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Toward Regional Development: Digital Transformation of Higher Education Institutions

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Abstract

This paper presents the findings of a study on digital maturity in higher education institutions in Bosnia and Herzegovina (BiH). Empirical research was conducted in 2020. Teachers from eight public higher education institutions in Bosnia and Herzegovina were included in the sample. The findings revealed that digital transformation has been ongoing in these institutions for some time, that some results have been achieved, but that digital maturity has not yet been attained. The findings also revealed barriers that must be overcome in order to accelerate digitalization and reap the anticipated benefits.

Keywords: digital transformation, higher education, regional development

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Introduction

According to the population census in 2013, Bosnia and Herzegovina (BiH) have around 3.5 million people and is an upper middle-income country that aspires to join the European Union. However, a number of requirements need to be met.

Over two decades after signing the Dayton Peace Agreement, with its complex and fragmented governance and power-sharing arrangements, progress toward

accession is constrained by limited reform progress (United Nations Bosnia and Herzegovina, 2021).

To remedy the situation, the authorities in Bosnia and Herzegovina (BiH) and the United Nations (UN) are committed to working together to achieve priorities in BiH.

According to the document "A Partnership for Sustainable Development: Bosnia and Herzegovina and the United Nations Sustainable Development Cooperation Framework 2021-2025", among other issues, one of the requirements is improved access to and quality of education because these items are seen as critical to future, sustainable development. Under priority "Quality, accessible and inclusive education, health and social protection" the UN system will support technology transfer and digital transformation. The focus will be on anticipating future skills needs and applications across the priorities and outcomes to drive innovation opportunities for sustainable growth and inclusive society (United Nations Bosnia and Herzegovina, 2021).

Knowing the situation in Bosnia and Herzegovina and guided by the need for an improved education system in order to contribute to future development, the authors asked the following research questions:
Research questions 1 (RQ1): When did higher education institutions in Bosnia and Herzegovina start the digital transformation and did they reach the appropriate level of digital maturity?
Research questions 2 (RQ2): If so, what are the main obstacles to intensive digital transformation in the higher education sector of Bosnia and Herzegovina.

After this introduction, a brief overview of the digital transformation in higher education and the importance of higher education for regional development is given. The research methodology is described with reference to the instrument used, the sample, and the data processing methods. After the methodology, the obtained results were presented and discussed. The paper ends with a conclusion that, in addition to the main findings and limitations of the research, provides further guidelines for research in this area.

Digital transformation and higher education

The universal acceptance of smart devices such as smartphones, tablets and various mobile technologies significantly accelerates the digitalization process. Today it means not only the regular use of digital technology but significantly affects all aspects of business by accelerating the process of change and ensuring a higher level of interconnection (Gimpel, Röglinger, 2015). According to the same authors, digitalization was primarily related to the IT sector several years ago and based on data processing and management within that sector. Still, today it affects all departments and moves from administrative and support tasks and processes to core business processes.

The use of technology to transform an organization's core business to better meet the needs of clients/customers is part of the digital transformation process (Clark, 2018). Clark (2018) examines the digital transformation in higher education through students' eyes (primary users of higher education services). He analyzes the changes that digital technologies, through digital transformation, can provide for them. According to this author, perceiving the digital transformation in the context of reshaping the student experience would include a series of changes such as: digitally attracting future students, registering on student information systems via different digital devices, providing different online learning options, using technology to monitor student progress and performance and executing intervention protocols, and establishing partnerships with the industry.

According to Matkovic et al. (2018), redefining educational services and products as well as the renewal of operational processes are the main goals of digital transformation in higher education. Sandkuhl and Lehmann (2017) think similarly, pointing out that digital transformation in higher education aims to redefine educational services and the accompanying redesign of all business processes.

Various issues confronting higher education institutions as campus security issues, information security, student success, IT strategy, student services, accessibility, digital integration, and artificial intelligence stand out as drivers of digital transformation in the education sector (Alcatel-Lucent Enterprise, 2019). The authors also state that digitally transforming higher education institutions would include not only updated hardware and software (despite their importance in the digital transformation process), but also the following factors: building a strong IT foundation, encouraging successful students, creating a secure campus, ensuring superior cyber security, and operational efficiency.

