of Key Pedagogical Principles for Effective Online Teaching and Learning – a combined guide introducing educators into a methodologically effective online class; (3) iSurvive compass for interactive and gamified online content creation that combines several parameters creating a tailor-made roadmap for the educator needs; and (4) an innovative MOOC that provides a high education course of specialisation in an area where skills needs are rapidly developing.

Towards e-Coaching, the First Step to Build Trust With a Digital Coach
2020-1-PL01-KA226-HE-095455, 01.03.2021-28.02.2023
Themes: A, B and C

Partners:
POLITECHNIKA BIAŁOSTOCKA (Poland)
TAMPEREEN AMMATTIKORKEAKOULU OY (Finland)
UNIVERSITAET LEIPZIG (Germany)
POLYTECHNEIO KRITIS (Greece)

Answering the call *Strategic Partnerships COVID-19 in Response of the Situation*, the Consortium of partners conducted in-depth research on the needs of the academic community in connection with the pandemic. The research results were based on over 5,000 student surveys and over 1,000 surveys among lecturers carried out at Partners universities after a "digital" semester. In the overall view of the survey results, digitisation was largely successful. Most of the teachers confirmed that they were able to conduct all courses online, and most students had to postpone only a few planned courses due to the situation. What do students like in distance learning? In the first place – availability, mobility and possibility to work at home. In the second place – they did not like anything! What do they dislike the most? In the first place – lack of contact and help from the teacher. In subsequent positions – technical challenges, the chaos, lack of co-ordination, lack of direct contact with the teacher and lack of direct contact with the group.

The aim of the project was to introduce a coaching method in distance education (e-coaching) that enables to "activate" students (inclusive education) and personalises the education process (each student receives "material" which is required, not a general lecture directed to everybody).

Coaching is a method of shaping skills based on the art of asking questions that mobilize the questioned (coachee) to self-analyse, act and seek knowledge.

The partners have been reaching these goals through the following outputs: (1) an innovative didactic methodology for distance education (e-coach), which will create the basis to build trust between parties of the educational process; (2) integrated e-learning platform on the application of e-coaching methodology; it includes the activation programme for teachers; and (3) pilot examples of e-coaching courses, i.e. 12 recorded calculus, algebra, programming and entrepreneurship classes using the innovative e-coaching methodology dedicated to higher education institutions.

Teaching Online Electronics, Microcontrollers and Programming in Higher Education
2020-1-PL01-KA226-HE-095653, 01.03.2021-28.02.2023
Themes: A, B and C

Partners:
POLITECHNIKA WARSZAWSKA (Poland)
DIETHNES PANEPISTIMIO ELLADOS (Greece)
AKADEMIA NAUK STOSOWANYCH W TARNOWIE (Poland)
UNIVERSITA DEGLI STUDI DI PADOVA (Italy)
EUROPAIKO ERGASTIRIO EKPAIDEFTIKIS TECHNOLOGIAS (Greece)

The project focuses on the customisation of the standard face-to-face materials for teaching technical subjects in the engineering field in such a way that they will meet the needs of the online education. The need emerged during the pandemic, where many higher institutions were called upon to change their teaching practices and update their training methods and materials. The challenge remains, especially for subjects that require physical contact with devices and hardware, such as electronics and embedded systems programming.

The first goal of the project is the development, preparation and implementation of the online courses related to electronics, microcontrollers (e.g. AVR, ARM, and PIC), board-based practice (like Arduino) and programming languages that are introduced together with physical equipment (e.g. C, C++, Python and VHDL). The courses are based on the open-source solutions and are available as Open Educational Resources (OER). These courses can be realized independently by students or with the support of educators as part of online education.

The project also focuses on the development of a tutorial on how to organise remote online learning for higher education students, especially

how to choose and use online platforms (such as MS Teams, Zoom and Jitsi), how to distribute didactic materials, how to support lectures using online courses and how to introduce innovative methods of teaching and learning in online distance education.

The goal is to create a rich collection of OERs that would be helpful for the target groups covering different learning needs in different settings. This material can be used by other universities as well during fully remote education and might lead to an adaptation of a mixed educational model of blended learning when conditions allow universities to combine face-to-face with online education.

Virtual Business Strategic Games in Online Higher Education
2020-1-PL01-KA226-HE-095683, 01.03.2021-31.08.2023
Theme: A

Partners:
UNIWERSYTET EKONOMICZNY W POZNANIU (Poland)
EFMD AISBL (Belgium)
CONFORM-CONSULENZA FORMAZIONE E MANAGEMENT SOCIETA CONSORTILE A RESPONSABILITA LIMITATA (Italy)
ATOMSCRIPT SP. Z O. O. (Poland)
UNIVERSITA DEGLI STUDI DI MACERATA (Italy)
UNIVERSITAT FUR WEITERBILDUNG KREMS (Austria)

The main aim of the project was to deliver sophisticated business simulation tools by combining a game with movie education – a virtual business strategic game supporting online education at universities during the COVID-19 pandemic. Specific aims are (1) to develop the architecture of strategic games while adjusting the tool to the requirement of online teaching process, together with quality assurance and effectiveness assessment; (2) to develop an engine of a virtual strategic game (new functionalities for teachers and students); (3) to create, test and implement new game scenario; (4) to create movies introducing the logic of the game and the user panel; and (5) to develop educational movies supporting business education as an integral part of game engine.

The predicted results are (1) higher competencies of the target group representatives (business students) such as business system thinking, internationalisation, strategic thinking, decision-making, performance management, problem resolution, strategic management, teamwork, employee and stakeholder development, communication skills; (2) higher competencies of the teachers using developed curricula and business simulation games; (3) higher efficiency of higher education in the face of the COVID-19 pandemic; (4) increased understanding and interest in business simulation

games used as the teaching technique; and (5) enriched training resources, available publicly and free of charge for academic community.

FGPE Plus: Learning Tools Interoperability for Gamified Programming Education
2020-1-PL01-KA226-HE-095786, 01.06.2021-31.05.2023
Themes: A, B and C

Partners:
UNIWERSYTET SZCZECIŃSKI (Poland)
UNIVERSITA DEGLI STUDI DI NAPOLI PARTHENOPE (Italy)
KAUNO TECHNOLOGIJOS UNIVERSITETAS (Lithuania)
INESC TEC – INSTITUTO DE ENGENHARIADE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA (Portugal)

The project aimed at providing necessary software and educational content for an effective application of gamification in programming education, primarily in higher education institutions, by extending the key elements of the framework developed in the prior FGPE project.

The project has delivered the following four intellectual outputs: (1) LTI Integration (software): enabling the use of gamified programming exercises within courses provided via popular LMS environments (such as Moodle and Open edX); (2) mobile gamified PLE (software): vastly improving the experience of the programming learning environment for mobile device users; (3) tutorial on gamification of programming exercises (guidance material): interactively guiding programming instructors on how to design and implement gamified programming courses; and (4) extended gamified exercise base (Open Educational Resource): extending the set of open-source gamified programming resources with new courses featuring 520 programming exercises.

Virtual On-the-Job Training in Tourism Sector
2020-1-PL01-KA226-HE-095877, 01.03.2021-28.02.2023
Themes: A, B and C

Partners:
WYŻSZA SZKOŁA TURYSTYKI I EKOLOGII W SUCHEJ BESKIDZKIEJ (Poland)
EDU SMART TRANING CENTRE LIMITED (Ireland)
UNIVERSITA DEGLI STUDI DI PALERMO (Italy)
GOETEBORGS UNIVERSITET (Sweden)

The COVID-19 pandemic has created long-term challenges for universities. These challenges require solutions at the level of creating digital

solutions. For example, the pandemic has prevented the implementation of student placements, which are part of the curriculum. In the project, the partners have developed a methodological guide for student supervisors for online internships in the healthcare sector. The guide focuses on social, interpersonal, organisational and conceptual skills, which are also a growing problem in the economy due to the lockdown.

MULTIMEDIA STUDENT INTERNSHIPS in the form of a web application (on-the-job training) has been developed by the partners. This form will motivate students to complete the online internship. It will increase their willingness to act and acquire knowledge. The developed solution will be an innovation at the university. In addition, materials have been prepared to support students in the implementation of new internship programmes. A new form – a *Handout for Students for Online Internships in the Horeca Sector,* has been created.

Experience and Immersive Technologies – From Creative Practice to Educational Theory
2020-1-PL01-KA226-HE-095891, 01.05.2021-30.04.2023
Themes: A and B

Partners:
UNIWERSYTET JAGIELLOŃSKI (Poland)
ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON (Greece)
PAŃSTWOWA WYŻSZA SZKOŁA FILMOWA, TELEWIZYJNA I TEATRALNA IM. LEONA SCHILLERA W ŁODZI (Poland)
UNIVERSITA TA MALTA (Malta)

This project responds to the urgent need to enrich the existing educational programmes for both cultural and media managers, and also for artists aspiring to connect with their audiences in the digital space. The project's overall goal was to develop an educational offer for these groups in the field of immersive media (XR), and ways of using these media to engage audiences. More specifically, the project aimed at increasing the skills and competencies of the participants in designing and evaluating immersive experiences in order to effectively manage, disseminate and produce culture in the digital sphere.

Further, the project aimed to increase the knowledge and competencies of the academic staff working with immersion technologies in order to effectively manage, disseminate and produce digital culture in a market environment.

The project's team also developed open educational resources (OER) in the field of experience management and culture with the use of immersive

technologies. Last but not least, the project's aim was to help building an open-minded attitude among students and academic staff towards the application of new technologies in the humanities.

ACCEPT THE CHALLENGE! - Gamification IN Online Higher EDucation
2020-1-PL01-KA226-HE-096034, 01.03.2021-31.10.2022
Themes: A and C

Partners:
WYŻSZA SZKOŁA INFORMATYKI I ZARZĄDZANIA Z SIEDZIBĄ W RZESZOWIE (Poland)
KAZIMIERO SIMONAVICIAUS UNIVERSITETAS, UAB (Lithuania)
UNIVERSIDAD DE MURCIA (Spain)
UNIVERZITA KOMENSKEHO V BRATISLAVE (Slovakia)

The aim of the project was to make the offer of four universities more attractive by developing a set of innovative tools to support the teaching process (in particular, remote teaching in the times of the COVID-19 epidemic) addressed to academic teachers, and, thus, to improve the quality of education at universities by October 2022.

As part of the project, a set of results have been developed and implemented: (1) providing methodological foundations for the implementation of gamification: describing the prerequisites and guidelines for the process of gamification of the subject/course; (2) giving an example of applying gamification in practice (on the example of a fully gamified subject/course in the field of entrepreneurship); and (3) providing tool support in the form of the described tools that can be used during the didactic process as part of the gamified subject/course. The products have also taken into account the perspective of both stationary classes, traditionally conducted in the classroom, and remote classes, so widely used now in connection with the global epidemiological crisis. The most important results of the project are (1) gamification body of knowledge, (2) good practice – an example of a gamified course and (3) lecturer's toolbox.

Advancing Digital Competence in Higher Education
2020-1-PL01-KA226-HE-096098, 01.04.2021-30.09.2023
Themes: A and C

Partners:
COLLEGIUM CIVITAS (Poland)
THE UNIVERSITY OF NORTHAMPTON HIGHER EDUCATION CORPORATION (United Kingdom)

UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA (Italy)
AGRICULTURAL UNIVERSITY OF ATHENS (Greece)

The aim of the project was to review and update the DigCompEdu framework to identify the most recent and necessary set of digital competences for higher education teachers. Participants developed the self-assessment tool and prepared the database of tools and resources, amplified with the artificial intelligence enhanced crawler. The project led to the evaluation and improvement of the main hard result (Digital Competence Learning Hub) before its release.

More than 240 HE teachers and education experts from the partnership participated in the project's activities to design and validate the tools. Participation in testing helped them define their competence gaps instantly and showed them the path for the advancement of their skills.

The project involved concrete target groups and created an international network of academic teachers and experts from HE sector through one face-to-face transnational conference, one online conference for decision-makers and other stakeholders and four online conferences held in national languages of the participating institutions, targeted especially at the local academic teachers.

Digital Competences for Improving Security and Defence Education
2020-1-PL01-KA226-HE-096192, 30.04.2021-30.08.2023
Themes: A and B

Partners:
WOJSKOWA AKADEMIA TECHNICZNA IM. JAROSŁAWA DĄBROWSKIEGO (Poland)
UNIVERSITA DEGLI STUDI DI TORINO (Italy)
VASIL LEVSKI NATIONAL MILITARY UNIVERSITY (Bulgaria)
ACADEMIA TEHNICA MILITARA FERDINAND I"" (Romania)

The aim of the DIGICODE project was to improve the security and defence education quality by using digital tools in the didactic activities and by developing digital competences of teachers. The main objectives of the project were to conduct a survey and collect detailed information in a group of students and lecturers from international universities, and to conduct a comparative analysis in order to compare the processes, strategies and methods used by the respondents.

