



Landscape of e-Learning during Covid-19: Case Study of Economic Disciplines in Croatia

Sanja Sever Mališ, Ivana Mamić Sačer, Katarina Žager

The University of Zagreb, Faculty of Economics and Business, Croatia

Abstract

Background: The Covid-19 pandemic has changed the digitalisation level of education. Many institutions had some knowledge and practical background in delivering lectures online. Some countries apply a top-down digitalisation approach driven by policy or strategy and externally impacted by the government. Some other countries rather initiate digitalisation internally by teachers and universities. **Objectives:** The main goal is to investigate the digitalisation level of the higher education system in Croatia, exploring the digitalisation of economic disciplines compared to other scientific fields. **Methods/Approach:** We assess the digitalisation level of higher education based on the regulatory framework, applied approach of digitalisation, the agility of transition to online teaching and the existing number of courses and online study programs. Education digitalisation in different countries is compared with the Croatian experience. **Results:** Although the satisfactory level of higher education institutions' agility to switch online exist, there hasn't been a centralised project led by the government and supported by proper funds to increase digitalisation in Croatia. Even before the pandemic, many e-courses from economics and business had been offered to students, but online study programs were exceptions, covering mainly the economics and business field. **Conclusions:** The Covid-19 pandemic has improved the digitalisation process in the Croatian education system. A general framework for the digitalisation of education should be developed containing the detailed administrative processes and appropriate funds to be implemented.

Keywords: higher education institutions; digitalisation; economic disciplines; Croatia

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Introduction

The global epidemic and online teaching have marked the last two academic years. However, online teaching is not just a product of emergencies caused by the Covid-19 pandemic. Many universities implemented online study programs in their strategies even before that period. Universities in Croatia are just one of many universities that, before the pandemic, had also had some practical experience in online teaching. In that context, the pandemic has only fastened the level of digitalisation in higher education, but there is still plenty of work in front of higher education institutions worldwide. Digitalisation is *“the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business”* (Gartner, 2022). In the light of education, the digitalisation process includes not only a change in the applied educational technologies but also certain expected administrative changes. Higher education as a sector is also a subject of digitalisation. EY Parthenon's survey (EY Parthenon, 2020) indicates that 93% of institutions expect digital tools and technology changes to impact these institutions significantly.

A certain image of digitalisation in the Croatian higher education system before the Covid-19 pandemic presents the research from 2012 conducted on the sample of the University of Osijek. This research shows that only 39.7 % of students took exams and midterm tests applying computers at that time (Dukić et al., 2012). The highest application of computers was noticed for social and technical sciences. Further, according to Dukić and Mađarić (2012), videoconferences were used for delivering lectures only in 13.7 %. This kind of lecture was mostly used in technical sciences. In addition, in 2015, more than 8000 e-courses in Croatia were registered (SRCE et al., 2022). Today, we have a perspective on increasing digitalisation in higher education.

Considering that some experience in the digitalisation of Croatian higher education has already existed even before the Covid-19 pandemic, the main goal of the paper is to investigate the digitalisation level of higher education in the Republic of Croatia. The research is based on the preliminary research of the topic in previous studies in Croatia and worldwide. Limited research about the digitalisation of higher education in Croatia, in general, has been conducted until now. Many research papers on this topic cover the impact of the Covid-19 pandemic on the digitalisation of schools or higher educational institutions worldwide (Johnson et al., 2020, Zawacki-Richter, 2020, Bond et al., 2021, Siddiquei et al., 2021, Harvard Business Publishing Education, 2020, UNESCO, 2022, Müller et al., 2020, etc.). However, a research gap can be found in analysing the regulatory framework for the digitalisation of higher education in Croatia. This kind of research in the economic field is especially lacking. Namely, this issue is highly relevant since the digitalisation of higher education can be performed as top-down or externally impacted digitalisation driven by policy, strategy, curricular reforms or re-organisation. Other than that, digitalisation could be initiated by leadership or staff as a bottom-up or internally impacted digitalisation (Tømte et al., 2019). Based on these postulates, different countries have experienced higher or lower maturity of the digitalisation of higher education. The topic of digitalisation is found to be very interesting from many research perspectives. Some of them were the direction of our paper (Brink et al., 2020, Ciurea, 2020, Korolovea et al., 2020, Johnson et al., 2020, Zawacki-Richter, 2020, Bond et al., 2021, Siddiquei et al., 2021, Rodriguez-Abitia, et al. 2021, etc.).

Furthermore, the importance of digitalisation in education is recognised not only nationally. The European Union is aware that employees lack some digital skills. According to the Digital Economy and Society Index, only 56% of European citizens „possess at least basic digital skills and only about one-third of Europeans possess

above basic digital skills (31%)" (DESI, 2021, p. 3). Although the survey indicated that 84% of people regularly used the Internet in 2019, the gap between having Internet access and using it with appropriate digital skills was noticed. With this issue in mind, the EU introduced the Digital Education Plan for 2021-2027. Several areas in this plan are recognised as a high priority. Among others, this document emphasises fostering the development of a high-performing digital education ecosystem and enhancing digital skills and competencies for digital transformation (European Commission, 2020, 2021a). According to the European Framework for the Digital Competence of Educators, six areas cover 22 elementary competencies (Redecker, 2017). Aware of the need for digitalisation, the EU Member States should support several actions to implement the Digital Education Plan and reach Europe's digital transformation by 2030. This will certainly affect the digitalisation level of higher education in every EU Member State and Croatia.