According to these authors, the digital transformation is a physical and philosophical shift intended to meet the growing demands of students, colleges, and campuses to create a learning environment in which everything is connected. Moreover, as Garbin Praničević et al. (2019) argued, digital transformation has enabled a significant shift from a 'teacher-centred' approach to more interactive 'student-centred' teaching, thus inducing major changes in learning models and pedagogy. Additionally, digital transformation creates an ecosystem or intelligent campus by combining technology, services, and security to bridge the digital divide and provide a collaborative, interactive, and personalized learning experience.

Library digitalization, conversation agents, online questions/answers, digital notes, facilitated studying, digital payment, online curriculum / online learning, informative applications, digitally controlled systems, and decision making based on data analysis are some of the interesting and great benefits that digital technology brings to educational institutions (Spear, 2019).

According to EHL Insights (n/a), online learning is just one of the ways that digital technologies and improvements have influenced students and classroom patterns. As a result, the author cites the following trends that have occurred and continue to occur in the educational process as a result of digital technology: improved accessibility and access, adapted access to learning, virtual reality, cloud-based learning, the inclusion of related things (IoT) in an educational environment, security, teaching digital citizenship, and big data.

EHL Insights (n/a) points out that online learning is just one of the ways in which digital technologies and their advancements have influenced students and trends in classrooms. Consequently, the author cites the following trends that, under the influence of digital technology, have occurred and are still occurring in the educational process: improved accessibility and access, adapted access to learning, virtual reality, cloud-based learning, the inclusion of related things (IoT) in the educational environment, security, teaching digital citizenship, big data.

Higher education and regional development

From the OECD perspective (OECD, 2018), regional development is perceived as "a general effort to reduce regional disparities by supporting (employment and wealth-generating) economic activities in regions." Over time, it has been noticed the shift from an economic perspective to wider noneconomic benefits of HEIs to regional development (Boucher et al., 2003). In a few countries, like Greece, Belgium and Norway, almost a few decades ago, universities have been a key element of regional development policy (Thanki, 1999). In time things have changed significantly. On the one side, the categories like knowledge transfer, community services, and community engagement slowly start to supplement university research and teaching. On the other hand, the number of countries where universities contribute to policies explicitly related to regional development has increased.

In Marmolejo and Puukka (2006) study based on an OECD review of 14 Regions throughout 12 Countries is pointed out that any country striving to be competitive should make a serious commitment to fortifying its regional innovation system through "cooperation between higher education institutions, public authorities and the business sector". Still, regarding the activities involving higher education in regional development, the named study present also considerations focused on the lack of proper incentives, indicators and monitoring such type activities outcomes. Consequently, the author(s) set the imperative for cultural change within HEIs based on perceiving regional engagement, academic excellence, and research as complementary activities.

In Gennaioli et al. (2013), it is revealed and present how educational opportunities and educational attainment enable the creation of new opportunities for entrepreneurs to improve their position in the market. Furthermore, Galvão et al. (2018) highlight entrepreneurship education's potential as a valuable strategic tool in

achieving regional development. Following that, the cooperation between academia, government, and business is suggested to strengthen society's entrepreneurial intention. One of the main reasons for the growing role of education for regional development seems just the appearance of cooperative approaches in regional governance, which additionally push universities to participate and engage in regional development and take a more responsible role than before (Fonseca and Nieth, 2021).

In line with Peer and Penker (2016), the relation between higher education institutions and regional development additionally receive the note of political expectations in terms of (i) regional economic potentials promotion, (ii) diversifications and (iii) the strengthening of the regional competitiveness. Analogy, building HEIs infrastructure in regions where they should "trigger "/induce regional development has been argued as regional political tools with perspective to be more responsible for further regional development. In summary, although the higher education institution was initially considered a location factor only, it has evolved into a key player in regional innovation and management.

Last but not least, in recent times, primarily in favor of ethics, the rising number of higher education institutions (HEIs) has been supervised regarding their contributions in boosting knowledge and regional development (Harrison and Turok, 2017).

Methodology

During May and June 2020, empirical research was conducted among employees of eight public universities in Bosnia and Herzegovina.

An online survey was conducted. The Google Forms option was used to create the survey questionnaire. The invitation to participate in the survey, along with a link to the survey questionnaire, was sent via e-mail. The official e-mail addresses of the teachers were obtained from the faculties' official websites at BiH's public universities. The population of teachers in BiH consisted of 4328 teachers, according to data available on the official website of the faculties (established units) of public universities in the country. A total of 3709 e-mails were collected (85.7% of the teacher population). They were invited to participate in the survey, and 665 of them responded, accounting for 17.93% of all e-mails sent. Following receipt of the e-mail, 11 teachers responded, stating that they were no longer employed at the faculties of BiH's public universities - they were external associates (no longer) or had retired. The rate of return was 18%.