The output was, among others, the publication of the Best Practices Handbook, including a collection of best practices and solutions used by universities in the times of COVID-19, and the development of a

curriculum for a summer school "Systems for Command and Control in Security and Defence Field".

Holistic Approach Towards Problem-based ICT Education Based on International Cooperation in Pandemic Conditions
2020-1-PL01-KA226-HE-096196, 01.06.2021-31.05.2023
Themes: A and C

Partners:
POLITECHNIKA BIAŁOSTOCKA (Poland)
UNIVERSITY OF RUSE ANGEL KANCHEV (Bulgaria)
NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU (Norway)
UNIVERZITET U NISU (Serbia)

The project aimed to address the needs of adapting teaching and assessment methods to pandemic conditions and also to adapt the education system to the 21st century (or knowledge-society) needs and state-of-the-art pedagogical research. The specific objectives of the project were to develop a methodology for problem-based teaching and corresponding assessment methods suitable for use in pandemic conditions, and put them into context of modern learning theories; develop methodology for teacher training that facilitates adoption of the new teaching and assessment practice and develop digital teaching and learning materials in the selected areas of ICT based on the above approach.

The results of the project will make higher education more attractive for students and will improve its quality. The level of digital competence of teachers and students improved. The links among students and companies were established or enhanced. The universities will attract a larger number of domestic and foreign students. Some of the long-term goals are to continue collaboration among four partner universities through the "European universities" programme and to increase students' employability.

A Model for Interactive (A)Synchronous Learning in Online STEM Education
2020-1-PL01-KA226-HE-096239, 01.03.2021-28.02.2023
Themes: A, B and C

Partners:
POLITECHNIKA ŁÓDZKA (Poland)
UNIVERSIDAD DE ALCALA (Spain)
HOCHSCHULE FUR TECHNIK UND WIRTSCHAFT DES SAARLANDES (Germany)
UNIVERSIDADE DE AVEIRO (Portugal)

The project partners decided to join forces for the development, implementation and dissemination of innovative and comprehensive teaching and learning solutions, supported by advanced IT technologies and tools, to increase the level of student-teacher interaction during online education.

To benefit the project participants, the consortium offered a series of training opportunities for academic teachers tailored to their individual needs, in order to increase their competencies in effective online teaching, arousing student interest and responsiveness. The students were able to get a gamification learning experience in the blended formula and to develop the 21st century skills sought by the labour market. The project was dedicated to the students and academics of the consortium universities and beyond, ready to bring the ICT technology to the forefront when facing the challenges of online education.

Innovative Competence in Online Higher Education
2020-1-PL01-KA226-HE-096278, 01.04.2021-31.03.2023
Themes: A, B and C

Partners:
UNIWERSYTET GDAŃSKI (Poland)
SVEUCILISTE U RIJECI (Croatia)
UNIVERZA NA PRIMORSKEM UNIVERSITA DEL LITORALE (Slovenia)
TURUN YLIOPISTO (Finland)
UNIVERSITATEA 1 DECEMBRIE 1918 (Romania)
UNIVERSITA DEGLI STUDI DI ROMA TOR VERGATA (Italy)

The InCompEdu project tackled the common challenges in the sudden switch to online teaching at the HEI in the EU caused by the COVID-19 pandemic, by identifying and sharing the good practices, knowledge and experience gained at the partner universities and beyond.

The project's activities focused on two aspects: digital competence of academic teachers and the development of new competencies in creation and implementation of online/hybrid courses and innovative curricula.

Outputs of the project include "building the digital competences in the academic community of tomorrow": a publication that focuses on analysing and finding open educational platforms that can easily be adapted and modified to work within a specific university to meet the needs of remote learning; Filmoteque: a set of training videos for academic teachers on how to teach using IT systems at various levels of the curriculum that covers multiple fields; and "Reimagining on-line courses for the future of high education," which developed innovative concepts of effective online classes.

The Use of Innovative Education Tools in the Fields of Nursing and Emergency Medical Services
2020-1-PL01-KA226-HE-096280, 01.03.2021-28.02.2023
Themes: A, B and C

Partners:
WYŻSZA SZKOŁA PLANOWANIA STRATEGICZNEGO W DĄBROWIE GÓRNICZEJ (Poland)
PRESOVSKA UNIVERZITA V PRESOVE (Slovakia)
UNIVERZITA JANA EVANGELISTY PURKYNE V USTI NAD LABEM (Czech Republic)

The project *The Use of Innovative Education Tools in the Fields of Nursing and Emergency Medical Services* was a response to the situation related to the COVID-19 pandemic and the university's transition to hybrid and remote learning. The aim of the project was to adapt education in such fields as nursing and emergency medical services to modern learning in a remote system. Another goal was to achieve the highest level of education and create an international training programme for practical subjects.

The outputs include an interactive, multilingual coursebook as well as a training programme of two specialist courses: "Healthcare worker in a crisis situation" and "Work in international medical rescue teams". The project also included the preparation of full course materials, both remote, hybrid and traditional. Additionally, two international conferences were organised.

Navigating Social Worlds: Toolbox for Social Inquiry
2020-1-PL01-KA226-HE-096356, 01.03.2021-28.02.2023
Themes: A and B

Partners:
SZKOŁA GŁÓWNA HANDLOWA W WARSZAWIE (Poland)
LATVIJAS UNIVERSITATE (Latvia)
UNIVERSITATEA BABES BOLYAI (Romania)
TARTU ULIKOOL (Estonia)
PUBLIC POLICY AND MANAGEMENT INSTITUTE (Lithuania)

The project *Navigating Social Worlds: Toolbox for Social Inquiry* highlighted the importance of first-hand data inquiry (including critical thinking) and mobilised digital tools for the purposes of education. Taking into account the COVID-19 pandemic and how it revealed the need to incorporate digital skills in teaching culture, the project aimed at equipping

teachers and lecturers with innovative tools that can be used for social inquiry; equipping the learners with knowledge, skills and competences that will enable them to make small-scale social research projects; raising awareness on how data can be interpreted in public discourses and narratives; mapping existing practices and solutions in online teaching and learning at HEIs in selected CEE countries; and finally assisting the "catching up" of the region in terms of digital skills and to reduce the digital gap. The project was conducted at the intersection of higher education and high school education, including both learners and teachers, and it provided a narrative for a different way of looking at education.

The most significant project output was the Toolbox for Social Inquiry – an online resource for teachers and lecturers who teach social sciences that introduces social research methods and social inquiry in their classrooms. Other outputs included country reports, cross-sectional survey on students' and teachers' perceptions of teaching online, recommendations for implementing digital tools for social inquiry, scientific articles, international conference and workshop for teachers.

Comprehensive Project for Distance Teaching Skills and Multimedia Resources for Technical Universities in Europe
2020-1-PL01-KA226-HE-096375, 01.03.2021-31.08.2023
Themes: A and C

Partners:
POLITECHNIKA GDAŃSKA (Poland)
UNIVERSITA POLITECNICA DELLE MARCHE (Italy)
FH JOANNEUM GESELLSCHAFT MBH (Austria)

E-Tech Project was brought to life in the midst of a specific situation – the COVID-19 pandemic – which showed that online learning is indeed a very important component of academic education. The aim of the project was to equip teachers with the right set of skills to prepare captivating, involving and interesting e-learning classes. The main product developed under the project was an e-learning course "Online teaching practice and e-learning courses" for academics. It was followed by a guidebook called "An Interactive Guide to Online Academic Teaching" (an open source publication in two versions: ready-to-print and digital, multimedia version), an open bank of educational resources and tools for virtual laboratory classes, a professional e-learning course for students. The best e-learning experts and practitioners were participating in the development of the materials.

The main goal was to make sure that the teaching and learning objectives are met regardless of the circumstances, improve the existing

state of e-learning at universities and other educational institutions, provide access to high-quality resources useful in preparing practical and theoretical classes and boost the level of satisfaction of lecturers and students participating in online education. The long-term project outcomes for academics were improved ability to prepare e-learning courses, popularisation of e-learning methods and techniques and increased confidence and quality of the courses on technical subjects.

HOlistic Online Teaching SUPport
2020-1-PL01-KA226-HE-096456, 01.04.2021-31.03.2023
Themes: A and C

Partners:
POLITECHNIKA POZNAŃSKA (Poland)
VALUEDO SRL (Italy)
LIBERA UNIVERSITA MARIA SS. ASSUNTA DI ROMA (Italy)
UNIVERZA V MARIBORU (Slovenia)
UNIVERSITAT RAMON LLULL FUNDACIO (Spain)

The general objective of the project was to enhance HEI educators' skills to enable them to develop digital training contents promoting equal opportunities for learners attending courses in the virtual/extended class. The detailed objectives included improving online teaching, promoting blending pedagogical, technical and technological aspects in the redesign of the training course, and increasing lecturers' skills in those three aspects. In order to close the gap between face-to-face lessons and virtual lessons, the educators should be supported in developing their skills and innovating in three dimensions: pedagogical, technical and technological.

To achieve the goal, the project produced the following four intellectual outputs: a desk research, in-depth interviews and questionnaires from both lecturers and students; the virtual/extended class Teaching & Learning Tasks Dynamic Toolkit – designed to support teachers in the acquisition of pedagogical and digital skills; adaptive interactive online platform supporting HE educators in solving technical problems; and finally, the software and dashboard for monitoring the technological aspects of the virtual training that allows partners to measure several technical indicators. The project delivered ready-to-use solutions for improving the skills of educators, suggesting them a practical, online and free-of-charge tool that could be used for delivering innovative training contents, identifying easy solutions to the most frequent technical problems, and ensuring technological quality of the online lessons, all in an automated way.

Digital Skills and Cross-domain Entrepreneurship for Societal Challenges
2021-1-PL01-KA220-HED-000027649, 01.12.2021-30.11.2023
Theme: B

Partners:
UNIWERSYTET EKONOMICZNY W KATOWICACH (Poland)
ALMA MATER STUDIORUM – UNIVERSITA DI BOLOGNA (Italy)
EKONOMICKA UNIVERZITA V BRATISLAVE (Slovakia)
INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT (France)
ISCTE – INSTITUTO UNIVERSITARIO DE LISBOA (Portugal)
MITTUNIVERSITETET (Sweden)
TAMPEREEN AMMATTIKORKEAKOULU OY (Finland)
TECHNICKA UNIVERZITA V KOSICIACH (Slovakia)
UNIVERSITAT AUTONOMA DE BARCELONA (Spain)
UNIVERSITE DE LAUSANNE (Switzerland)

The partnership decided to apply for this project given that it offers an optimal framework to address the needs that are shared by all participant organisations. Therefore, the project aims at developing transnational cooperation to foster innovative curricula, promoting cross-entrepreneurial mindsets and competences around digital skills.

The goal is to realise those initiatives following a pan-European perspective that is inclusive and that introduces in the curricula a global approach that, while tackling local challenges, addresses common needs at a European level. The project offers a platform to work around these aspects, and it offers the possibility to enrich a new paradigm in which HEIs work in strong partnerships to improve competences in curricula with an EU transnational approach.

Digital Support in Chemistry Teaching
2021-1-PL01-KA220-HED-000027619, 01.11.2021-31.10.2024
Theme: B

Partners:
UNIWERSYTET JAGIELLONSKI (Poland)
ALMA MATER STUDIORUM – UNIVERSITA DI BOLOGNA (Italy)
EUROPEAN CHEMISTRY THEMATIC NETWORK ASSOCIATION (Belgium)
LATVIJAS UNIVERSITATE (Latvia)
TECHNISCHE UNIVERSITAET WIEN (Austria)
VILNIAUS KOLEGIJA (Lithuania)

The aim of the project is to address the needs of academic chemical community concerning digital transformation. The DISTINCT consortium aims to provide contribution in the form of support and assistance when dealing with the basic questions related to digital transformation and the emerging new normal. The questions refer to the issues on how to carry out the digital transformation of chemical studies in a balanced, systemic manner; how to live and survive in the digital world. The concerns regarding "new reality" and how to overcome IT-induced psychological barriers also play a major role.

Moreover, the project searches for answer on how to get used to risks and uncertainty brought by the pandemic after a long period of stability and predictability; in other words, how to deal with breaking out of the rhythm of everyday life. Finally, the issue of building resilience against possible future crises by applying digital solutions is also tackled.

