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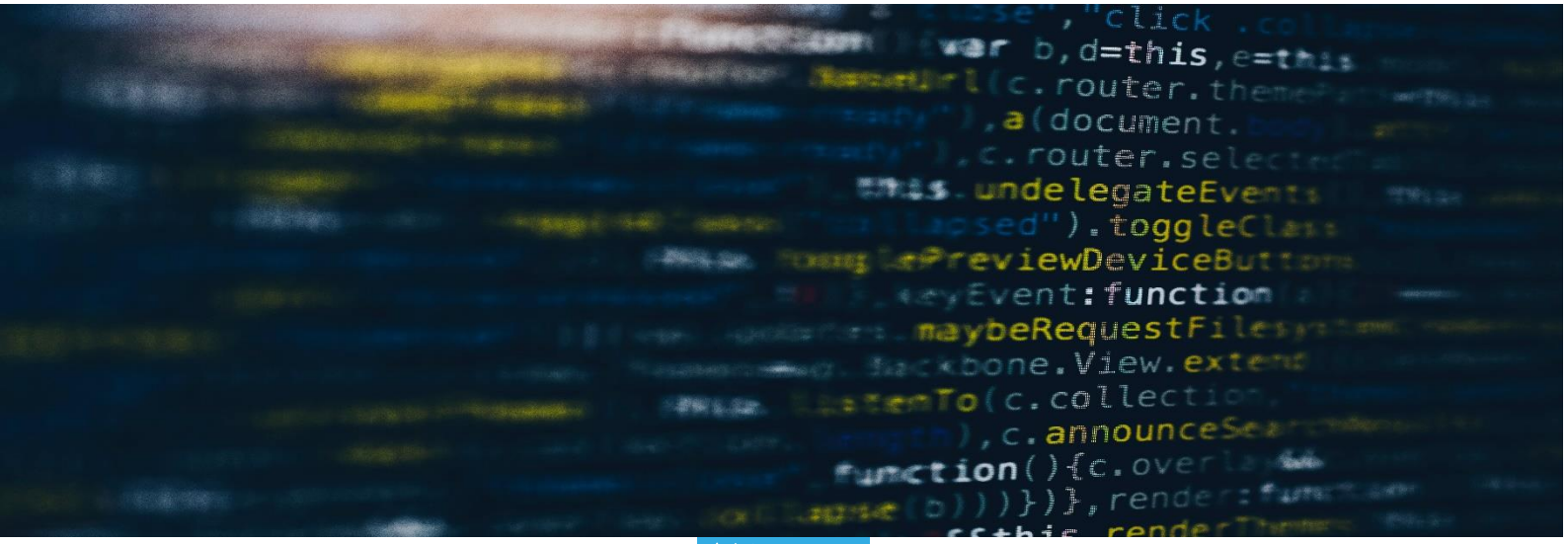

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Abstract

This report contains a set of extended abstracts presented at the workshop "Digital Transformation, Data and AI in the Western Balkans", that was held between 9 and 11 December 2021 in Skopje, North Macedonia. The workshop aim was to discuss Europe's ambition to become the world-leading region for developing and deploying cutting edge, ethical and secure AI, data and digital transformation services and to promote a human-centric approach in the global context. It concluded that this agenda is also important for the Western Balkan (WB) region, which can, in turn, adopt and benefit from these emerging technologies. The workshop objectives were:

- Update participants on the EU's policy on digital transformation, data and Artificial Intelligence.
- Discuss about the main factors that can help or hinder the introduction of digital transformation in Western Balkan countries.
- Present the state-of-play, opportunities, trends and likely impacts of Digital transformation, Data and AI in the Western Balkans.
- Discuss on the added value of the adoption of digital technologies and AI including the drivers, enablers, barriers, and risks and related mitigation actions, specific to the Western Balkans context.
- Discuss regional differences in the attitudes towards digital technologies and AI.

The workshop hosted 102 participants from 12 countries including EU Member States: Bulgaria, Croatia, Slovenia and Italy; candidate and potential candidate countries Albania, Bosnia and Herzegovina, Kosovo (This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence), North Macedonia, Serbia and Turkey; European neighbourhood policy countries associated to Horizon 2020: Moldova and Ukraine. During the three workshop days, participants discussed the state of play of digital transformation in the respective countries, the implementation of AI in education, society, public services, business, exchanged good practices, established partnerships, and ultimately learned from each other.