Considering the previous research results, we find it useful to explore the digitalisation level in higher education in Croatia with a specific perspective in the economic field. To fulfil the main purpose of the paper, we set two main research questions:

- RQ1 *What was the digitalisation level of the higher education system in Croatia before the Covid-19 pandemic and compared to other countries?*
- RQ2 *What is the digitalisation level of economic disciplines compared to other higher education disciplines in Croatia?*

The paper's results could contribute to scholarly literature in the economic area and general. While some research papers included only the perspective based on the survey about the digitalisation level, our results are based on the official registers. Other than that, as some studies stress that the university funding and size could be the limitation of their studies (Rodriguez-Abitia et al., 2021, Erlam et al., 2021), our study was primarily based on the data from official national registers where the difference between private and the public university is visible. Our paper does not include only the Covid-19 impact on the digitalisation level, as some papers were specified for (e.g. Johnson et al., 2020, Erlam et al., 2021). Rather, our viewpoint includes a wider approach with a special reference to the very beginning of higher education digitalisation in Croatia. For the study, we assess the digitalisation level of higher education based on the regulatory framework, applied digitalisation approach, the agility of transition to online teaching and the existing number of courses and online study programs. Also, the overview of education digitalisation in different countries is compared with the Croatian experience.

The paper's content includes the introduction section, where we briefly explain the methodology used. The results and discussion chapter is the main part of the paper. First, we explore the regulatory framework of higher education in Croatia, then discuss the advantages and disadvantages of the top-down vs bottom-up approach of higher education digitalisation. The next sections present our discussion and main results on the agility of higher education institutions in the transition from F2F to an online teaching environment caused by the Covid-19 pandemic, as well as on the e-courses, online study programs and e-learning platforms in Croatian higher education systems with the perspective on economic disciplines. Furthermore, future expectations regarding the digitalisation of the higher education system in general and economic disciplines are given. The paper ends with the final remarks on the research questions, the study's limitations and the main conclusions.

Methodology

The evaluation of higher education digitalisation maturity in Croatia with the perspective on economic disciplines is conducted through the analysis of the higher education digitalisation level. For this study, the digitalisation level is analysed through the preparedness of the regulatory framework, the applied digitalisation approach on a national level, the agility of transition from face-to-face to online teaching regarding the Covid-19 pandemic, as well as through the number of delivered e-courses, online study programs and the application of e-learning platforms. The shaped form of research is common in education research (Johnson et al., 2020, Zawacki-Richter, 2020, Bond et al., 2021, Siddiquei et al., 2021, Müller et al., 2020, and others).

Several goals are set based on the research questions posed in the introduction. First, we investigate the overall regulatory framework for higher education in Croatia by providing the analysis of laws, the related ordinances, national and university strategies and institutional support for digitalisation in higher education. Further related to that, the analysis of different examples of the top-down and bottom-up approach of higher education digitalisation is made so the comparison to the Croatian approach could be done. In addition, our goal is to research the preparedness and actions of higher education institutions for online teaching environments before the Covid-19 pandemic and indicate the related changes. Based on that, the agility of the transition from F2F to online teaching could be estimated. Also, national statistics about e-courses, online study programs and e-learning platforms with special care on economic disciplines are investigated. Finally, we indicate future expectations of digitalisation in higher education in Croatia.

Case study of online learning of higher education in Croatia

Regulatory framework for online learning in higher education in Croatia

Croatian higher education is based on the Bologna process. This process started in 2005 and has been continuously improved. That involves, among others, offering new technical models of learning. Using modern information technology in teaching and learning is a prerequisite for the higher education system's survival, especially nowadays.

The modernisation of higher education is recognised as a high priority and is one of the goals of the National recovery and resilience plan 2021-2026 (Government of the Republic of Croatia, 2021). The reform of higher education has included, among others, the digitalisation of higher education. Due to the lack and inadequate infrastructure for implementing digital tools in higher education institutions in Croatia, there is a need for investments in a digital change of higher institutions. According to the DESI 2021 for Croatia, digital investments of EUR 158 million, including substantial measures for the digital transformation of higher education (EUR 84 million), are intended to improve digitalisation in universities and research centres. This could lead to faster digitalisation of higher education in Croatia.

So far, the digitalisation of higher education in Croatia has been conducted in line with the Digital Education Action Plan 2021-2027 (European Commission, 2020) and the Council's conclusions on digital education in Europe's knowledge societies (European Council, 2020). A strategic approach to digital transformation includes investments in digital learning infrastructure and the digitalisation of administration processes. According to the Index of readiness for lifelong digital learning, Croatia took third place in the EU concerning policies and institutions for digital learning but 21st place when it comes to the availability of digital learning (Beblavý et al., 2019).

With its 13th place, Croatia is in the European average in terms of the digital learning readiness index in Europe and is recommended to invest in digital infrastructure and train educators.

Universities are the main part of higher education institutions in the Republic of Croatia. *“Higher education institutions in the Republic of Croatia include universities (and their constituents - faculties and art academies), polytechnics and colleges. A university is an institution organising and delivering university study programs and professional study programs, and Polytechnics and colleges deliver professional study programs. The main difference between polytechnics and colleges is the number of study programs they deliver (polytechnics deliver at least three study programs in three different scientific fields)”*. (ASHE,2022). According to the ASHE (2022), in the 2018/19 academic year, 117 higher education institutions in Croatia provided lectures for 162,928 students. Higher education in Croatia is still dominantly organised as public higher education institutions (90% of students study in public HEI), while 10% of all students study in private higher education institutions.