Massive Open Online Week for Collaborative Digital Education
2021-1-PL01-KA220-HED-000027566, 01.01.2022-31.12.2024
Theme: B

Partners:
UNIWERSYTET EKONOMICZNY W KATOWICACH (Poland)
ACEEU GMBH (Germany)
EUROPEAN E-LEARNING INSTITUTE (Denmark)
HELIXCONNECT EUROPE S.R.L (Romania)
RIGAS TEHNISKA UNIVERSITATE (Latvia)
UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II (Italy)

MOOW CODE is a forward-looking and impact-oriented project that aims to develop and promote MOOW (Massive Open Online Week), a multifaceted, synergistic format of digital learning and co-creation in higher education. The ambition of the project is to kick-start a strong MOOW movement across Europe by providing all required methods and instruments for MOOW planning, organisation and implementation.

MOOW is a promising new format and concept that builds on the strengths of traditional MOOCs, the university Entrepreneurial Weeks and online idea-stage accelerators and bootcamps. However, unlike these formats, MOOWs offer a fully digital and highly interactive learning environment that is set within a rigid timeframe (one week) and is designed to facilitate the development of new ideas, products and solutions through collaboration and co-creation. Each MOOW focuses on a single topic of relevance and importance. A typical MOOW will include a digital Bootcamp where students, teachers, innovators and developers can teamwork on ideas and products. There will also be public lectures, talks and

panel discussions aimed at a wider audience. The project will ensure that all MOOWs are organised and deployed in a unified way, with a shared concept, structure and identity.

Fostering Digital and Green Transformation in SMEs
2021-1-PL01-KA220-HED-000027531, 01.12.2021-30.11.2023
Theme: B

Partners:
UNIWERSYTET EKONOMICZNY W POZNANIU (Poland)
CONFORM – CONSULENZA FORMAZIONE E MANAGEMENT SOCIETA CONSORTILE A RESPONSABILITA LIMITATA (Italy)
EFMD AISBL (Belgium)
FUNDACJA "PARTNERZY DLA SAMORZADU" (Poland)
KAUNO TECHNOLOGIJOS UNIVERSITETAS (Lithuania)
UNIVERSITA DEGLI STUDI DI MACERATA (Italy)
UNIVERSITAT ROVIRA I VIRGILI (Spain)

Climate change and environmental degradation present an existential threat to Europe and the world. Smart use of clean digital technologies can serve as a key enabler for climate action and environmental sustainability. The digital transition and a smarter and greener use of technologies will help make Europe the first climate-neutral continent by 2050, a key goal of the European Green Deal. Technology can improve energy and resource efficiency, facilitate the circular economy, lead to a better allocation of resources, reduce emissions, pollution, biodiversity loss and environmental degradation. At the same time, the ICT sector must ensure the environmentally sound design and deployment of digital technologies.

The higher education system has to work together with politicians to establish the European Green Digital Coalition that will accelerate the ICT sector's transition towards a sustainable, climate neutral, circular and zero-pollution economy, while at the same time contributing to innovative, sustainable, inclusive and resilient society and economy. This project is a big step forward this initiative. The project focuses on a course oriented on managing green digital transformation in SMEs. Higher education systems must follow the changes that are being pursuit in the real economy. The project aims at educating students on the importance of green and digital revolution, on importance of every small eco-innovation in every sector. Moreover, it aims at adjusting the curricula to the requirements of processes that are running around.

Immersive Design and New Digital Competences for the Rehabilitation and Valorization of the Built Heritage
2021-1-PL01-KA220-HED-000032239, 01.11.2021-31.12.2023
Theme: B

Partners:
POLITECHNIKA WARSZAWSKA (Poland)
AEEBC LIMITED (Ireland)
CENTOFORM SRL (Italy)
MORE SRL (Italy)
OZYEGIN UNIVERSITESI (Türkiye)
POLSKIE STOWARZYSZENIE MENEDZERÓW BUDOWNICTWA (Poland)
UNIVERSIDADE DA MADEIRA (Portugal)
UNIVERSITA DEGLI STUDI DI FERRARA (Italy)

ID4EXCELLENCE intends to meet Europe 2030 growth strategy priorities on employment and education and considers the EU Roadmap Opening Up Education enhancing education and skills development through new technologies.

The project is addressed primarily to students and universities but also to architects, engineers, construction specialists and educational organisations. It assumes upgrading and innovating existing training programmes with up-to-date Immersive Design methods and tools built for the built heritage interventions with both virtual and dimensional environments and time-based narrative and story space, improving the effectiveness of teaching and learning through the application of an inclusive approach to the project, increasing the synergic use of up-to-date technologies in an integrated way, with a teamwork approach and personal development, as well as increasing the cooperation among educational institutions and enterprises in the EU for better employability. Supporting the updating of skills and competences through an inclusive approach to the built heritage intervention, making of new technologies and the combination of Key Enabling Technologies (KETs), Virtual Reality (VR), Immersive Interactive Experience (IIE) and advanced 3D modelling is the general aim of the ID4EXCELLENCE project.

The project will develop, among others, comparative research on VR technologies applications for the rehabilitation and valorisation of the built heritage, training modules for immersive design experts or digital training toolkit for immersive design experts.

Developing E-marketing Skills for the Business Market
2021-1-PL01-KA220-HED-000032209, 01.11.2021-31.10.2024
Theme: B

Partners:
POLITECHNIKA GDAŃSKA (Poland)
INSTITUTO POLITECNICO DO PORTO (Portugal)
STICHTING HOGESCHOOL UTRECHT (Netherlands)
TURUN AMMATTIKORKEAKOULU OY (Finland)

The DEMS project tackles the European-wide societal challenges in lacking competent higher education graduates to efficiently manage online marketing platforms and opportunities, both in national and international contexts. Global pandemic, accompanied by lots of travel and meeting restrictions, has permanently changed the way of conducting businesses, from marketing until final purchasing decisions. The goals and practices of this project are closely related to digitalisation and the sustainable conduct of businesses, especially SMEs.

Moreover, the project is aimed to achieve the following objectives: to define SMEs actual workforce needs in digital marketing, which will help to identify the precise learning needs, to design a transversal curriculum with learning outcomes that reflect the labour market needs and the critical learning areas of students, to initiate the digitalisation of less experienced teachers and reinforce the pioneering teachers with inspiring and cooperative training activities, to boost graduates´ digital marketing skills by delivering five high-quality and accessible training modules in digital marketing and to practice these courses with a wide range of business students.

Excellence for Digital Education in Materials Engineering
2021-1-PL01-KA220-HED-000032141, 01.01.2022-30.06.2024
Theme: B

Partners:
POLITECHNIKA ŁÓDZKA (Poland)
PANEPISTIMIO THESSALIAS (Greece)
TARTU ULIKOOL (Estonia)
TECHNICKA UNIVERZITA V LIBERCI (Czech Republic)

The idea of the project DigiMat has arisen from the observed inconsistency between the digitalised world of the present times and the educational system that to a high extend fails to meet the contemporary expectations. In fact, the pandemic revealed the issues with transforming the traditional methods of teaching and learning into digital forms. Although the ICT technologies are already present in modern, innovative education, still the research, experimental and technology-oriented subjects (such as materials science and engineering) may greatly benefit from

support for teachers that want to conduct them in an online form and satisfy high students' involvement, motivation and creativity.

The project aims at increasing the teachers' capability to conduct technology-oriented subjects/projects digitally into student-oriented manner. The approach towards new forms of education should cover the understanding of the needs and motivators of students that can be consciously used to stimulate the learning process.

Remote Student Monitoring Framework for Securing Exams
2021-1-PL01-KA220-HED-000032089, 01.11.2021-31.10.2023

Partners:
POLITECHNIKA BIAŁOSTOCKA (Poland)
ENOROS CONSULTING LIMITED (Cyprus)
NEAPOLIS UNIVERSITY (Cyprus)
UNIMED – UNIONE DELLE UNIVERSITA DEL MEDITERRANEO (Italy)
UNIVERSITY OF PIRAEUS RESEARCH CENTER (Greece)

Digital transformation has become a priority for HEIs in the current period, and this is a natural and necessary process for organisations that claim to be leaders of change and be highly competitive in their domain. The aim of the project is to develop IT tools to improve implementation in a safe manner and reliable exams in a remote form. It includes the following three main tasks: (1) development of an accredited framework for monitoring the security of remote examinations, (2) development of a guide to conduct remote examinations for higher education and (3) development of a platform for remote monitoring of students during remote exams.

As part of task 1, surveys will be carried out in all partner countries among three groups of beneficiaries: students, academic teachers and administration employees. The main goal will be to identify good practices in the field of remote verification of teaching effects at universities. The research results will constitute the basis for developing a framework for monitoring the security of remote exams. The aim of task 2 is to develop a manual for conducting remote examinations, which is also a user's manual for the remote examination platform/tool developed under task 3. The platform developed under task 3 will be open to all interested parties. At all stages of the project implementation, students, academic teachers and university IT department employees will be involved by verifying the partial and final results.

Developing DIGital Skills and Tools for Better Inclusion of Refugees and ImmigranTs
2021-1-PL01-KA220-HED-000032041, 01.11.2021-31.10.2023

Partners:
AKADEMIA FINANSÓW I BIZNESU VISTULA UCZELNIA NIEPAŃSTWOWA (Poland)
FURIM INSTITUTT (Norway)
LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN (Germany)
UC LIMBURG (Belgium)

For the past several years, refugee access to higher education has been a critical topic in the European context and represented a chance for universities to scale up services for all students, not just for refugees. Refugees can face many barriers to accessing higher education, including a lack of information, advice and individual guidance sensitive to their specific needs, inadequate provision of intensive language courses for academic purposes and restricted access to government student finance schemes.

Research conducted with the refugees and the experiences of service providers indicate that there is a strong desire to attend university among refugees who have completed secondary school. However, their access to higher education remains limited – opportunities for refugees in countries of first asylum to pursue higher education are scarce, and the educational and professional needs of highly educated refugees do not play a prominent role in resettlement programmes. At the same time, both asylum seekers and refugees face problems with integrating into the labour market in most Member States due to a lack of necessary skills and qualifications.

The overall goals of the project were building readiness for digital education among adult refugees/immigrants and developing digital pedagogical competences of higher education teachers. More specifically, the authors planned to achieve the following specific objectives: development and implementation of educational resources that enable higher education lecturers and administrative staff to deepen their knowledge and competences in working with adult refugees in the form of a set of training tools for educators, as well as developing and using open educational resources and a free and open educational platform, bringing together adult refugees/immigrants in the form of a digital database and online forum. A thoughtful and individualised approach to the academic environment and organisational structure was implemented. In addition, a clear concept of pedagogical approach, resources and learning outcomes was developed, together with appropriate academic support mechanisms. Finally, accessibility and integration at all stages of the educational process were addressed, as well as the effective integration of technology in a manner appropriate to the operational context.

Generation Blockchain
2021-1-PL01-KA220-HED-000031176, 01.11.2021-30.11.2023
Theme: B

Partners:
UNIWERSYTET SZCZECIŃSKI (Poland)
EUROPEAN E-LEARNING INSTITUTE (Denmark)
FRANKFURT SCHOOL OF FINANCE & MANAGEMENT GEMEINNUTZIGE GMBH (Germany)
MOMENTUM MARKETING SERVICES LIMITED (Ireland)
STICHTING HOGESCHOOL VAN AMSTERDAM (Netherlands)
UNIVERSIDADE DO PORTO (Portugal)

To reduce skill mismatches, universities must respond to current events and prepare for future business and economic needs by producing a generation of highly skilled graduates. The aim of the *Generation Blockchain* project is therefore to improve the ability of academic teachers to teach the students of management and business about blockchain. The planned results include the development of the project audit, which will reveal whether and how blockchain technology is currently taught in Europe, and the development and implementation of open training materials regarding flipped learning.

The materials will be tested during the project by business schools in the project partner countries. Another goal is to develop an online training course called "Generation Blockchain". It will enable flexible and free learning paths conducted on an interactive and digitised platform. The project partners intend to provide access to knowledge and resources that will allow them to effectively engage in blockchain technology over 500 students and academic teachers. It is also intended to encourage the formal inclusion of blockchain training in higher education institutions' curricula.

Alliance for Responsible and Impactful Investment in Eastern Europe
2021-1-PL01-KA220-HED-000023017, 01.01.2022-31.12.2023

Partners:
UNIWERSYTET ŁÓDZKI (Poland)
EUROPEAN BUSINESS ANGEL NETWORK (Belgium)
FUNDACJA ROZWOJU PRZEDSIĘBIORCZOŚCI (Poland)
HELIXCONNECT EUROPE S.R.L (Romania)
ISQ E-LEARNING, SA (Portugal)
UNIVERSITATEA DE VEST DIN TIMISOARA (Romania)

As startups are becoming the backbone of the EU economy in terms of employment and innovation, a massive attention should be set on developing impact investment capabilities into the next generation entrepreneurs. As the university spin-offs and graduate-led startups hold 67.8% of share in the EU market, the entrepreneurship education at the HE

level should therefore include the impact investment as a key competence for their students.