A digital maturity measurement model developed by Đurek et al. (2017; 2018) was used to assess digital maturity. This model is comprised of seven major domains and 45 items. Questions about the start of digitalization and the percentage of business activities/processes that had been digitalized at the time of the survey, the first

digitalized business activity/process, and possible obstacles to digital transformation were added to the questionnaire.

The Cronbach Alpha coefficient was used as a measure of the internal consistency of a set of statements to investigate the reliability, i.e., the internal consistency of the dimensions. This coefficient has a value between 0 and 1; the closer it is to 1, the more reliable the measurement scale is. Cronbach's Alpha coefficients of 0.7 and higher are considered acceptable (Nunnally et al., 1994).

The Cronbach Alpha coefficient values for the digital maturity dimensions are shown in Table 1.

Table 1

Cronbach Alpha coefficient for digital maturity dimensions

No	Dimension	Number of items	Cronbach Alpha
1	**Leadership, planning and management**	7	0.935
2	**Learning and teaching**	5	0.902
3	**Scientific-research work**	6	0.907
4	**Technology transfer and service to the society**	5	0.920
5	**ICT culture**	8	0.913
6	**ICT infrastructure**	7	0.936
7	**Quality assurance**	7	0.922

Source: Author's calculation

Comparing the results from the previous table and the reference values of the Cronbach's alpha coefficient (available in the literature), it can be concluded that the investigated dimensions of digital maturity used in this study have excellent internal consistency.

IBM SPSS Statistics 25 (IBM SPSS Statistics for Windows, version 25.0. Armonk, NY: IBM Corp. Released 2017) and Microsoft Excel (Office version 2016, Microsoft Corporation, Redmont, WA, USA) were used for statistical data analysis. The Kolmogorov – Smirnov test was used to test the normality of numeric variables. Descriptive statistics procedures were used to describe the collected data: frequencies (absolute and relative, %) for categorical data, mean (M) as measures of central tendency and standard deviation (SD) and coefficient of variation (CV) as measures of variability for numeric data.

Results

According to the findings, the digital transformation of public higher education institutions in Bosnia and Herzegovina takes more than 5 years - 63.3 percent of respondents said it started before 2016, while others said it began after 2016.

The mean values of digital maturity dimensions ranged between 3 and 4, precisely between 3.35 and 3.88. The dimension with the highest mean is "ICT culture," while the dimension with the lowest mean is "Technology transfer and service to society." The coefficients of variation show that all dimensions' means are well represented. Descriptive statistics for individual dimensions of digital maturity are shown in Table 2.

Table 2
Descriptive statistics for digital maturity dimensions

No	Dimension	M	SD	CV
1	**Leadership, planning and management**	3,50	1,02	29,1%
2	**Learning and teaching**	3,64	1,00	27,5%
3	**Scientific-research work**	3,38	1,02	30,2%
4	**Technology transfer and service to the society**	3,35	1,09	32,5%
5	**ICT culture**	3,88	0,86	22,2%
6	**ICT infrastructure**	3,73	0,99	26,5%
7	**Quality assurance**	3,56	1,05	29,5%

Note: M - mean; SD - standard deviation; CV - coefficient of variation

Source: Author's calculation

The mean digital maturity score is 3.59 with a standard deviation of 0.85 (coefficient of variation is 23.67%).

The presented results answer the first research question about the beginning of a digital transformation in higher education institutions in Bosnia and Herzegovina and their digital maturity.

Furthermore, respondents were asked to provide a free estimate of the proportion of digitalized business processes/activities in their faculties' total number of business processes/activities. The results show that 629 respondents stated the exact percentage/share, 22 said "I don't know," and 14 made a comment about the COVID-19 pandemic but did not state the exact share/percentage. According to the responses of these 14 respondents, the faculties have made significant progress in digitalization as a result of the COVID-19 virus pandemic. This pandemic has caused and continues to cause significant changes in how the educational process is implemented. As expected, the range of shares ranges from 0 to 100 percent. Nine respondents stated 0 as the answer, while 15.1% of them pointed out that half of business activities/processes have been digitalized in their institution. Of the other respondents, 28.1% state that less than 50% of business activities/processes have been digitalized, and 56.8% that more than 50% of business activities/processes are

involved. More specifically, 42.1% of respondents state that more than 70% of all business activities/processes have been digitalized in their higher education institutions.