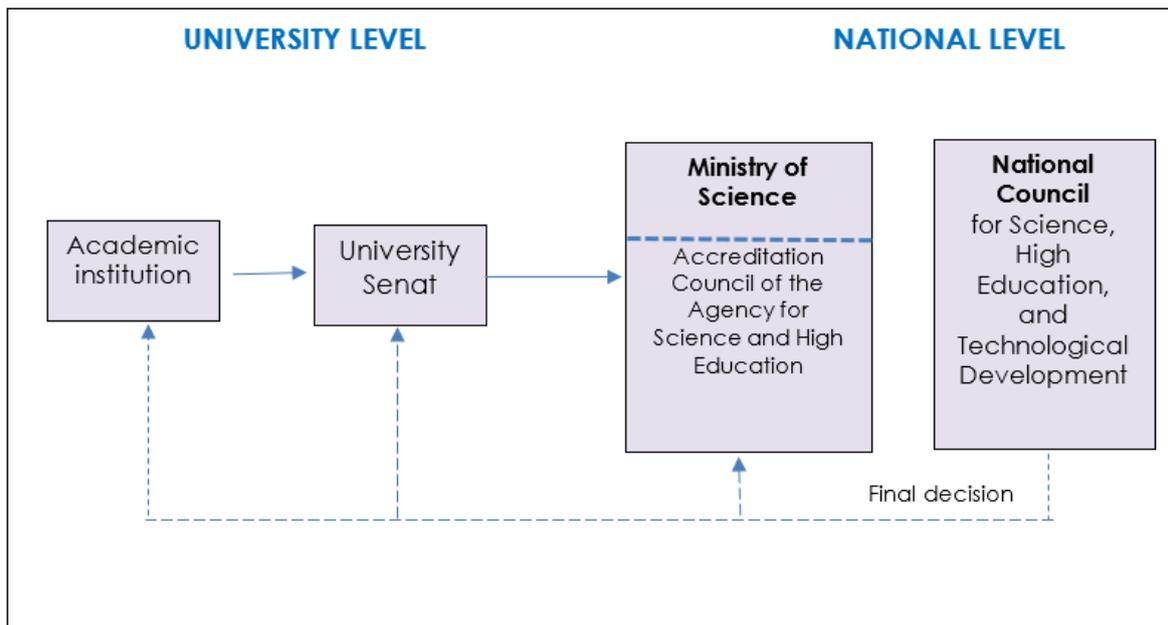
The improvement of higher education is recognised in the Croatian National development strategy 2030 as one of the priority areas for achieving the strategic goal of „educated and employed people“. According to the Strategy, digital transformation and computerisation of the educational system are significant for education in Croatia (Croatian National development strategy, 2021).

According to the Law on Scientific Activity and Higher Education, a study program can be organised as an online study program. The relevant national authority must formally regulate online teaching to be legally valid. In Croatia, it is a National Council for Science, Higher Education, and Technological Development. This Council establishes many important rules and ordinances to achieve a quality education system. One rule is the criteria and procedures for evaluating online studies (NCVO, 2016). These criteria are a part of general rules for the evaluation of study programs, so they don't cover all the determinants but only those specific to online teaching. The proposed criteria are related to the study programs where at least 50% of all courses are taught online, and an online course is a course in which at least 50% of the lecturing hours are delivered online.

Online teaching factors are infrastructure, students (learners), teacher/instructor, content, institutional, and motivational factors (Siddiquei et al., 2021). Related to that, planning for online learning *“includes identifying the content to cover and considering how different types of interactions will be supported and prioritised. Consequently, development of online courses may take up to 9 months.”* (Erlam et al., 2021). To get permission for online teaching, a higher education institution in Croatia must additionally specify the purpose of the online program in detail. It must also meet the criteria prescribed for the infrastructure and technical prerequisites, personal prerequisites, and support provided for teachers and students. In addition to the criteria prescribed in detail, the guidelines for assessing students' knowledge are also provided. Those criteria were adopted in 2016, indicating that online studies were present in Croatian higher education even before the coronavirus pandemic. These prescribed rules, particular the guidelines for assessing students' knowledge, were very helpful at the beginning of the pandemic when, almost overnight, we had to switch to online teaching. The accreditation of study programs is serious and responsible work and, therefore, should be realised according to the proposed procedures. Figure 1 shows the accreditation/approval process of online studies in Croatia.

Figure 1

The Accreditation/Approval Process of the Online Study Program



Source: Author's illustration

As seen in figure 1, the approval process consists of several steps. After a long and demanding review process, the National Council for Science and Higher Education makes the final decision at the national level. A positive response means that the study program is approved. Students who complete online studies have all legal rights, and those who have studied in classic offline programs. Therefore, all these procedures and criteria should be considered when considering any study programme's learning outcomes.

A partially carried out online study and the academic names acquired by its end are towards the Law on Scientific Activity, and Higher Education is considered equivalent to other higher education teaching forms (National Gazette, 2017). This is why the intended learning outcomes and acquired competencies in online studies should not differ from those delivered in a traditional manner, i.e. onsite learning.

The University of Zagreb, the largest and oldest university in Croatia, differs three levels of e-learning. The first level is mostly directed to disclosing information (web, e-learning system), and less is used for communication between professors and students (only e-mail or forums). The second level comprises the integration of e-learning and classical lectures with the application of e-learning systems, videoconferences, webinars or e-portfolio systems. The third level concerns the greatest usage of e-learning through e-learning systems, videoconferences, webinars or e-portfolio systems and other web tools (UNIZG, 2009). The University of Zagreb issued an E-learning strategy in 2007 (UNIZG, 2007). Similar, in 2011, the University of Rijeka issued an E-learning development strategy on the University of Rijeka (UNIRI, 2011). Some other universities in Croatia have also developed their strategies. Although there isn't a strong top-down approach to the digitalisation of higher education, still, the E-learning Centre is meant to be a central institution that could provide support and training to teachers, students and institutions in the use of e-learning technologies with the main task to provide the systematic implementation of e-learning in Croatian higher education (SRCE, 2022).