The objectives of ARIEES were to help universities (and potentially adult training centres) to improve their entrepreneurship courses by infusing impact investment know-how, and to upgrade the digital competencies of lecturers/trainers to ensure that the impact investment knowledge could be properly infused into the learners while certifying competences and boosting the quality of entrepreneurship trainers. This was done by acquiring responsible and impactful investment courses, conducting webinars as pilots for the course (for students, startups and investors), conducting webinars with digital education pedagogical innovations, as well as developing a digital micro-credential system and the Impact Investment Hub networking platform.

Descriptions of the projects are based on Erasmus+ application forms.

Annex II

Survey questionnaire on Erasmus+ project leaders' digital competences, social competences, learning potential and digital maturity

Questionnaire – the research tool for assessing Erasmus+ project leaders' digital competence, social competence and project leaders' learning potential

Please enter the CODE from the e-mail inviting you to the survey.

The CODE consists of four digits. The CODE is used to maintain the anonymity of your answers and will allow us to reach selected respondents in case of the second wave of the survey.

Were you a co-ordinator (or a contact person) of the project financed by the Erasmus+ Programme?
Please select only one answer.

- ☐ Yes
- ☐ No

Did the implementation of the project activities, of which you were the co-ordinator (or contact person), fall within the period of the COVID-19 pandemic (i.e. from 1 March 2020 to the present day)?
Please select only one answer.

- ☐ Yes
- ☐ No

The survey is addressed exclusively to co-ordinators of projects financed by the Erasmus+ Programme, which were implemented during the COVID-19 pandemic. Thank you for your willingness to participate in the survey.

In how many projects financed by the Erasmus+ Programme and implemented during the COVID-19 pandemic have you acted as co-ordinator?

Please select only one answer.

- One
- Two or three
- Four or more

Please select one of the projects in which you acted as a co-ordinator and whose implementation period coincided with the COVID-19 pandemic. This may be the project that you consider to be the most important/most difficult/the one with the higher number of participants. Please answer the following questions with only this particular project in mind.

Were you the only person managing the project?
Please select only one answer.

- Yes, I managed the project myself.
- I shared the co-ordinator's tasks with another person.
- Did you initiate this project?

Please select only one answer.

- Yes, I was the main person to initiate the project.
- Yes, alongside other people.
- No, the project was initiated by other people.

Did you participate in writing the project application?
Please select only one answer.

- Yes, I was the main author of the application.
- Yes, I was the author of the application alongside other people.
- No, the project was developed by somebody else.

Have your ideas, original educational programmes, original methods, ways of working been used in the project?
Please select only one answer.

- ☐ Yes, to a large extent.
- ☐ Yes, to a small extent.
- ☐ No.
- ☐ I do not know.

Which of the following aspects of the project have you influenced personally?
You can select more than one answer.

- ☐ Subject matter of the project
- ☐ Project goals
- ☐ Duration of the project
- ☐ Selection of partner institutions in the project
- ☐ Working methods used in the project
- ☐ Selection of co-workers for the project
- ☐ Development of criteria for selection of project participants
- ☐ None of the above

Please estimate what percentage of your professional time was spent on project management:
Please select only one answer.

- ☐ Up to 20%
- ☐ Between 20% and 50%
- ☐ Between 50% and 75%
- ☐ More than 75%

Have you ever personally sought institutional partners for the project?
Please select only one answer.

- ☐ Yes, many times.
- ☐ Yes, once or occasionally.
- ☐ No, never.

Assuming that you would like to submit a new application for a project financed by the Erasmus+ Programme, how easy or difficult would each of the following tasks be?
Please select only one answer in each row.

	1 – Very easy	*2*	*3*	*4*	*5 – Very difficult*
Preparing the project application					
Obtaining help from an institution providing advice and support in submitting an application					
Fulfilling formal requirements necessary to submit an application					
Finding foreign partners for the project					
Submitting the project application					

To what extent do the following statements apply to you?
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I know what institutions operate in my sector.					
I have my own contact network of persons with whom I can carry out joint projects.					
I have initiated the co-operation within the project by myself on at least one occasion.					
I am certain that if I want to carry out another project, I will be able to find a partner without any major problems.					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I have a sense of systematic co-operation with a permanent group of institutions.					
I am well acquainted with the procedures for the implementation and settlement of EU projects.					

To what extent do you think the following statements are true?
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Gaining contacts for potential joint activities, e.g. projects with other institutions, is crucial in the work of a project leader.					
The basis for the implementation of European projects is to have suitable partners for co-operation.					
A well-chosen partner in the project is necessary to achieve all project objectives.					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Continuous expansion of the professional contact network helps with project work.					

In connection with the ongoing pandemic, are you familiar with the frequently changing regulations and recommendations concerning work and social functioning?
Please select only one answer.

- ☐ Extremely familiar
- ☐ Very familiar
- ☐ Hard to say
- ☐ Slightly familiar
- ☐ Not at all familiar

Did key project activities coincide with the COVID-19 virus pandemic (i.e. the period from 1 March 2020 to the present day)?
Please select only one answer.

- ☐ Yes
- ☐ No

Did the pandemic make it necessary to introduce changes in the way that the project activities were implemented?
Please select only one answer.

- ☐ Yes, there were big, significant changes.
- ☐ Yes, there were minor changes.
- ☐ No, it was not necessary.
- ☐ It is hard to say.

What did these changes involve?
You can select more than one answer.

- ☐ Subject matter of the project
- ☐ Project implementation deadline
- ☐ Project duration
- ☐ Changing partners in the project
- ☐ Working methods in the project
- ☐ Limiting or cancelling mobility activities within the project
- ☐ Health and safety regulations applicable in the institution
- ☐ Restrictions on personal meetings
- ☐ Communication methods within the project
- ☐ Pandemic prevention measures
- ☐ Purchase of infrastructure (e.g. hardware, software) necessary for online working
- ☐ Other aspects (please describe):
- ☐ _
- ☐ None of the above

Did you take part in developing changes to the rules of project activities, implementation, regulations and documents in connection with the COVID-19 pandemic?
Please select only one answer.

- ☐ Yes, I was the main initiator of formal changes.
- ☐ Yes, I was a member of a wider group that was implementing formal changes.
- ☐ No, the changes were made by another person/persons.

In your opinion, to what extent the project activities conducted during the COVID-19 pandemic were implemented successfully?
Please select only one answer.

- ☐ Up to 25%
- ☐ Up to 50%
- ☐ Up to 75%
- ☐ Between 75% and 100%

Which of these aspects contributed the most to your project's success?
Please select only one answer.

- ☐ Support from the leading organisation
- ☐ Support from the management of my institution

- ☐ Work of the project team
- ☐ My skills as a co-ordinator
- ☐ Experience of partner organisations
- ☐ The infrastructure in place (e.g. hardware, software)
- ☐ Adequate working conditions (e.g. for online working)
- ☐ None of the above

What were the main problems that you encountered as co-ordinator of a project implemented during the COVID-19 virus pandemic?
You can select more than one answer.

- ☐ Project cancellations
- ☐ Transition to online working by multiple institutions
- ☐ Closed national borders
- ☐ Limited opportunities for face-to-face meetings
- ☐ Mobility restrictions
- ☐ Problems related to the recruitment of project participants
- ☐ Problems related to partnership co-operation
- ☐ Problems related to project funding (e.g. due to non-standard types of expenses that have emerged due to the COVID-19 virus)
- ☐ Problems related to the organisation of project dissemination events
- ☐ Problems related to the organisation of work on intellectual outputs (educational products)
- ☐ Limitations on the part of the grant provider
- ☐ Other (please specify):

_ _

- ☐ None of the above

As a project co-ordinator, did you feel responsible for the health and safety of project participants and colleagues?
Please select only one answer.

- ☐ Fully responsible
- ☐ To an extent responsible
- ☐ Hard to say
- ☐ Slightly responsible
- ☐ Not at all responsible

Did you, as co-ordinator, take any specific preventive measures in connection with the implementation of project activities during the COVID-19 virus pandemic?

Please select only one answer.

- ☐ Yes
- ☐ No

Have the project team's communication principles changed due to project implementation during the pandemic period?
Please select only one answer.

- ☐ Yes
- ☐ No
- ☐ Not applicable

What methods for remote communication did you use for project work during the COVID-19 virus pandemic?
You can select more than one answer

- ☐ Phone calls
- ☐ E-mails
- ☐ Instant messengers
- ☐ Video conferences
- ☐ Other (please specify):
- ☐ _
- ☐ None of the above

Please rate how easy or difficult you find the following situations:
Please select only one answer in each row.

	Very difficult	*Rather difficult*	*Neither easy nor difficult*	*Rather easy*	*Very easy*
Implementation of project activities during the pandemic					
Adapting the way project activities are implemented to the pandemic period					
General pandemic uncertainty					
Situation of risk to my own health and the health of those close to me					

(*Continued*)

	Very difficult	*Rather difficult*	*Neither easy nor difficult*	*Rather easy*	*Very easy*
Situation of risk to the health of co-workers					
My own preparation for online work					
Team's preparation for online work					

During project management …
Please select only one answer.

- I try to minimise risk and avoid making risky decisions.
- Risk cannot be avoided; it is part of the project work.
- I do not avoid situations that require risky actions – such actions often bring positive
- Results

Please rate how much do you agree or disagree with the following statements:
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I can quickly adapt to a new situation.					
Every crisis situation can teach you something.					
I like to do several tasks at once.					
Time pressure reduces the effectiveness of my work.					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I like bringing ideas to life.					
Implementing project activities during the pandemic allowed me to test myself in completely new circumstances.					
I prefer to perform tasks in a linear fashion (one after the other).					
I can usually foresee the consequences of my actions.					
Stress has a mobilising effect on me.					

Which of the following activities did you undertake during the project implementation?
You can select more than one answer.

- ☐ Promoting pro-health attitudes and behaviours
- ☐ Promoting civic attitudes and behaviours
- ☐ Promoting pro-environmental attitudes and behaviours
- ☐ Promoting preventive attitudes and behaviours in relation to the COVID-19 virus pandemic
- ☐ Building co-operation based on dialogue and trust
- ☐ Conducting dialogue with project partners
- ☐ Activities towards achieving equality of socio-economic opportunities for project participants
- ☐ Activities related to psychological and pedagogical assistance for project participants
- ☐ Investing in developing your own or your team's competences
- ☐ None of the above

How important is it for you to introduce elements of interdisciplinarity or combining disciplines and fields when implementing a European project?
Please select only one answer.

- ☐ Very important
- ☐ Rather important
- ☐ Neither important or unimportant
- ☐ Rather unimportant
- ☐ Completely unimportant

Please rate, on a scale of 1–5, your knowledge of project evaluation and project outcomes assessment:
1 – very weak ——————————————— 5 – excellent
Mark the icons.

☆ ☆ ☆ ☆ ☆

Do you carry out an ongoing evaluation of the project results on your own?
Please select only one answer.

- ☐ Yes
- ☐ No

What tools do you use to evaluate the project results?
You can select more than one answer.

- ☐ Established, proven evaluation tools
- ☐ Established tools adapted by me to the project's specific character
- ☐ Own, tailored tools

During project implementation, I believe I have no problems with …
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Integrating a team of co-workers					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Developing a team spirit					
Dividing tasks among co-workers and co-ordinating their work					
Motivating co-workers					
Adapting communication methods to different types of audiences					
Enforcing compliance with agreed deadlines					
Evaluating co-workers' performance					
Noticing conflict situations within the team					
Delegating own tasks and responsibilities to co-workers					
Mitigating possible conflicts between co-workers					
Noticing co-workers' problems, including those concerning their private lives, socio-economic situation, etc.					

Please undertake a self-evaluation and generally rate your work as a project co-ordinator:
Please select only one answer.

- ☐ Very weak
- ☐ Weak
- ☐ Sufficient
- ☐ Good
- ☐ Very good
- ☐ I am unable to evaluate myself.

Please rate the subjective level of difficulty for the following activities:
Please select only one answer in each row.

	Very difficult	*Rather difficult*	*Hard to say*	*Rather easy*	*Very easy*
Clear and precise communication					
Providing feedback					
Communicating difficult messages					
Moderating discussions					
Actively listening to others					
Assertive refusal					
Accepting praise, compliments					
Giving praise, compliments					
Mediating between conflicting parties					
Adjusting communication style and language to the audience and circumstances					

To what extent are the following statements true about you?
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I am a person with a positive attitude towards the world.					
I can identify emotions that accompany me in a given moment.					
I can feel what emotional state my interlocutor is in.					
I can control my negative emotions.					
I have a wide network of friends.					
I am a reflective person, I contemplate a lot.					
I am empathic.					
I like co-operating with others, completing tasks in a team.					
I am more comfortable when working on my own.					
I am a person who maintains relationships with others.					
I believe that following ethical principles is extremely important.					