As an additional comment to the previous question, respondents most often pointed out administration, student work, and exam registration as business processes/activities that were digitalized among the first.

Slightly more than half of the respondents are satisfied with the process of digital transformation at their higher education institutions, i.e., they are satisfied with the digital maturity of their institutions (n = 367; 55.2%). Other respondents, 298 of them (44.8%), are not satisfied with the way and speed of digitalization of their faculties and pointed out obstacles that, in their opinion, significantly slow down the digital transformation of their faculties. The results show that more than 80% of respondents consider all offered items as obstacles to intensive and efficient digital transformation. Only small nuances show that, according to them, the biggest obstacle is the cost of application/implementation of digital technologies in business. In contrast, the management of institutions (specifically their support and digital literacy) is a slightly smaller obstacle. The ratio of respondents for the answers is an obstacle / not an obstacle for all offered items is shown in Table 3.

In addition, the respondents rated the strength of each of the offered items as follows: 1 - small/weak obstacle, 2 - medium obstacle and 3 - big/strong obstacle. The representation of individual responses according to the strength of the obstacles is also given in Table 3. The results show that the fear of possible attacks and data theft, and security issues are most often pointed out as small obstacles. Medium obstacles are problems related to business control, while the biggest obstacles are the costs of application/implementation of digital technologies in business.

Table 3
Descriptive statistics for digital maturity dimensions

No		**% of respondents**		**strength of the obstacle**		
		NAO	AO	1	2	3
1	**Lack of management / administration support**	13.1%	86.9%	42.6%	32.3%	25.2%
2	**Poor IT literacy of management / administration**	10.4%	89.6%	40.0%	30.5%	29.3%
3	**Application / implementation costs**	1.7%	98.3%	11.0%	19.6%	69.4%
4	**Poor computer literacy of employees**	4.7%	95.3%	27.7%	31.9%	40.4%
5	**Extensive IT infrastructure**	4.0%	96.0%	22.3%	32.5%	45.1%

6	**Impossibility of adequate data protection**	11.1%	88.9%	44.4%	26.6%	28.9%
7	**Fear of possible attacks and data theft**	12.8%	87.2%	48.8%	26.6%	24.6%
8	**Security issues**	12.1%	87.9%	47.9%	29.1%	23.0%
9	**Problems related to business control**	12.4%	87.6%	39.0%	34.7%	26.2%
10	**IT department size**	8.1%	91.9%	26.5%	25.7%	47.8%

Note: NAO - not an obstacle; AO - an obstacle; 1 - small / weak obstacle, 2 - medium obstacle and 3 - big / strong obstacle

Source: Author's calculation

The results in Table 3 and the accompanying text answer another research question related to barriers to intensive digital transformation in higher education institutions in Bosnia and Herzegovina.

Discussion

More than half of teachers say their higher education institutions began digitalization before 2016, implying that the digital transformation of business has been ongoing for more than 5 years. When viewed in the context of assessing digital maturity and satisfaction with digitalization, the question "Why are these results not better?" arises. It should be remembered that digitalization is an ongoing process that cannot be completed due to daily advancements and new solutions in the field of digital technology. No matter how much we follow new technological achievements, it is impossible to complete the digital transformation once and for all. Besides, people, their non-acceptance and/or difficulty in accepting technology, different attitudes toward technology, different views of the educational process, and sometimes even rejection and conscious sabotage of all activities undertaken by the school may be significant obstacles to better results. Of course, it is important to remember that doing business in a turbulent, dynamic, and highly competitive environment can impose various requirements that can interfere with all plans of higher education institutions, including digitalization plans.

The analysis of the obtained results clearly shows that higher education institutions in Bosnia and Herzegovina are only in the middle of the road known as digital transformation. This was derived from the results obtained in terms of digital maturity. The average digital maturity score is 3.59, with individual dimension ratings ranging from 3.35 to 3.88. Although the mean grade of digital maturity is closer to grade 4 than grade 3, there is insufficient evidence to draw a different conclusion than "only in the middle of the road."

This middle ground is best understood through the dimensions of digital transformation. The "ICT culture" dimension has the highest mean grade, and the "Technology transfer and service to society" dimension has the lowest mean grade. The names of these dimensions show that higher education institutions in Bosnia and Herzegovina pay attention to developing a culture oriented to information and communication technologies (ICT). Still, they do not make adequate use of ICT in the practical application of acquired knowledge.