Acknowledgements

This JRC Report is based on the materials and presentations delivered during the workshop “Digital Transformation, Data and AI in the Western Balkans" that was organised by the European Commission Joint Research Centre (JRC) in collaboration with the Food and Agricultural Organisation of the United Nations (FAO), the United Nations Global Geospatial Information Management (UN GGIM) and the University Ss Cyril and Methodius in Skopje (UKIM). The workshop was opened by H.E. Julian VASSALLO, Deputy Head of EU Delegation to North Macedonia, followed by Carlos TORRECILLA SALINAS, Head of Unit at the European Commission Joint Research Centre, Jeton SHAQIRI, Minister of Information society and administration, North Macedonia Government, Prof. Dr. Nikola JANKULOVSKI, Rector of University Ss Cyril and Methodius in Skopje and Mr. Trajan ANGELOSKI, President of Macedonian Chambers of Commerce. The workshop had more than 100 participants from WB and EU representing the public sector, civil society, academia and business, which exchanged good practices and established partnerships.

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2.7 Digital transformation and Artificial intelligence in Education

2.7.1 Goce Delcev University–Stip drives seamless transition to remote learning during pandemic

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- This overview covers a success story with transition to online working at the Goce Delcev University (UGD), due to proper university development.
- 67% of the students believe that online teaching should continue after the emergency COVID19 measures, as a supplement to regular teaching.
- Timely addressing digitalisation in higher education institutions is key for success in the long run.
- Universities should review their structures to be less bureaucratic and more adaptable, flexible, and enabling each learner to progress at their own pace.

Goce Delcev University - Stip (UGD) has been one of the first educational institutions in N. Macedonia that has implemented information and communication technology (ICT) in its education processes. ICT significant changes in the learning and teaching processes in higher education institutions around the world. The importance of those changes came to place when the world was challenged by the pandemic. UGD was the first university in North Macedonia to seamless transitioned to remote learning and its success was recognized by Microsoft and shared worldwide as a good example. This extended abstract highlights practices and activities that took place at the university in the face of the global crisis caused by Covid-19.

UGD was formed almost 15 years (27 March 2007) ago and since than the university has managed to become second top-ranked public university in N. Macedonia. The university is education hub in the East part of the county and is being recognized internationally over special approach and emphasis on quality teaching and improvement in student life throughout new modern study programs and e-systems and established quality systems at the highest institutional level. The university now functions in 15 units - 12 faculties and three Academies on 4 campuses, with more than 9,000 active students on three cycles of studies.

Universities around the world have a long history of operating in environments that are unstable, disruptive, and unpredictable. They have always managed to give answer to political changes, financial crises, and disruptive trends. The pandemic is one of them and it is the biggest one since Second World War. COVID-19 has created severe operational challenge and universities struggled with transition to online working. This was mainly due to:

- Inadequate information technology infrastructure. In the implementation of teaching and learning process, administration, and all academic activities within the university, good IT infrastructure is required. The quality and quantity of infrastructure need to be considered for improvements in productivity and efficiency".
- Limited expertise for online teaching and learning methods. Teachers need to receive training in how to apply what they have learnt in a variety of situations (transfer) and over an unlimited time span (lifelong learning)".

These uncertain times, guessing "what is next" for the higher education sector needs some calculated speculation and some risk-taking and this was mitigated at UGD due to proper university development. Since the beginning the university had a clear vision that included development of platforms for online education. The university had adequate information technology infrastructure including fully functional platform for student's administrative work (e-index), platform for online learning (e-learning, Moodle) and platform for published study materials (e-library) when the pandemic started. Experience knowledge developed over the period of usage of the platforms was key of having ready employees that can easily use the platforms and have some expertise for online teaching.

Three days after the official lock down of the country, on 15 March 2020 the first online class was delivered, and after that all classes were offered online. By the end of March 2020, more than 4,400 students and 360 lecturers were actively using Microsoft 365 and all classes were online using Microsoft Teams. Over the course of three months, students and teachers benefited from more than 100,000 hours of audio lectures and 50,000 hours of live video. They participated in more than 11,000 live meetings (Microsoft case, 2020).