Please rate how much do you agree or disagree with the following statements:
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Implementing a project during a pandemic requires special digital skills.					
Remote communication is more difficult than face-to-face communication.					
The pandemic period forced me to start using new tools/ software.					
Educational activities can be conducted remotely without any loss in quality.					
I can control emotions and stress that come with working online at home.					
I can alleviate the stress of online work for others.					

Please indicate to what extent the following statements describe you:
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I can usually foresee problems coming.					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I always try to learn from difficult experiences for the future.					
I always see at least a few possible solutions for each situation.					
I believe that highly developed social skills are the basis for effective teamwork.					
I can find arguments for my beliefs during a discussion.					
I like exploring new things.					
I take a long time to make difficult decisions.					
I am a person who initiates activities in a team.					
I prefer tried and tested solutions.					
I analyse my failures and setbacks.					
I avoid spontaneous decisions.					
I need to know all the pros and cons before making an important decision.					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I am able to look critically at everything around me.					
I can apply innovative solutions in my work.					

Please select an answer for each of the following statements:
I believe I can …
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Bring collaborators together around a project idea					
Recognise areas for change that will help to better implement the project					
Define short-term project goals					
Define long-term project goals					
Create an atmosphere of effective co-operation within the team					
Divide tasks among the team so that they match the competences and skills of co-workers					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Control the workload of people in my team					
Co-ordinate the work of a dispersed team (e.g. working remotely)					
Lead the work of a team consisting of people from different nationalities and cultural backgrounds					
Be in charge of a task involving several institutions from different countries (e.g. an international project)					
Identify my own strengths and weaknesses					

Please rate how easy or difficult you find the following tasks:
Please select only one answer in each row.

	Very difficult	*Rather difficult*	*Hard to say*	*Rather easy*	*Very easy*
Using e-banking services					
Filing your tax return online					
Filing an official application via the ePUAP system					

(*Continued*)

	Very difficult	*Rather difficult*	*Hard to say*	*Rather easy*	*Very easy*
Making use of an electronic document workflow					
Organising my own online work					
Starting a video conference with several people at the same time					
Protecting my PC from network viruses					
Sharing the screen with others during a video conference					

Please rate how up-to-date you are with modern ICT solutions that can be used in your work.
Please select only one answer.

- ☐ I am completely up-to-date.
- ☐ I am moderately up-to-date.
- ☐ I feel that I have small gaps in my knowledge of modern ICT solutions.
- ☐ I have significant gaps in my knowledge of modern ICT solutions, and I have no need to be up-to-date.

Please mark your answer for each of the following statements:
I believe that I have no problems using …
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Web resources					
Text editors (e.g. Microsoft Word)					

(*Continued*)

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
Spreadsheets (e.g. Microsoft Excel)					
Instant messengers					
E-mail					
Online collaboration tools					
Video conferencing tools					
Project management tools					

Please rate your overall level of proficiency in using modern technology:
Please select only one answer.

- ☐ Very low
- ☐ Low
- ☐ Sufficient
- ☐ High
- ☐ Very high
- ☐ No opinion

Have you participated in any training courses (class-based or online) on the use of modern technology in the last 6 months?
Please select only one answer.

- ☐ Yes
- ☐ No

How often do you participate in training courses to improve competences used at work?
Please select only one answer.

- ☐ Several times a year
- ☐ Once a year

- ☐ No more than once every three years
- ☐ No more than once every five years
- ☐ Less than once every five years

Due to the COVID-19 pandemic, did you attend any training courses that would be useful in carrying out your tasks as a project leader in these unusual times?
Please select only one answer.

- ☐ Yes
- ☐ No.

Have you conducted any training courses in the past year?
Please select only one answer.

- ☐ Yes, it was an internal training course (at my institution).
- ☐ Yes, it was an external training course (for people outside my institution).
- ☐ No, I have not.

With regard to yourself, do you have a sense of continuous learning or do you tend to rely on previously acquired knowledge and skills?
Please select only one answer.

- ☐ Yes, I am still developing.
- ☐ I am still developing, but more slowly than I used to.
- ☐ I have no need for development – I rely on previously acquired knowledge and skills.

Do you have a planned path for your own development, career?
Please select only one answer.

- ☐ Yes, I have a clearly defined path.
- ☐ Yes, but the path is rather general.
- ☐ No, I do not currently have such a plan.

To what extent, in your own estimation, are you emotionally and personally involved in the project?
Scale from 1 (minimal involvement) to 5 (full involvement).
Mark the icons.

☆ ☆ ☆ ☆ ☆

Please rate how well the following statements describe you:
Please select only one answer in each row.

	Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
I can respect others' opinions even if I do not agree with them.					
I can separate people from their views.					
I always comply with applicable rules and laws.					
Other people's criticism does not bother me.					
Ethical behaviour is very important to me.					
I can sometimes bend the rules to achieve my goals.					
I am aware of my own strengths and weaknesses.					
I make the most important decisions concerning my life independently.					
I can be flexible when sudden and unforeseen changes occur.					

If you have any additional comments regarding project implementation during the COVID-19 virus pandemic from the co-ordinator's perspective, please write them below:

… ..... … … …

We are almost done! There are only a few demographics-related questions left.
Please indicate the sector in which your institution operates:
Please select only one answer.

- ☐ Public
- ☐ Private
- ☐ Non-governmental

Please indicate under which area(s) the project was implemented:
You can select more than one answer.

- ☐ Youth sector, Action 1
- ☐ Youth sector, Action 2
- ☐ Youth sector, Action 3
- ☐ School education sector, Action 1
- ☐ School education sector, Action 2
- ☐ Vocational education sector, Action 1
- ☐ Vocational education sector, Action 2
- ☐ Higher education sector, Action 1
- ☐ Higher education sector, Action 2
- ☐ Adult education sector, Action 1
- ☐ Adult education sector, Action 2
- ☐ Operational Programme Knowledge Education Development (POWER) Erasmus+ Sport Central Actions

Please indicate the subject area of the surveyed project:
You can select more than one answer.

- ☐ Formal education
- ☐ Informal education
- ☐ Non-formal education
- ☐ Ecology and environmental protection
- ☐ Civil society and human rights
- ☐ Social inclusion
- ☐ Counteracting discrimination
- ☐ National minorities
- ☐ Working with migrants
- ☐ Social work
- ☐ Gender equality
- ☐ Youth policy
- ☐ Health care
- ☐ Culture & Arts

- ☐ Hobbies & Sports
- ☐ Other (please specify):

_ _

How many foreign partners (institutions) participated in the surveyed project?
Please select only one answer.

- ☐ None
- ☐ 1–3
- ☐ 4–5
- ☐ More than 5

What was the budget for this project?
Please select only one answer.

- ☐ Less than EUR 60,000
- ☐ EUR 60,00–200,00
- ☐ More than EUR 200,00

What is the current status of the project?
Please select only one answer.

- ☐ Ongoing
- ☐ Suspended and extended due to the pandemic
- ☐ Completed

Please indicate your total length of service:
Please select only one answer.

- ☐ Less than 5 years
- ☐ 5–10 years
- ☐ 11–15 years
- ☐ More than 15 years

How many different institutions have you worked in so far?
Please select only one answer.

- ☐ 1
- ☐ 2–4
- ☐ 5 and more

How many European projects have you been a co-ordinator of so far?
Please select only one answer.

- ☐ 1
- ☐ 2–4
- ☐ 5 and more

Please indicate your length of service at the institution where the surveyed project was implemented:
Please select only one answer.

- ☐ Less than 2 years
- ☐ 2–5 years
- ☐ 6–9 years
- ☐ 10–13 years
- ☐ More than 13 years

Have you ever worked abroad for at least 6 months?
Please select only one answer.

- ☐ Yes
- ☐ No

What is your level of education?
Please select only one answer.

- ☐ Lower secondary education
- ☐ Secondary education
- ☐ Higher education, first degree
- ☐ Higher education, second degree
- ☐ Higher education, third degree

What is your area of education?
You can select more than one answer.

- ☐ General
- ☐ Technical, engineering
- ☐ Humanities, social, pedagogical sciences
- ☐ Natural sciences
- ☐ Philological
- ☐ Law, finance, administration
- ☐ Economics
- ☐ Management, marketing

- ☐ Medical, pharmaceutical
- ☐ Arts
- ☐ Vocational
- ☐ Other (please specify):

_ _

The town in which your institution is located has a population of:
Please select only one answer.

- ☐ Fewer than 3,000 people
- ☐ 3,000–15,000 people
- ☐ 15,000–100,000 people
- ☐ 100,000–1,000,000 people
- ☐ More than 1,000,000 people

Please indicate your age:
Please select only one answer.

- ☐ Less than 26 years
- ☐ 26–35 years
- ☐ 36–46 years
- ☐ 46–55 years
- ☐ 56–65 years
- ☐ More than 65 years

Please indicate your sex:
Please select only one answer.

- ☐ Female
- ☐ Male

Annex III

Selected European Universities Initiative alliances

1CORE
Leader: 4EU+ European University Alliance E.V. – legal entity of the alliance
Partners: Copenhagen University, Heidelberg University, Milano University, Sorbonne University, **University of Warsaw**

The six universities of the 4EU+ Alliance jointly conduct research and teach students, create initiatives related to innovation, technology transfer and university social responsibility. Together, the universities implement more than 100 projects for research, education and enhancing staff competences. The challenges for the alliance partners are to increase mobility rates, which will be crucial for all universities, to deepen integration and increase balance at the European level and to establish a common framework for education. The main mission of the alliance is to develop a borderless cooperation in education, research and innovation within the network.

ARQUS II
Leader: University of Granada
Partners: Graz University, Leipzig University, University Lyon 1 Claude Bernard, University of Minho, University of Padova, University of Vilnius, **University of Wrocław**

The ARQUS network brings together nine comprehensive research universities that have a wealth of experience in collaborative projects and share a common profile as internationalised institutions with a deep regional commitment in mid-sized cities. The main aspiration of ARQUS is to act together as a laboratory for institutional learning in order to advance the design, testing and implementation of an innovative model for deep inter-university collaboration.

ATHENA
Leader: Instituto Politécnico do Porto
Partners: Hellenic Mediterranean University, Universität Siegen, Univerza v Mariboru, Vilniaus Gedimino technikos universitetas, Università Cusano, Université d'Orléans, Universidade de Vigo, **Maria Curie-Skłodowska University**

The ATHENA European University is a federation of mid-size higher education institutions in nine European countries. It draws on their combined strengths to reach a common objective: deliver high-quality education with a positive impact on research, youth employability and social advancement at the national and European levels. With a strong focus on research and education in the fields of science, technology and engineering, ATHENA aims at accompanying and shaping the digital transformation of societies, and thus supports the development of an inclusive, sustainable and safe digital economy.

CIVICA
Leader: Institute of Political Sciences Paris,
Partners: Bocconi University, CEU Central European University, European University Institute, Hertie School of Governance, IE University, National University of Political Studies and Public Administration, **SGH Warsaw School of Economics**, Stockholm School of Economics

CIVICA's vision for 2030 is to deepen and expand its activities in key areas such as education, research, civic engagement, innovation and lifelong learning; to develop a diverse and inclusive CIVICA community and continue its global reach; to establish CIVICA's leading role in the social sciences; and to create a framework for sustainable institutional collaboration.

In line with its mission, CIVICA will continue to serve local and global communities, defend fundamental European values, support environmental sustainability and conduct research in areas relevant to social science policy. At the same time, CIVICA will also continue to focus on the internal communities of the alliance. From autumn 2022 to autumn 2026, thousands of students and young researchers are expected to gain new opportunities to pursue international mobility, benefit from new educational offers and Europe-wide civic engagement opportunities.

ECIUn+
Leader: University of Twente
Partners: Autonomous University of Barcelona, Dublin City University, European Consortium of Innovative Universities – legal entity of the alliance, Hamburg University of Technology, Kaunas University of Technology, Linköping University, **Łódź University of Technology**, National Institute of Applied Sciences in Toulouse, Tampere University, University of Aveiro, University of Stavanger, University of Trento

The mission of the ECIU network is efficient, open learning at the European level that addresses multidisciplinary societal challenges and supports research and lifelong learning. The network partners are creating an inspiring model of a true European university for the benefit of European society. The 14 consortium members share a strong commitment to entrepreneurship, innovative forms of teaching and learning and high-quality research. Working together and learning from each other, ECIU universities strive to achieve scientific and educational excellence that will have a real impact on business and society.