To sum up, a certain regulatory framework has been developed for the digitalisation of higher education on a national and university level. Even the EU research has confirmed that Croatia is well prepared based on a strategy preparedness for digitalisation. However, necessary infrastructure seeks significant investments, which are expected to be provided in the future.

Top-down vs bottom-up approach of digitalisation

Tømte et al. (2019) reported that higher institutions usually miss overall digitalisation strategies, especially online learning. Rather, this is a result of individual and individual departments' initiatives. This is why in most countries, many institutions offer e-courses rather than whole online study programs. The same research states that the level of digitalisation is higher in the case of the top-down approach, as is the case of Denmark, more than in the case of Norwegian higher education, which is more bottom-up digitalisation oriented. Bond et al. (2018) confirm that the top-down approach would also be more useful in other research on these two main approaches to the digitalisation of higher education. Vivitsou (2019) illustrates the digitalisation of education driven by the government in Finland through two waves starting in 2015 (Vivitsou, 2019). Higher education in Germany has been in the process of digitalisation since 2000. The Federal Ministry of Education and Research funded the implementation of new media in education. Other than that, there were some other funds available for e-learning. Besides funding, the government effort was seen in some strategic documents and policies. Digital Agenda 2014–2017 was introduced to establish the Higher Education Forum on Digitalization to develop concepts and studies on digitalisation at universities (Zawacki-Richter, 2020). Despite the effort of the government, a small number of universities in Germany are satisfied with the level of digitalisation of learning/teaching (just 1.7 %, Gilch et al. 2019). McKinsey Global Institute (Gandhi et al., 2016) found that the USA's digitalisation level is also low in their education system.

According to the Digital Economy and Society Index (DESI) survey, Croatia is placed 19th of 27 places of all EU Member States in 2021. In education, a certain centralised effort in digitalisation has been given at a primary and secondary education levels. The top-down approach to the digitalisation of schools in Croatia has been present since 2015 through the project *e-Schools: Development of the System of Digitally Mature Schools led by CARNET and financed by EU funds and the Croatian state budget* (CARNET, 2019). The project includes 903 primary schools, 364 secondary schools and 50 art schools, and centres for upbringing and education, which strongly impacts the digitalisation of this level of education. As a result of this project, the digitalisation of schools has improved Croatian primary and secondary education levels. On the contrary, although the importance of digitalisation is recognised in national education strategies and laws, the digitalisation of higher education is driven by separate initiatives by academics, faculties or even universities. As the European Commission (2021b, p. 3) investigated, „education, science and research are still reflected in the national Recovery and Resilience Plan (RRP), which is expected to boost the digital transformation of higher education“ in Croatia.

The agility of higher education institutions in the transition from Face-to-Face (F2F) to an online teaching environment caused by the Covid-19 pandemic

The Covid-19 pandemic has changed the way of living, doing business and consequently the way of teaching and learning. The pandemic has fastened

digitalisation in education more than any national or supranational strategy or university initiative. Namely, according to data from the United Nations Educational, Scientific and Cultural Organization (UNESCO), facing the global pandemic Covid-19 and lockdowns, more than 1.2 billion students worldwide had stopped having face-to-face classes by mid-May 2020 (ECLAC-UNESCO, 2020).

Today, every professor or student is aware of the many advantages of digitalisation. Many students worldwide have experienced different forms of teaching, from traditional face-to-face to online. Between these two ways of teaching, many other mixed forms include a certain level of IT support to compensate for the distance between professors and students. However, distance learning isn't a brand-new way of teaching. The University of London has considered the birthplace of distance learning, introduced in 1858 (University of London, 2021). Apart from that institution, the University of the Cape of Good Hope in South Africa, founded in 1873, followed the same way of teaching as the University of London and set academic standards and examinations for associated 'university colleges' (UNISA, 2021). Online or distance learning as a high level of education has also evolved from the remote forms of learning in Australia and New Zealand around 1922 (Erlam et al., 2021).

As the EUA's survey from 2014 points out, 91 % of institutions that participated in this survey provided some e-learning: distance learning, mixed approach to learning, problem-solving learning, lectures, experiential learning or simulations. According to the same research, 82% of respondents also offered online courses (ENQA, 2018). The results are not surprising as it is justified to expect that some kind of IT-supported lecture delivery is common in the 21st century. Some kind of blended teaching is given, even if only for disclosing learning materials through some platforms.

The public consultation with 2700 contributions the European Commission received between 18 June to 4 September 2020 highlighted "that almost 60 % of respondents had not used distance and online learning before the crisis" (European Commission, 2020). Hence, the research carried out by Harvard Business Publishing Education in 2020 stresses that around 63% of educators and 67 % of students involved in their study from 800 business students and educators all over the world had some pre-Covid-19 online teaching/learning experience (Harvard Business Publishing, 2020). Before the Coronavirus pandemic, as OECD's Teaching and Learning International Survey (2018) says, only 39 % of teachers in the EU felt comfortable and very well prepared for digital technology implementation in teaching (European Commission, 2020). Johnson et al. (2020) surveyed 672 US institutions. Their results confirm that American lecturers faced the same problems regarding shifting from F2F lecturing to online delivering knowledge as their colleagues from all over the world. Namely, in almost all institutions, some professors had no online teaching experience before the pandemic. Around 49 % of the faculty had some previous online experience in teaching. When shifting to online learning, US academics used synchronous video (80 %), pre-recorded lectures (65 %) and pre-recorded video from external sources (51 %). Despite the differences in the percentages, all the research mentioned above states that a significant amount of institutions and professors weren't prepared enough and had insufficient knowledge to switch from onsite F2F teaching to offsite distance learning. With this in mind, universities worldwide should prepare for administrative and technological changes within 24 hours. The global survey performed by the International Association of Universities has shown that at the beginning of the pandemic, the majority of higher education institutions on a global level prepared their selves for transition to distance learning with higher or lower efficiency (85 % in Europe, 72 % in Americas and 60 % in Asia & Pacific). Only a few suspended teaching while an institution develops an appropriate solution. Only 3 % of institutions cancelled teaching (Marinoni et al., 2020).