Although more than half of the teachers stated that more than half of their business processes/activities at their faculties had been digitalized, the question is how much they have been digitalized and what level of digital maturity these business processes/activities have attained. It is assumed that they changed the way of working and the practice that was in place until about ten years ago. They have most likely implemented technology in their business, but this does not imply that they have achieved top digitalization solutions.

The true picture of digital transformation and digital maturity in Bosnia and Herzegovina's higher education institutions would be obtained only after comparison with world universities. While they may not have implemented technology as long as the university in Bosnia and Herzegovina, the solutions they use in their business activities are far more advanced than in Bosnia and Herzegovina. Comparison with best practices could provide a real impetus for more intensive digitalization of education in Bosnia and Herzegovina, not just in higher education but also at other levels of education. Considering that a significant number of private higher education institutions operate in Bosnia and Herzegovina, putting enormous competitive pressure on public higher education institutions, it is clear that the higher education institutions included in this study must significantly increase all digitalization activities.

Perhaps "opponents" of digital technologies and digitalization, in general, will argue that the essence of education is not in digitalization and that knowledge acquisition does not always rely on technology. While they may be correct, today's society simply imposes technology in all spheres so that educational institutions must adapt and continuously adopt new trends. It must be mandatory, especially since new generations are practically born with technology and use it in every possible field, and digitalization solves the problem of physical/geographical distance.

As expected, digitalization began in the administration department, emphasizing student service administration and the exam application process. Starting with the fact that providing education services is the primary or at least one of higher education institutions' primary activities, and students are their primary stakeholders, it is understandable to focus first on improving the quality and digitalization of business activities. That increases student satisfaction and significantly increases the satisfaction of other indirect stakeholders such as parents, competent institutions, the economy, and the larger community.

According to the findings, only half of the respondents are satisfied with their institution's digital maturity or degree of digitalization. Respondents pointed out the costs of technology implementation, demanding IT infrastructure, poor IT literacy of employees, and the size of IT departments as the biggest obstacles, i.e., some items mentioned in the literature as obstacles and challenges of digital transformation. These impediments demonstrate that technology, procurement, and implementation remain the main issue. Furthermore, the above points to financial resources as a significant obstacle, which may be a problem in the public institutions of Bosnia and Herzegovina due to the complex structure and organization of the state and the relatively complicated solution of financing these institutions. Nevertheless, it should be mentioned that free open source applications and software can be found that can significantly contribute to reducing implementation costs, and financial resources cannot be an excuse to avoid and inadequately implement digitalization. Of course, open-source software is not always the happiest and the best solution and cannot be compared to custom software. Still, by adapting business processes, they can be a significant step in digital transformation in the higher education sector (at least for Bosnia and Herzegovina). The obstacle that stands out in this group is digital literacy. Still, it is not insurmountable because a planned approach within each organization can significantly increase the level of digital literacy of people at a relatively low cost.

Conclusion

The findings suggest that higher education institutions in Bosnia and Herzegovina have acknowledged the necessity of digital transformation and are taking steps in the right direction. However, they still have a long way to go in digital maturity. Several facts confirm this conclusion: more than half of the institutions have been digitalized for five years; the mean grades of the surveyed dimensions range between 3 and 4; slightly more than 50% of business processes/activities have already been digitalized; the costs of application/implementation of digital technologies in business, digital illiteracy, lack of management support and security issues were highlighted as significant obstacles to intensive digital transformation. By improving the current situation in terms of digital transformation and digital maturity, higher education institutions in Bosnia and Herzegovina will primarily help themselves and their direct stakeholders who will contribute to the development of their immediate and wider environment through their future activities.

Of course, the research had some limitations due to the size and characteristics of the sample. The survey was conducted among employees, primarily teachers at higher education institutions, working at faculties in various scientific fields. The sample represented 18% of the population and included different science and related fields, influencing the results.

The obtained results and limitations of the conducted research should guide future research activities. First, the sample should be enlarged and equalized in area and field. It would also be beneficial to include private higher education institutions. Comparing the situation in public and private higher education institutions may serve as an impetus for more rapid and intensive digitalization. The findings of such research can provide new insights into approaches to digital transformation, both in terms of integrating digital technologies into everyday business and planning and implementing it.

In addition, future research should include an analysis of the level of development of Bosnia and Herzegovina, its regions, and the regions to which it belongs. The obtained results should be crossed with the results on the quality and digital maturity of higher education insinuations, compared with the situation in previous years and conclude further directions of education development to more intensive regional development.

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