ENHANCE
Leader: Technical University of Berlin
Partners: Chalmers University of Technology, Delft University of Technology, Gdańsk University of Technology, Norwegian University of Science and Technology, Polytechnic University of Milan, Polytechnic University of Valencia, RWTH Aachen University, **Warsaw University of Technology**

ENHANCE is a consortium of research universities in the technical and life sciences. It brings together Europe's leading technical universities with the objective of creating systemic, structured and sustainable cooperation between the consortium's universities that will lead to new solutions beyond existing models of cooperation. The aim of the alliance is to use science and technology for the benefit of society in order to turn global challenges into development opportunities.

The ENHANCE consortium universities work together with 30 associated partners: enterprises, municipalities, student organisations, research networks, non-profit foundations and organisations.

EU4DUAL
Leader: University of Mondragon
Partners: Baden-Wuerttemberg Cooperative State University Stuttgart, ESTIA School of Advanced Industrial Technologies, FH JOANNEUM University of Applied Sciences, John von Neumann University, Malta College of Arts Science and Technology, PAR Visoka Poslovna University College, **Koszalin University of Technology**, Savonia University of Applied Sciences

EU4Dual is a network of nine leading centres for dual education in Europe with the goal of becoming a global reference for dual education. The network aims to create an integrated dual education institution worldwide – a multi-campus, multidisciplinary institution committed to close integration between the academic community, industry and its regions.

EU GREEN
Leader: University of Extremadura
Partners: Institute of Technology Carlow, Otto von Guericke University of Magdeburg, University of Angers, University of Évora, University of Gävle, University of Oradea, University of Parma, **Wrocław University of Environment and Life Sciences**

EU Green is a transnational alliance of European universities created by nine partner institutions that have the potential to be engaged in all regions

of Europe. At the same time, they focus on the communities of their regions while adopting a global perspective.

EU Green focuses on a new model of growth by shaping a new generation of European citizens, enhancing the employability of young people, strengthening sustainable development at regional level, linking growth and competitiveness, implementing genuine social inclusion, adapting scientific development to address emerging global challenges, strengthening innovation in digital competences and supporting the rebuilding of economic and social quality and resilience in a post-pandemic world and in the face of potential security threats.

EUNICE
Leader: Poznań University of Technology
Partners: Brandenburg University of Technology Cottbus-Senftenberg, EUNICE AISBL – legal entity of the alliance, Karlstad University, Polytechnic Institute of Viseu, Polytechnic University of Hauts-De-France, University of Mons, University of Cantabria, University of Catania, University of Peloponnese, University of Vaasa

The EUNICE network was established to design and put into practice a model of a European university with great potential to create flexible activities in order to tackle the challenges and problems faced by a changing Europe and world.

EUNICE aims to replace the traditional form of education with a personalised one, which includes the promotion of inter-university "blended" mobility. It provides a competitive and personalised educational offer that meets the needs of individuals, society, the labour market and the industrial and business sectors.

EURECA-PRO
Leader: University of Leoben
Partners: Hasselt University, Mittweida University of Applied Sciences, **Silesian University of Technology**, Technical University Freiberg, Technical University of Crete, University of Leon, University of Lorraine, University of Petrosani

EURECA-PRO is a global education centre and interdisciplinary research and innovation leader in environmental and social development for sustainable consumption and production of goods. It covers technological, environmental, economic, social and political aspects. The international cooperation will strengthen the higher education system in Europe, contributing to mobility, civic engagement, shared values and approaches to responsible system design. By merging universities into a consortium,

students and staff will have the possibility to learn and conduct research in the field of responsible consumption and production.

FORTHEM
Leader: Johannes Gutenberg University of Mainz
Partners: Lucian Blaga University of Sibiu, University Dijon Bourgogne, University of Agder, University of Jyvaskyla, University of Latvia, **University of Opole**, University of Palermo, University of Valencia

Within FORTHEM, seven universities with pre-existing extensive global and European partnerships and shared experience in academic projects are joining forces and sharing networks to create a permanent multilateral and European collaborative environment. FORTHEM is composed of multi-disciplinary public research universities that are located (all but one) outside the capital regions and are not among the largest or highest ranked universities in their respective countries.

It is a new network of institutions with dynamic and flexible capacity to experiment with new and innovative forms of collaboration. FORTHEM thus presents a reproducible model for European and non-European universities that want to develop similar new alliances.

SEA-EU 2.0
Leader: University of Cádiz
Partners: Christian-Albrechts University of Kiel, Nord University, University of Algarve, **University of Gdańsk**, University of Malta, University of Naples Parthenope, University of Split, University of Western Brittany

SEA-EU is an alliance of six coastal European universities whose vision is to create an international, multi-ethnic, multilingual and inter-disciplinary European University. It will enhance scientific and teaching cooperation, as well as foster innovation and knowledge transfer. The universities forming the alliance are united by a cultural and economic tradition linked to the sea. They cover almost all the seas and oceans that form the northern, western and southern facets of the European continent: Baltic Sea, Atlantic Ocean, North Sea, Mediterranean Sea and Adriatic Sea. Most importantly, the maritime sector is of great strategic importance to the economies of these six regions.

T4EU
Leader: Saarland University
Partners: Estonian Academy of Arts, Catholic University of Portugal, Jean Monnet University, Sofia University St. Kliment Ohridski, University of

Alicante, University of Primorska, **University of Silesia in Katowice**, University of Trieste, Vytautas Magnus University

The mission of the Transform4Europe network is to transform Europe by educating and training knowledge entrepreneurs. The University of Silesia in Katowice, together with six foreign universities, are uniting to jointly conduct research at the highest level and educate young people in international fields of study. They are also establishing a shared, multilingual campus in order to safeguard the future of their regions and, by extension, the countries of Europe.

Una Europa
Leader: Catholic University of Leuven
Partners: Complutense University Madrid, Free University of Berlin, **Jagiellonian University in Kraków**, Leiden University, Paris 1 Panthéon-Sorbonne University, Una Europa vzw – legal entity of the alliance, University of Bologna, University of Helsinki

Una Europa is a union of 11 leading European research universities striving to create the university of the future – a truly European inter-university environment, built on the potential and strengths of its partners. The network's member universities have been educating across Europe for more than 1,000 years. Together, they integrate over 500,000 students and almost 100,000 university staff in a network along with millions of online learners.

UNIgreen
Leader: Almeria University
Partners: Agricultural University – Plovdiv, Higher Institute of Biotechnologies of Paris, Higher Education Institution of the Province of Liège, University of Modena and Reggio Emilia, Agricultural University of Iceland, Polytechnic Institute of Coimbra, **Warsaw University of Life Sciences**

UNIgreen aims to create an alliance constituting a model European university for higher education and research in the areas of agricultural, bio and life science. The project aims to enable the free movement of knowledge, facilitate the acquisition of dual or joint European degrees and attract talent from outside Europe by promoting multilingual learning, interculturalism and increased inclusivity.

The project is also expected to contribute to achieving economic transformation at the local and regional levels, while at the national level, it aims to launch trans-regional networks for development, innovation and

entrepreneurship and strengthen the personal and professional competences of citizens, thus increasing their employability.

UNITE!
Leader: Technical University of Darmstadt
Partners: Aalto University, Graz Technical University, Grenoble Institute of Technology, KTH Royal Institute of Technology, Polytechnic University of Catalonia, Polytechnic University of Turin, University of Lisbon, **Wrocław University of Science and Technology**

Unite! is a network of seven universities stretching from Finland to Portugal, connecting European regions in terms of economic perspective, entrepreneurship and innovation. Unite! combines engineering, science and technology with grand societal challenges, creating solutions for a new generation of European and global citizens.

UNIVERSEH
Leader: University of Toulouse
Partners: **AGH University of Science and Technology (Cracow)**, Heinrich Heine University Düsseldorf, Luleå University of Technology, University of Luxembourg, University of Rome Tor Vergata, University of Namur

UNIVERSEH – the European Space University for Earth and Humanity – is a network of space universities. Developing fields of study that go beyond the Earth's globe is the path towards the future discipline of space and its better understanding. The alliance's activities will provide the basis for building innovative, employment-oriented curricula and will support mobility, integration and multilingualism.

YUFE 2030
Leader: University of Maastricht
Partners: **Nicolaus Copernicus University in Toruń**, University Carlos III of Madrid, University of Antwerp, University of Bremen, University of Cyprus, University of Eastern Finland, University of Rijeka

YUFE, or Young Universities for the Future of Europe, is made up of ten dynamic, young, student-centred research universities and four non-academic partners working on higher education, the labour market and entrepreneurship. The network aims to radically change and transform European higher education by becoming a leading model of a student-centred, open and inclusive European university.

Annex IV

Survey questionnaire on digital transformation of universities

Digital transformation strategy of the university

1. How would you describe the level of advancement of your university's digital transformation?

- ☐ Our university has not yet embarked on a holistic digital transformation.
- ☐ Our university has already introduced modern digital solutions in some areas, but we are still in the early stages of the transformation towards Education 4.0.
- ☐ Our university's digital transformation is already at an advanced stage.

2. How would you describe the ongoing digital transformation process at your university?

- ☐ The direction of our university's digital transformation is set continuously by the Rectors Committee.
- ☐ The digital transformation of our university takes a continuous, bottom-up approach through the implementation of good practices at the unit and employee levels.
- ☐ Our university is consistently implementing a pre-planned digital transformation strategy, enacted and adopted centrally (in the form of a government regulation, resolution or other document). In order to properly implement the change, an appropriate body (team, working group) has been established to oversee the process.

3. What do you think is the biggest challenge in your university's digital transformation process?
You can select multiple answers.

- ☐ Lack of knowledge/reliable sources of information on the digital transformation of the university
- ☐ Lack of experience in the digital transformation process of the university
- ☐ Lack of competences among managerial staff needed to carry out systemic changes at the university
- ☐ Lack of support from the state/public administration
- ☐ Lack of financial resources needed to carry out systemic changes at the university

- Resistance/passivity on the part of staff
- Resistance/passivity on the part of managerial staff
- Lack of faith in the success of the university' s digital transformation
- Failure to adjust the university's adopted management model to the ongoing technological changes
- Lack of a well thought-out strategy for the university's digital transformation
- Lack of need for organisational changes at the university
- Other, please specify: … …… … … … ..
- I do not see any challenges in the digital transformation process of our university.

II. Management model of the university

4. How would you describe the management model adopted at your university?

- Our university follows a traditional organisational model based on personal team management and ongoing task delegation. At this point in time, we do not use any systems to monitor staff activity or optimise the use of resources.
- Our university is gradually streamlining organisational processes towards intelligent management based on the use of new digital technologies and Education 4.0 solutions. So far, management at our university is still largely traditional, through direct supervision of employees by superiors.
- In many areas, our university has already introduced automated and flexible organisational processes that minimise the need for direct supervision of employees by superiors (e.g. systems for monitoring work activity, systems for remote management of assigned tasks). We are currently conducting further process changes and improvements.

5. How is the process of managing staff and delegating tasks/reviewing the performance of tasks assigned to staff carried out at your university?

- The management of the work of staff is carried out in a purely direct, personal way, without the use of digital tools dedicated to managing and planning the work of teams/employees/projects.
- The management of the work of university staff is largely done in a direct, personal way, with little support from a variety of digital tools (various software and applications for managing and planning the work of teams/employees/projects).

- The management of the work at our university is largely done through the use of digital tools (dedicated software and applications for managing and planning the work of teams/employees/projects).
- Only digitised tools for managing staff work are used at the university (including dedicated software and applications for managing and planning the work of teams/employees/projects), we avoid any form of micromanagement.

6. How would you define the level of networking of your university regionally and globally?

- Our university quite rarely cooperates with other universities.
- Our university enters into partnerships primarily with other Polish universities.
- Our university enters into partnerships primarily with foreign universities.
- As a university, we are open to partnerships with both Polish and foreign universities.

III. Infrastructure

7. How would you rate the overall level of technological advancement of your university:

- Our university uses basic technological solutions and underlying software to maintain the continuity of teaching, research and administrative processes in the era of ongoing technological changes.
- Our university is still using basic software and tools, although advanced, intelligent systems are increasingly being introduced, allowing us to adapt the way we conduct teaching and academic research to the requirements of the evolving educational reality.
- Our university uses advanced technological solutions to optimise and streamline the way teaching, academic research and administrative services are carried out in times of digital revolution.

8. Which of the following statements best describes the data collection and analysis policy adopted at your university:

- Data collected at our university in the different areas of its operation (teaching, research and administration) is processed and analysed selectively for the needs of individual offices and administrative divisions. We do not use an integrated data analysis system.