During the first stage of the pandemic, the so-called first total lockdown stage, in Croatia, as in other countries, a fast transition from onsite learning in the classroom to some online learning happened. During the pandemic, several recommendations for the organisation of teaching in higher education institutions have been given by the Croatian Institute of Public Health (HZJZ, 2022). These recommendations have marked the way of teaching in these institutions. Since this transition had happened overnight without any strategic planning and enough time to prepare professors, students and IT support for such a big change, many professors started by uploading some lecture materials on currently available platforms or recording audio presentations, some additional tools (quizzes, chats, forums, videos, simulations, etc.) helped bypass F2F to online teaching. Considering all the shortages of such overnight transition without any strategy, this emergency remote teaching first followed the same principles of face-to-face teaching in class. Some professors delivered their lectures and seminars as synchronous or asynchronous teaching. Emergency remote teaching involves „ *fully remote teaching solutions for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses and that will return to that format once the crisis or emergency has abated.*“ (Hodges et al., 2020). Emergency remote teaching is considered a distance education branch (Bond et al., 2021). In the second stage of the pandemic, fully online learning was an optimal solution for many institutions. At this stage, the first shock had passed; students and professors became familiar with available media for online teaching/learning and lectures were significantly adjusted for online teaching. Lectures, workshops, seminars and other student obligations were provided online (synchronous or asynchronous). With the phase of getting back to the so-called „new normal life“ and finishing total lockdowns, academic institutions opened their doors to students and invited them again into classrooms. However, to be in line with the valid epidemiological measures, faculties with large numbers of students have applied a hybrid approach. Necessary IT equipment had been purchased to deliver lectures onsite and online simultaneously. Professors and students faced new challenges with delivering lectures to students in traditional classrooms as well as to the students on distance learning.

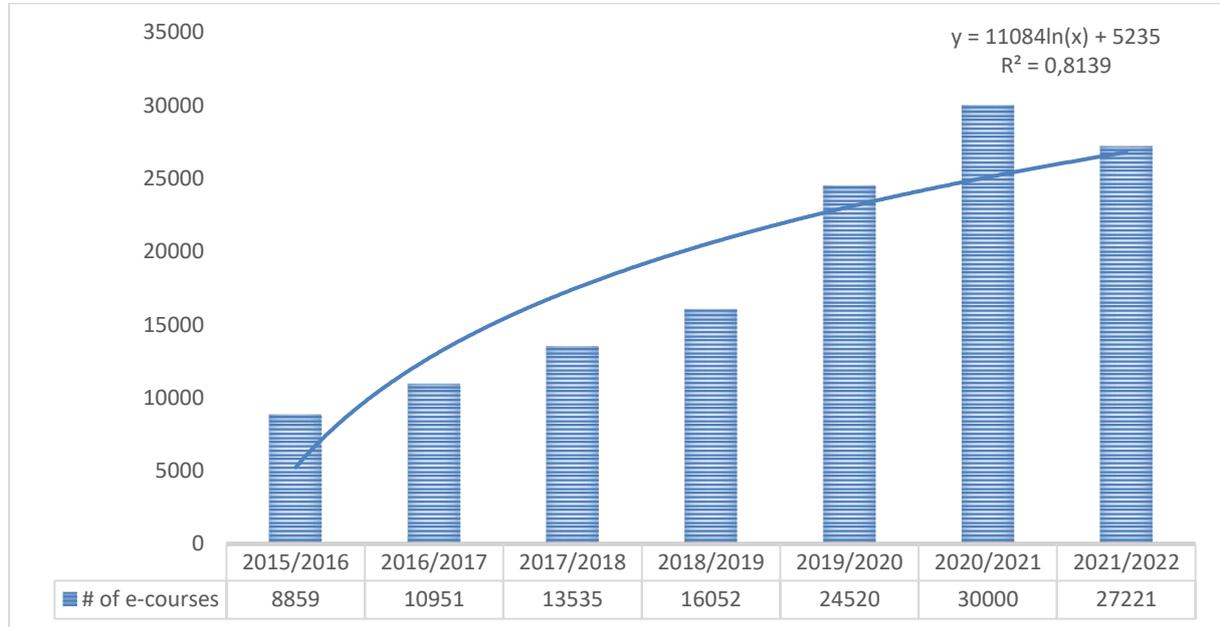
To wrap up, although there wasn't enough time to plan a switch from F2F to online teaching, Croatian higher education institutions have shown very high agility to proceed with teaching in an online environment, and none of these institutions wasn't stopped working during the pandemic.

E-courses, online study programs and e-learning platforms in Croatian higher education systems with the perspective on economic disciplines

In 2015 the Ministry of science, education and sport and the University Computing Centre (SRCE) established the Catalogue of e-courses in the higher education system in the Republic of Croatia. For this research, e-courses are defined as “*courses that use the possibility of new technologies to improve the quality performance of the curriculum and/or the teaching and learning process. We can distinguish multiple shapes or levels of e-courses, from those simple ones with only teaching materials and information on courses available on the Internet to complex ones designed precisely for the online, interactive, and collaborative environments and combine several educational components in a single study course or programme*”. (SRCE, 2019, p. 4). The number of e-courses has constantly increased over the last several years (Table 1). In the academic year 2015/16, there was only 8.859 e-courses, and the most significant changes occurred during the Covid-19 pandemic when the number grew

to 30.000. The pandemic has accelerated the implementation of IT in the learning process all around the world. Countries and universities with previous experience in online teaching could adapt much easier to the new situation.

Figure 2
Number of E-courses at the Croatian Universities



Source: Adapted by authors according to SRCE and Ministry of Science and Education (2022)

Data from Table 1 were collected according to the Ordinance of the organisation and using the Catalogue of the e-courses in higher education of the Republic of Croatia (SRCE, 2019). However, due to the pandemic, many courses have been performed online in the last two academic years. Therefore, it is reasonable to expect that the number of courses performed in an online environment is even much higher. The University of Zagreb, the oldest and the largest Croatian university, is a leading university with more than 9.000 e-courses. It is more than 1/3 of all e-courses offered at Croatian universities. The largest share belongs to the university's studies (undergraduate, graduate, or integrated studies). This is in line with the number of students, as well as the number of courses. Namely, students must study at the university level (where most courses are taught). On the other side, it can also be noticed that other universities also offer e-courses to their students; for many students, that means easier access to the education system, which can lead to better professional development and competitiveness in the labour market. The same is with economic disciplines. The number of e-courses in economic discipline is presented for the largest public faculties where the economy is taught. It is worth noting that the number of e-courses from the economy field represents less than 3 % of the total number of e-courses. The number is pretty low, but it must be mentioned that these e-courses are based on the e-platforms registered in the system. Other than the e-courses provided by the faculties of economy, economic disciplines are taught at some other faculties as well, meaning that the number of e-courses from economic discipline in real is even higher, especially during the last two pandemic years.

Table 1

Number of e-courses in the higher education system in Croatia in the academic year 2021/2022

University	University studies		Other studies		Total number of e-courses
	Undergraduate, graduate, and integrated	Postgraduate	Professional studies	Study not specified	
University of Zagreb	6,053	623	1,301	1,141	9,118
Faculty of Economics and Business Zagreb	0	0	11	34	45
University of Rijeka	2,578	39	715	965	4,297
Faculty of economics and business Rijeka	162	0	0	0	162
University of Split	1,300	0	128	938	2,366
Faculty of Economics, Business and Tourism Split	0	0	0	0	0
University of Osijek	1,402	203	266	184	2,055
Faculty of economics Osijek	102	0	0	0	102
University of Zadar	3,334	0	365	29	3,728
Department of Economics	46	0	0	0	46
University of Dubrovnik	1,033	79	295	0	1,407
Department for Economics and Business Dubrovnik	175	79	125	0	379
Juraj Dobrila University of Pula	0	0	0	1	1
University North	216	1	308	0	525
Department of Business and Management in the Media	0	0	24	0	24
Department of Business Economics	22	0	0	0	22
Other universities	635	0	1,416	1,674	3,725
Total	16,551	945	4,794	4,931	27,221

Source: adapted by the authors according to SRCE and Ministry of Science and Education (2022)

To provide some level of online learning, a certain e-learning platform is needed. The two most common used e-learning systems (table 2) are SRCE's Merlin and CARNet's Loomen, and both are based on the Learning Management System Moodle (CARNET, 2022, SRCE, 2020). Besides that, some other universities use their e-learning platforms.

Table 2

Ten most common used e-learning platforms in higher education institutions in Croatia

E-learning system	2018./2019.	2019./2020.	2020./2021.	2021./2022.	Total
University system for e-learning-Merlin, SRCE	13,021	23,316	27,280	26,590	116,401
CARNet LMS - Loomen	652	815	1	0	2,908
System for e-learning, University of Rijeka	0	0	0	0	2,683
Distance learning system and online teaching support, Juraj Dobrila University of Pula	0	0	2,393	0	2,393
ELF – Faculty of organisation and informatics, University of Zagreb	307	296	326	381	2,319
Faculty of humanities and social sciences: MOODLE	542	0	0	0	1,734
Portal of the Faculty of Electrical Engineering and Computing, University of Zagreb	0	0	0	0	1,315
E-learning portal of the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb	754	0	0	0	1,009
Sharepoint LMS – Faculty of Architecture, University of Zagreb	136	0	0	0	656
Portal Military study, University of Zagreb	178	0	0	0	624

Source: adapted by the authors according to SRCE and Ministry of Science and Education (2022)

As Table 3 shows, there are only 16 full online study programs in Croatia. Of 16 study programs that are taught online, 14 are also taught in person. Only four programs are delivered only online. Usually, online study programs in Croatia are designed as professional programs (12 undergraduate or graduate programs), and only four are university programs. Both public and private higher institutions that offer online programs are almost equally represented (9:7). Zagreb and its surrounding area offer 9 programs, and the rest are delivered by other university centres such as Split and Rijeka.

Regarding the field of study, nine of 16 studies cover economic disciplines. The higher education institutions that deliver these economic programs are mostly private (7), whereas only two public institutions offer online programs in the economic field. This is not surprising since 14 of 25 private institutes deliver study programs from the economic field (Ministry of Science and Education, 2022a). The language in which a programme is taught is mostly Croatian, and two studies offer programs in Croatian and English.