- Intelligent systems for data processing and analysis have already been partially implemented at our university in order to improve the teaching, research and administrative processes, but these are still piecemeal solutions that do not cover the entirety of the processes carried out.
- Data collected in different areas of our university's operations are integrated in comprehensive analysis systems (conducted in real time), which allows for faster reactions and efficient strategic decision-making even in unforeseen circumstances.

How does your university prepare teaching and academic staff for the ongoing digital transformation and the technological changes that come with it?

- We do not provide systematic training programmes for teaching staff at our university; we leave the acquisition of new skills and competences (including digital) to their own discretion.
- Basic training programmes for teaching staff are provided at our university, primarily focused on preserving the standard and quality of teaching.
- Comprehensive programmes of various training courses for teaching staff – both mandatory and optional – are conducted at our university, aimed at developing their knowledge, competences and skills in the changing conditions of the educational ecosystem.

10. How does your university prepare administrative staff for the ongoing digital transformation and the technological changes that come with it?

- We do not provide systematic training programmes for administrative staff at our university; we leave the acquisition of new skills and competences (including digital) to their own discretion.
- Basic training programmes for administrative staff are provided at our university, primarily focused on preserving the standard and quality of the university's administrative service.
- Comprehensive programmes of various training courses for administrative staff – both mandatory and optional – are conducted at our university, aimed at developing their knowledge, competences and skills in the changing conditions of the educational ecosystem.

IV. Human capital

11. How would you rate the level of competence of the teaching and academic staff at your university?

	High level	*Medium level*	*Basic level*	*Hard to say*
Ability to use digital software and tools	☐	☐	☐	☐
Willingness and openness to work with AI solutions	☐	☐	☐	☐
Smooth transitioning between modes of work (traditional, remote, hybrid)	☐	☐	☐	☐
Remote teamworking using digital tools	☐	☐	☐	☐
Managing people who work remotely using digital tools	☐	☐	☐	☐
Remote learning using digital tools and online platforms	☐	☐	☐	☐
Working and interacting with systems based on artificial intelligence	☐	☐	☐	☐
Solving complex problems using digital tools	☐	☐	☐	☐

12. How would you rate the level of competence of the administrative staff at your university?

	High level	*Medium level*	*Basic level*	*Hard to say*
Ability to use digital software and tools	☐	☐	☐	☐
Willingness and openness to work with AI solutions	☐	☐	☐	☐
Smooth transitioning between modes of work (traditional, remote, hybrid)	☐	☐	☐	☐
Remote teamworking using digital tools	☐	☐	☐	☐
Managing people who work remotely using digital tools	☐	☐	☐	☐
Remote learning using digital tools and online platforms	☐	☐	☐	☐
Working and interacting with systems based on artificial intelligence	☐	☐	☐	☐
Solving complex problems using digital tools	☐	☐	☐	☐

13. Which training courses would you find attractive to support your university's digital transformation process? You can select multiple answers.
Training for university managerial staff on:

- ☐ Business strategy management and planning
- ☐ Management of dispersed teams
- ☐ Advanced digital competences
- ☐ Working with specific digital tools (e.g. CAD, SAP)
- ☐ Data collection and analysis
- ☐ Internal communication
- ☐ Other, please specify: … …… … … … ..

14. Which training courses would you find attractive to support your university's digital transformation process? You can select multiple answers.
Training for teaching and academic staff on:

- ☐ Advanced digital competences
- ☐ Working with specific digital tools (e.g. CAD, SAP)
- ☐ Data collection and analysis
- ☐ Working in diverse dispersed teams
- ☐ Internal communication
- ☐ Other, please specify: … …… … … … ..

15. Which training courses would you find attractive to support your university's digital transformation process? You can select multiple answers.
Training for administrative staff on:

- ☐ Advanced digital competences
- ☐ Working with specific digital tools (e.g. CAD, SAP)
- ☐ Data collection and analysis
- ☐ Working in diverse dispersed teams
- ☐ Internal communication
- ☐ Other, please specify: … …… … … … ..

16. What other activities would you find attractive to support your university's digital transformation process?
You can select multiple answers.

- ☐ Mentoring of managerial staff in the context of organisational and process changes in higher education

- ☐ Observing good practices at other universities with similar characteristics/educational profile
- ☐ Opportunity to consult on the direction and course of organisational and business changes with experts in Education of the Future
- ☐ Access to profiled information materials and guides for managerial staff of the educational ecosystem (online materials)
- ☐ Access to training materials for teaching, academic and administrative staff (traditional materials)
- ☐ Networking meetings as a space for exchanging experiences and ideas among representatives of other universities undergoing digital transformation (*lessons learned*).
- ☐ Other, please specify: … …… … … … ..
- ☐ None of the above

V. Product

What innovative teaching solutions have your university introduced?
You can select multiple answers.

- ☐ Creative thinking laboratories
- ☐ Fabrication laboratories (providing the opportunity to implement own projects and ideas using digital production and manufacturing equipment, including 3D printers, 3D scanners, CNC machines, laser cutters, laser plotters, CNC embroidery machines, sewing machines and others)
- ☐ Media laboratories (allowing people with different skills to work and learn together on projects using new media and technologies, e.g. recording studios, sound laboratories)
- ☐ Makerspaces (creative *garages*)
- ☐ Simulation spaces (with VR, AR and Mixed Reality equipment)
- ☐ Innovation studies (space for testing and developing cross-industry cooperation)
- ☐ Science and Technology Park
- ☐ Business Incubator/Startup Incubator
- ☐ Other, please specify: … …… … … … ..
- ☐ None of the above.

18. Which of the activities towards supporting the development of students' competences of the future does your university undertake?

- ☐ Providing additional courses and programmes to develop the competences of the future (including digital and social competences)

- Providing students with external e-learning platforms for the development and verification/certification of acquired competences
- Creating dedicated laboratories for learning selected competences of the future
- Cooperation with leading specialist content providers
- Taking measures aimed at strengthening cooperation with the university's socio-economic environment
- Conducting consultations with the university's socio-economic environment on newly opened courses and specialisations
- Integration of educational offers with staff development programmes of business entities outside the university
- Integrating the offer with managerial staff development programmes
- Cooperation with graduates of our university
- Providing courses taught by practitioners and experts from outside the academy
- Providing optional classes oriented towards learning the competences of the future
- Supporting student research initiatives
- Supporting student implementation activities
- Other, please specify: … …… … … … ..
- None of the above.

19. To what extent do students at your university have a say in the individual design of the curriculum and the selection of individual subjects/courses?

- Due to complex procedures and formal requirements, curricula at our university are not updated more than once every few years. They include small blocks of optional classes to be chosen by students individually.
- The curricula at our university are modified on an ongoing basis in consultation with student representatives and guarantee a free choice of subject path/module and optional courses selected by students according to their preferences.
- The framework curricula at our university are modified on an ongoing basis in consultation with student representatives and guarantee a high degree of freedom to construct the course of study and the modules/subjects pursued.

20. Please indicate the name of your university:

_ _

21. Please indicate your position at the university:

– –

22. Number of students participating in EUI courses:

– –

Annex V

Survey questionnaire based on the Higher Education-Business Engagement Index and its indicators

Measuring the scope and quality of cooperation between the academia and business environment
HEI code

– –

DIMENSION 1: R&D COLLABORATION

Revenues from joint HEI-business research projects in the last reporting year.

– –

Revenues (net) from contracted research in the last reporting year.

– –

Total revenue from research activity in the last reporting year.

– –

Total number of active cooperation agreements implemented by HEI (and its dependent entities whose mission is HE-business knowledge transfer) and business signed in the past calendar year (joint research)

– –

Total number of active cooperation agreements implemented by HEI (and its dependent entities whose mission is HE-business knowledge transfer) and business signed in the past calendar year (contracted research)

– –

Total number of cooperation agreements signed by HEI (and its dependent entities whose mission is HE-business knowledge transfer)

and business signed/implemented in the past calendar year (joint research)

– –

Total number of cooperation agreements signed by HEI (and its dependent entities whose mission is HE-business knowledge transfer) and business in the past calendar year (contracted research)

– –

Number of unique entrepreneurs with whom cooperation agreements have been signed in the last calendar year (all types of agreements are counted, including joint research agreements, contracted research agreements, consulting services agreements and others)

– –

Total value of signed new cooperation agreements in the last calendar year

– –

Number of student projects conducted in cooperation with business in the last academic year (student project – any project implemented by students for or in cooperation with business)

– –

Number of people employed in R&D, including projects conducted under consortia with businesses in the last four reporting years

– –

Number of new technologies, materials, products, methods, procedures, software and plant species developed for businesses, based on agreements between the HEI and the businesses in the last four reporting years

– –

Value of agreements concluded by the HEI concerning new technologies, materials, products, methods, procedures, software and plant species developed for businesses in the last four reporting years

– –

Number of people who defended their doctoral theses in a given calendar year, including those supervised by business

– –

Number of opened doctoral procedures in a given calendar year, including those co-financed by business

– –

Number of publications developed with business representatives in the last four reporting years

– –

Total number of HEI publications in the last four reporting years

– –

Number of joint papers written with at least one business representative developed in the last four reporting years

– –

Total number of articles published by the HEI in the last four reporting years

– –

Number of articles published by the university employees together with a business representative in the last four reporting years

– –

Number of other publications, including professional publications and reports, published as joint papers with business in the last four reporting years

– –

Number of publications developed as a result of joint research projects in the last four reporting years

– –

Total number of HEI academic staff (full-time employees)

– –

Total number of HEI academic staff (part-time employees)

– –

Number of citations for papers developed with business representatives in the last reporting year

– –

Number of degree theses (bachelor's, master's and doctoral) written under joint supervision by a faculty member and business representative in the last academic year.

	BA	*MA*	*PhD*
Curricula developed for a specific business			
HEI-business joint curricula			
Other curricula			

– –

Number of alumni who received an academic title/degree based on thesis written in cooperation between the HEI and business in the last academic year.

	BA	*MA*	*PhD*
Curricula developed for a specific business			
HEI-business joint curricula			
Other curricula			

– –

DIMENSION 2: PERSONNEL AND STUDENT MOBILITY

Number of students (regardless the study cycle and the form of studies) applying to take part in placements/internships in the last academic year (apart from placements offered within the study programme as obligatory, so-called vocational student placements). "Student" is understood here as a person studying at the university X within a BA, MA or PhD curriculum.

– –

Number of students taking part in obligatory placements/internships in the last academic year

– –

Number of students taking part in non-obligatory placements/internships in the last academic year

– –

Total number of students studying presently at HEI

– –

Number of completed obligatory placements/internships in the last academic year

– –

Number of completed non-obligatory placements/internships in the last academic year

– –

Number of HEI staff applying to take part in temporary mobility in business in the last academic year. "HEI staff" is understood here as any person which signed an employment contract with HEI.

– –

Number of HEI staff taking part in temporary mobility in business in the last academic year

– –

Number of completed temporary mobilities of HEI staff in the last academic year

– –

Number of students who took part in placements/internships and, on completion of their education, found employment in the same sector as their placement/internship

– –

Number of temporary mobilities in business offered by HEI (student temporary mobilities) in the last academic year

– –

Number of temporary mobilities in business offered by HEI (staff temporary mobilities) in the last academic year

– –

Number of internship scholarships for students funded by business

– –

Number of internship scholarships for HEI staff funded by business

– –

Number of HEI staff on temporary mobility in business (seconded employees)

– –

Number of business personnel on temporary mobility at the HEI (seconded employees) as lecturers

– –

Number of business staff on temporary mobility at the HEI (seconded personnel) in the field of:
Administration,
Training&education,
R&D

– –

Number of management positions (lower and senior) at the HEI taken by business representatives (in training and education field)

– –

Number of management positions (lower and senior) at the HEI taken by business representatives (in research field)

– –

Number of management positions (lower and senior) at the HEI taken by business representatives (in administration field)

– –

Number of management positions (lower and senior) in business taken by HEI staff

– –

Number of personnel who have completed at least one contract for business (civil law contract) in the past year

– –

Number of contracts with business completed by HEI staff in the past year

– –

Number of study visits conducted by HEI staff at business

– –

Number of study visits conducted by business representatives at HEI

– –

Total number of persons taking part in study visits (both HEI and business staff)

– –

Number of study visits at business conducted by students (first-cycle studies)

– –

Number of study visits at business conducted by students (second-cycle studies)

– –

Number of study visits at business conducted by students (third-cycle studies)

– –

Number of students taking part in study visits at business

– –

Number of HEI staff who left HEI and went on to work in business, by the field of:
Administration
Training&education
R&D

– –

Number of business personnel who left business and went on to work at HEI by:
Administration
Training&education
R&D

– –

DIMENSION 3: IMPROVEMENT OF THE EDUCATIONAL OFFER AND PROVISION OF EDUCATIONAL SERVICES (INCLUDING LLL)