The Agency for science and higher education surveyed online studies in Croatia regarding online study programs. Based on the survey, it is concluded that students of different ages (from 18 to above 35) enrolled in online study programs, and the average yearly number of students per study is 30. Underrepresented and vulnerable groups, such as older students, students with disabilities, part-time students, travelling students, and students from rural areas, smaller towns and islands, are more likely to enrol in online study programs (ASHE, 2020).

To synthesise, there was a significant number of e-courses provided in Croatia even before the pandemic. Hence, before the pandemic, only 16 study programs were offered fully online, and half were from the economy field. Private institutions are more agile in preparing and offering such studies to be recognised on the market. To be

prepared for such a digital environment, national institutions such as CARNET and SRCE developed e-learning platforms that are accompanied by e-learning platforms of the faculties and universities in Croatia. Such platforms certainly have helped bridge the transition to online learning in the pandemic environment.

Table 3

Online study programs in Croatian higher education system in 2021

Property	Type	Location	Scientific areas	Scientific field	Modes of delivery	Languages
Public	Undergraduate university programme	Rijeka	Social sciences	Economy	1) In person 2) Online	Croatian
Private	Undergraduate professional programme	Zaprešić	Social sciences	Economy	Online	Croatian
Private	Undergraduate professional programme	Zagreb	Social sciences	Economy	Online	Croatian
Public	Specialist graduate professional programme	Split	Social sciences	Kinesiology	1) In person 2) Online	Croatian
Public	Undergraduate university programme	Zagreb	Humanities	Philology	1) In person 2) Online	Croatian
Private	Specialist graduate professional programme	Zagreb	Social sciences	Economy	Online	Croatian
Private	Undergraduate professional programme	Zagreb	Social sciences	Economy	1) In person 2) Online	1) English 2) Croatian
Private	Specialist graduate professional programme	Zagreb	Social sciences	Economy	1) In person 2) Online	1) English 2) Croatian
Public	Graduate university programme	Zagreb	Humanities		Online	Croatian
Private	Specialist graduate professional programme	Zaprešić	Social sciences	Economy	1) In person 2) Online	Croatian
Private	Specialist graduate professional programme	Zagreb	Interdisciplinary fields of science	Project manag.	1) In person 2) Online	Croatian
Public	Undergraduate professional programme	Split	Social sciences	Kinesiology	1) In person 2) Online	Croatian
Public	Undergraduate professional programme	Split	Social sciences	Kinesiology	1) In person 2) Online	Croatian
Public	Undergraduate professional programme	Split	Social sciences	Kinesiology	1) In person 2) Online	Croatian
Public	Undergraduate professional programme	Split	Social sciences	Kinesiology	1) In person 2) Online	Croatian
Public	Graduate university programme	Rijeka	Social sciences	Economy	1) In person 2) Online	Croatian

Source: adapted by the authors according to Ministry of Science and Education (2022b)

Discussion

Future expectations regarding the digitalisation of the higher education system

The pandemic additionally highlighted and accelerated the implementation of IT in the educational system all over the world. In these circumstances, “over the night” online teaching from an option has become a real necessity. But this learning and teaching model has also brought new challenges for students and professors. Education in an online environment requires new skills, knowledge, the organisation of lectures, student knowledge assessment, etc. Furthermore, institutions, faculties, high schools and universities had to invest in the new digital platform, IT equipment, technical support, seminars, and webinars for students and professors to be better prepared for new learning and teaching.

The period ahead will be marked by further digitisation of business activities. The digitalisation of „all and everywhere“ requires adjustments in the way of thinking and doing things. Online teaching will become a regular part of the education system. Benefits from online teaching can especially be seen in long-life learning and teaching for part-time students. But despite all the benefits, some challenges regarding online teaching are still present. This particularly refers to the assessment of students' knowledge. To avoid any undesirable elements in the process of knowledge assessments, it would be useful to apply the motto “teaching online, but knowledge assessment offline (or under strong, controlled conditions)”.

We can be sure that teaching and learning during the pandemic will affect future educational processes. Survey results show that some benefits from online teaching/learning are expected to be followed in the post-pandemic period in combination with face-to-face delivery. For instance, a survey conducted in 2020 in New Zealand concluded that 83 % of respondents voted in favour of flipped classrooms with both online and face-to-face delivery (Erlam, 2021). Yamada and Nakamura (2021) also believe there is no going back after universities fully experience online teaching/learning.

Final remarks on research questions and the limitations of the study

Based on the previously presented arguments about the digitalisation level of higher education in Croatia, with special attention on economic disciplines, final remarks on the research questions are given.

RQ1 was formed as: „What was the digitalisation level of the higher education system in Croatia before the Covid-19 pandemic compared to other countries?“

The digitalisation level is considered through four parts: regulatory framework, the approach of digitalisation, agility of transition to online teaching and the existing number of courses and online study programs. Our study results indicate that although there is a recognised necessity for digitalisation in national and university strategies and law, there was still no unique digitalisation project in the higher education system. Besides, the lack of investments in this field didn't help digitalisation. The bottom-up approach of digitalisation of the higher education system was applied, which is less effective in the digitalisation process than other countries. Hence, numerous e-courses but only 16 online study programs were offered before the pandemic. Croatian institutions showed very high mobility regarding the agility of institutions to replace the traditional way of teaching with online teaching. However, they shared the same organisational problems as other universities worldwide.

RQ2 was: „What is the digitalisation level of economic and business disciplines compared to other higher education disciplines in Croatia?“

According to the official registers by the Ministry of Science and Education, our research results show that the number of e-courses in the economic field is underrepresented compared to other disciplines. Still, most online study programs are about business and the economy.

This study faces some limitations. Firstly, the research was carried out based on the available statistical data from the Ministry of Science and Education and SRCE. The main limitation is related to the number of e-courses since the Register depends on the promptitude of the institutions in submitting e-courses to the Register. According to the Ordinance, courses shall be open for one academic year. For each new academic year, it is necessary to open a new course, and the course is archived at the end of the academic year. Another limitation is the economic disciplines submitted in the Register as e-courses. We explored only the number of e-courses delivered by the faculties of economy and business. A certain number of e-courses in the economic field are given by other faculties as well. Finally, our research was also limited by the pandemic because all or the vast majority of courses were delivered online during the pandemic.

Conclusion

The teaching and learning process has been evolving from its start. The corona pandemic has pushed many higher education institutions towards fully online learning. Many pedagogues stress that teachers shouldn't teach in the same way they had been taught since time has changed. Teachers should adapt their skills to the age they are living as their students represent new generations. We live in the Information Age, so no education should be performed without proper information technology. Certain digitalisation levels should be applied as well. Today, education is also adjusted towards its environment in an online world.

The main goal of this research was to explore the digitalisation level of higher education in Croatia with special attention on economic disciplines. The survey was performed to evaluate the digitalisation level of higher education based on the regulatory framework, applied digitalisation approach, the agility of transition to online teaching and the existing number of courses and online study programs. Also, the overview of education digitalisation in different countries is compared with the Croatian experience. The research has shown that the overall regulatory framework for higher education in Croatia in the form of laws and related ordinances, national and university strategies, and institutional support exists. Hence, as some previous research results in some countries show, in Croatia, too, the bottom-up approach of digitalisation is used since there hasn't been any global joint project of digitalisation of all higher education institutions as it has been for primary and secondary schools.

Further, significant investments are expected to increase the digitalisation level. Croatian universities, polytechnics and other higher institutions have shown high agility in switching from F2F to online teaching since the Covid-19 pandemic started. Our study has shown that many e-courses had been offered to students before the pandemic. Still, as in many other countries, complete online study programs were exceptions rather than the rule. Those online programs that were offered were mostly from the economic field. Private institutions are more involved, so a more proactive role is expected of public faculties in the economy and business. As infrastructure is a concern, e-learning platforms existed before the pandemic. It is worth mentioning that Croatia has two institutions with a supportive role in the digitalisation of education; CARNet and SRCE. However, necessary infrastructure seeks significant investments, which are expected to be provided in the future. Online learning increases

accessibility and affordability for many students, especially working professionals. The awareness of these and other benefits of online teaching will certainly change the way higher education professors teach. The Covid-19 pandemic has just started the fastening process of digitalisation. Now is the time to apply national and university strategies that involve e-courses and e-learning models, and government should ensure enough funds for that. So, our survey results could contribute managerial perspective in high education institutions regarding implementing new study programmes and introducing new e-courses.

Finally, we shouldn't forget that some distance learning existed in the past. The roots of distance or online learning, used nowadays, are from postal schooling and learning via radio or TV. So, today, these kinds of learning have been switched to online learning. It is expected to be adaptive in the future in other possible ways of transferring information and sharing and exchanging knowledge.

Considering our research limitations regarding the availability of official public data, we propose that some future research strives towards the data provided by the faculties and other higher institutions that deliver studies in the field of economic discipline. Also, the digitalisation level could be investigated more deeply, providing some empirical surveys on the topic, which will include the opinion of teachers and students.

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About the authors

Sanja Sever Mališ, PhD, is a university professor at the Faculty of Economics and Business Zagreb, Department of accounting. Since 2018, she is holding the position of Vice-dean for strategic partnerships and projects, and since 2020 she has been Vice-dean for business operations and strategic partnerships at FEB – Zagreb. In 2022 she was elected Dean of the Faculty of Economics and Business – Zagreb. Actively participates in teaching courses in the integrated undergraduate and graduate university study and professional study as well as in the postgraduate university studies at the Faculty of Economics & Business – Zagreb. She is a co-author of several university textbooks and scientific books and has been appointed as the reviewer for several scientific journals. She has published about 100 scientific and professional papers and participated in international and national scientific and professional conferences. The author can be contacted at ssever@efzg.hr.

Ivana Mamić Sačer, PhD, is a university professor at the Faculty of Economics and Business Zagreb, Department of accounting. She is the course coordinator for Government Audit, International Accounting, Basics of Accounting, and Analysis of financial statement and also lectures on the course Accounting. Ivana Mamić Sačer was project manager on several university projects and served as President of the Internal Auditing Chapter at the Croatian Association of Accountants and Financial Experts from 2014-2018. She has published over 100 articles in the accounting field and is a member of the Expert Council for the State Audit Office in Croatia. Ivana has moderated and/or spoken at several international congresses, sessions and conferences. The author can be contacted at imamic@efzg.hr.

Katarina Žager, PhD, is a university professor at the Department of accounting at the Faculty of Economics and Business Zagreb. She teaches courses (Accounting I, Accounting Information Systems, Accounting for SMEs) at the integrated undergraduate and graduate university study programmes and several postgraduate specialist studies and doctoral study courses. She authored or co-authored over 200 papers in the areas of accounting. She held a variety of positions at the Faculty of Economics & Business in Zagreb: Vice Dean for Education and Students (2004-2006), Head of the Department of Accounting (2008-2010), Head of the Master Study programme in Accounting and Auditing (2008-2010). Since 2007 she has also been the Head of the Postgraduate Study in Accounting and Taxes. Since 2017 she has been the President of the National Scientific Promotion Committee for the field of Economics. The author can be contacted at kzager@efzg.hr.