Number of students enrolled in study programmes that are jointly delivered by the HEI and business or are dedicated to specific businesses in the past academic year

– –

Number of alumni of study programmes that were jointly delivered by the HEI and business or were dedicated to specific businesses in the past academic year

– –

Number of students receiving scholarships funded by business in the past academic year

– –

Number of candidates applying for study programmes that are jointly delivered by the HEI and business in the last recruitment

– –

Average (weighted by the number of ECTS points) for students who study in the fields of education co-created by employers or dedicated to specific businesses in the past academic year

– –

Average grades in studies other than those co-created by employers or dedicated to specific businesses in the last academic year

– –

Number of exams jointly carried out by university employees and business representatives in the past academic year on study programmes conducted jointly with HEI and business

– –

Revenue from selling educational services to businesses in the last academic year (for programmes conducted jointly by HEI and business) by I, II and III-cycle of studies

– –

Revenue from selling educational services to businesses in the last academic year (for programmes conducted jointly by HEI and business) by post-diploma studies

– –

Revenue from selling educational services to businesses in the last academic year (for programmes conducted jointly by HEI and business) within training courses

– –

Revenue from selling educational services to businesses in the last academic year (for programmes conducted jointly by HEI and business) within certification of competences

– –

Number of HEI courses/training sessions delivered to business in the past academic year

– –

Number of people who took part in courses/training sessions for business in the past academic year

– –

Number of companies whose representatives took part in courses/training sessions for business in the past academic year

– –

Number of people who took part in more than one course/training session for business in the past academic year

– –

Number of courses/training sessions and other development services delivered by business to HEI in the past academic year (paid services)

– –

Number of courses/training sessions and other development services delivered by business to HEI in the past academic year (free of charge services)

– –

Number of HEI staff participating in courses/training sessions and other development services delivered by business to HEI staff in the past academic year (paid services)

– –

Number of HEI staff participating in courses/training sessions and other development services delivered by business to HEI staff in the past academic year (free of charge services)

– –

Number of businesses delivering courses/training sessions and other development services to the HEI in the past academic year (paid services)

– –

Number of businesses delivering courses/training sessions and other development services to the HEI in the past academic year (free of charge services)

– –

Number of alumni who found employment in their studied profession on completion of their education (only for studies dedicated to specific businesses)

– –

Number of alumni who found employment in their studied profession on completion of their education (only for studies carried out jointly with employers)

– –

Number of alumni who found employment in their studied profession on completion of their education (for other studies)

– –

Number of students who found employment in companies that cooperate with the HEI (for courses of study dedicated to specific companies)

– –

Number of students who found employment in companies that cooperate with the HEI (only for studies carried out jointly with employers)

– –

Number of students who found employment in companies that cooperate with the HEI (for other studies)

– –

Number of ECTS credits assigned to courses designed directly at the request of employers in the last academic year

– –

Number of business representatives who are members of the bodies that support the designing/modifying of study programmes in the past academic year

– –

Number of delivered courses that were jointly designed by faculty members and business representatives in the past academic year

– –

Number of students taking part in courses that were jointly designed by faculty members and business representatives in the past academic year

– –

Number of new courses that were jointly designed by faculty members and business representatives in the past academic year

– –

Number of study programmes that were jointly designed by the HEI and business in the past academic year

– –

Number of businesses whose representatives were involved in the designing/modification of study programmes in the past academic year

– –

Number of business representatives involved in teaching courses at the HEI in the past academic year within study programmes dedicated to specific companies

– –

Number of business representatives involved in teaching courses at the HEI in the past academic year within joint study programme with business

– –

Number of business representatives involved in teaching courses at the HEI in the past academic year within other study programmes

– –

Number of grant applications for activities conducted jointly by the HEI and business as regards designing/modification of study programmes and opening of new study programmes, submitted by HEI in the past academic year

– –

Number of grants for activities conducted jointly by the HEI and business as regards designing/modification of study programmes and opening of new study programmes, in the past academic year

– –

Value of grants for activities conducted jointly by the HEI and business as regards designing/modification of study programmes and opening of new study programmes, in the past academic year

– –

Number of business guest lectures in the past academic year (business for HEI)

– –

Number of HEI guest lectures in the past academic year (HEI for business)

– –

Number of participants of business guest lectures in the past academic year (business for HEI)

– –

Number of participants of HEI guest lectures in the past academic year (HEI for business)

– –

Value of financial support (donations) received from business aimed directly at education and the development of teaching facilities in the past academic year

– –

Number of donor businesses who gave funds aimed directly at education and the development of teaching facilities in the past academic year

– –

Number of competences acquired outside the formal system certified by the HEI (business personnel competences) – funded by public funds

– –

Number of competences acquired outside the formal system certified by the HEI (business personnel competences) – funded by business

– –

Number of business personnel whose competences acquired outside the formal system have been certified by HEI in the last academic year (those funded by public funds)

– –

Number of business personnel whose competences acquired outside the formal system have been certified by HEI (those funded by business)

– –

Number of companies who have funded personnel competence certification at the HEI in the past academic year

– –

DIMENSION 4: COMMERCIAL ACTIVITIES

Revenue from leasing research and/or training facilities and/or equipment in the past year (including leasing of lab equipment or conference equipment)

– –

Number of HEIs departments which lease (and charge for leasing) facilities in the past year

– –

Total number of HEIs departments in the past academic year

– –

Business donations to the HEI's facilities/equipment in the past year

– –

Number of analysis or academic studies or artistic activities delivered to private entities (businesses), excluding certification and quality declarations in the past year

– –

Gross revenue from analysis or academic studies or artistic activities delivered to private entities (businesses), excluding certification and quality declarations in the past year

– –

Number of contracts on certification or quality declarations signed with business in the past year

– –

Net revenue from certification or quality declarations agreements signed with business in the past year

– –

Number of consultancy contracts and selling of services/know-how to business signed in the past year (expert opinions, analysis, surveys, testing require input from HEI, however, do not generate new knowledge)

– –

Aggregated value of consultancy contracts and selling of services/know-how to business signed with business in the past year

– –

Number of unique entrepreneurs with whom consultancy and know-how sales agreements have been signed in the past year (if more than one contract was signed with the same entrepreneur, it shall only be counted once)

– –

Revenue from consultancy and know-how sales agreements in the past year

– –

Total expenditure on research in the past year

– –

Total income from all kinds of know-how and intellectual property (IP) in the past year (including patents, copyrights, designs, trademarks, confidentiality agreements and plant species protection rights), excluding income from licenses for other institutions

– –

Total number of all kinds of know-how and IP licenses in the past year

– –

Number of granted licenses which were accompanied by the purchase of other services (e.g. consultancy, contract research, etc.) in the past year

– –

Number of all kinds of know-how and IP licenses sold in the past year

– –

HEI's outlays on the purchase of licenses and IP in the past year (excluding standard computer software). Licenses as understood here shall refer to R&D activities.

– –

Number of licenses purchased in the past year (standard software excluded)

– –

Sum of unique licensees with whom contracts were signed in the past year (if more than one contract was signed with a given licensee, it shall be counted only once)

– –

Number of spin-outs established in the past year (spin-out – a company funded by at least one employee or student or alumnus of the HEI, in order to commercialise innovative ideas and technologies, usually independent (organization-wise, legal-wise and financial-wise) from the HEI)

– –

Number of spin-offs established in the past year (spin-off – a company funded by at least one employee or student or alumnus of the HEI, in order to commercialise innovative ideas and technologies, usually somehow dependent (organisation-wise, legal-wise and financial-wise) from the HEI)

– –

Revenue generated by spin-offs in the past year

– –

Number of spin-offs which generated revenue in the past year

– –

Total number of HEI's spin-offs

– –

Number of spin-offs which have been functioning for three years or more

– –

Number of discontinued spin-offs in the last three years

– –

Number of spin-offs with at least one external investor (other than co-founders or HEI)

– –

Total gross value of private investment in spin-offs in the past year (including investments, loans from investors, banks, business angels, but excluding grants, donations and loans from state or public institutions)

– –

Number of permanent employees in spin-offs

– –

Number of active patents in the HEI's portfolio, including joint patents with businesses

– –

Number of patents issued by the National Patent Office or a patent office abroad to the HEI in the past year, including joint patents with businesses

– –

Number of inventions developed jointly by the HEI and business in the past year

– –

Number of patents issued by the National Patent Office or a patent office abroad in the past year to other company than HEI, whose employee created or co-created the property

– –

Number of protection rights shared with a business concerning utility models, trademarks or integrated circuit layout designs issued by the National Patent Office or a patent office abroad to the HEI, whose employee created or co-created the property

– –

Number of revenue-generating patents in the past year (within license or sale agreements)

– –

DIMENSION 5: SOCIAL ENGAGEMENT

Number of joint social engagement non-profit activities carried out by the HEI and business in the past year, in the following areas:

• fight against poverty

– –

social inclusion

– –

labour market

– –

• education

– –

- health

– –

- safety

– –

- culture and sport

– –

- quality of governance

– –

Number of unique entrepreneurs with whom the HEI has performed joint social engagement non-profit activities in the past year, in the following areas:

- fight against poverty

– –

social inclusion

– –

labour market

– –

- education

– –

- health

– –

- safety

– –

- culture and sport

– –

- quality of governance

– –

Expenditure on joint HEI and business social engagement and non-profit activities in the past year in the following areas

• fight against poverty

– –

social inclusion

– –

labour market

– –

• education

– –

• health

– –

• safety

– –

• culture and sport

– –

• quality of governance

– –

Outlays from business on joint HEI and business social engagement, non-profit activities in the past year in the following areas

• fight against poverty

– –

social inclusion

– –

labour market

– –

• education

– –

• health

– –

• safety

– –

• culture and sport

– –

• quality of governance

– –

Outlays from HEI on joint HEI and business social engagement, non-profit activities in the past year in the following areas

• fight against poverty

– –

social inclusion

– –

labour market

– –

• education

– –

• health

– –

• safety

– –

• culture and sport

– –

• quality of governance

– –

TECHNOLOGY TRANSFER UNITS

Value of TTU income that is transferred to the research units

– –

Total revenues of TTU

– –

Year of TTU establishing

– –

TTU annual budget (public funds)

– –

TTU annual budget (funds from excess cash/indirect research agreement costs)

– –

TTU annual budget (revenue from licenses)

– –

TTU annual budget (revenue from regional/national or European subsidies)

– –

TTU annual budget (other funding sources)

– –

TTU expenditure on promotion (the amount spent on promotion (e.g. trade shows, events or materials) in the past financial year))

– –

TTU networking (the number of national, European and international networking organizations in which the TTU is a member)

– –

TTU training activity (the number of activities undertaken to develop the TTU personnel's competences)

– –

Number of the TTU's business clients

– –

What is the place of TTU in the HEI structure? (you may point several answers)

- ☐ centralized internal unit
- ☐ internal unit

- ☐ company or external non-profit organization
- ☐ an external company or profit-oriented organization
- ☐ branch company or organization
- ☐ company or an external organisation which is owned in total by the HEI

Does TTU have its own seed fund or venture capital fund?

- ☐ Yes
- ☐ No
- ☐ I do not know

PARTICULARS

Total revenue of HEI in the past year, including business donations

– –

HEI gross result in the past year

– –

HEI net result in the past year

– –

Number of first, second and third degree students, as per 1 October 2017 (within study fields joint with business or dedicated to specific businesses)

– –

Number of first, second and third degree students, as per 1 October 2017 (within other study fields)

– –

Number of doctoral degrees pending in the past year (doctoral degrees pending by those working in business)

– –

Number of doctoral degrees pending in the past year (degrees oriented at solving business problems)

– –

Number of doctoral degrees pending in the past year (degrees on research co-financed by business)

– –

Number of doctoral degrees pending in the past year (study fields co-financed by business)

– –

Number of doctoral degrees pending in the past year (other fields of study)

– –

Number of conferred academic titles and degrees (e.g. BA, MA, MSC, PhD) in the past year – oriented at solving business problems

– –

Number of conferred academic titles and degrees in the past year – other degrees

– –

Number of conferred academic titles and degrees in the past year – study fields co-financed by business

– –

Number of conferred academic titles and degrees in the past year – other fields of study

– –

Total number of HEI employees

– –

Number of R&D staff – those working on joint projects with business, financed by business

– –

Number of R&D staff – others

– –

Number of academic teachers, in the past year

– –

Number of academic teachers, in the past year, including those conducting business activities

– –

Outlays on R&D – outlays for basic research

– –

Outlays on R&D – outlays for applied research

– –

Outlays on R&D – outlays for industrial research

– –

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Note: **Bold** page numbers refer to tables and *italic* page numbers refer to figures.

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