Knowing the infrastructure and experience that we had, the university main goal was no to stop in any way the education process. Swiftly the teachers and students adopted Teams and, in some cases, even enhanced teacher student interactions.

UGD is integrated university and agile decision-making processes gave the flexibility to response fast in real-time to the constantly shifting demands of the pandemic. This change has come suddenly, and it demanded immediate responses in relation to safety, communication, and education continuity.

All classes on first, second and third cycles of studies were offered online from all 15 different faculties plus educational centers that the university has. The learning methods were challenged, and creative approaches were used so that each study programme can be delivered online. All examinations (tests and exams) were delivered online over Teams or Moodle platform in regulated planed academic calendar and not a single activity was postponed. Thesis defending on all cycles of studies was delivered and all administrative work was organized online. Wide area of activities were organized online, from online meetings for Professors Councils, to study program reaccreditations activities and online conferences.

Student satisfaction was important and we organised (25-31 May 2020) a survey with participation of 1237 students from all faculties (Djidrov, 2020). Of the 1,237 surveyed students, only 19 (2%) stated that they did not have access to a computer or other IT device, and 83 (7%) students stated that they did not have easy access to the Internet. Most of the students (67%) said that they believe that online teaching should continue after the emergency measures, as a supplement to regular teaching. Less than 10% of students had difficulty following online lectures, using IT tools and using UGD's e-services and more than 50% of students are satisfied with the timely introduction and organization of online lectures, as well as the support that UGD has provided during the lock down. Here we should also mention those about 30% of the students who declared themselves neutral on these issues (Zdravev, 2020).

The process of implementing ICT in everyday work in teaching is not easy, especially in times of crisis and emergency measures. Timely addressing digitalisation in higher education institution is key for success in a long run.

This momentum is an opportunity for higher education to develop online education further, where we might need to reconsider not only our technology strategy, but also education strategy. Now is the time for higher education institutions to reconsider their value propositions and operating models for successfully and sustainably delivering universities missions in the years to come. Universities should review their structures to be less bureaucratic and more adaptable, flexible, and enabling to academics, researchers, and students.

After what all higher education institutions have faced around the world with the pandemic, we need to embrace online teaching beyond the emergency remote mode that the pandemic has forced us to adopt. We need to re-envision the spaces where learning takes place with using multiple physical and virtual spaces both in and outside of universities. We need to rethink and reimagine the traditional modes of teaching and learning in ways that have appropriate peer to peer contact, in-person services that is necessary to develop skills like emotional intelligence, engagement and collaboration. We need to embrace personalized and self-paced learning systems that offers alternative pathways where diverse individual needs of each learner will be addressed that will be flexible enough to enable each learner to progress at their own pace. This will allow lifelong and student-driven learning to continuously improve existing skills and acquires new ones based on students' individual needs. This will help us expand our student pool, another challenge that is pressuring the universities in N. Macedonia and around the world.

At UGD we see our post-Covid expectations as a way to leverage our new potential with our existing capacity. We will have to optimize multiple delivery modes and embrace more creativity and innovation in teaching and learning in the upcoming years, with blending teaching and learning methods that will improve learning outcomes.

References

Hetty Primasari, Clara & Setyohadi, Djoko. (2018). Improvement of Information Technology Infrastructure in Higher Education using IT Balanced Scorecard. Proceeding of the Electrical Engineering Computer Science and Informatics. 5. 10.11591/eecsi.v5i5.1590.

Tawana Kupe. (2020) COVID-19: A time to reimagine and reposition universities, site: www.universityworldnews.com (accessed 14.11.2021)

Dzidrov, M. (2020). Survey for students' experience - online education during the Covid 19 crisys. Shtip:
University Goce Delchev.

Zdravev, Zoran and Boev, Blazo and Dzidrov, Misko (2020) Implementation of e-learning and ICT in the educational process of UGD in the situation of Covid-19 emergency. Истражувачки активности на МАНУ за справување со пандемијата од Ковид-19.

Microsoft Customer stories – Case example: Leading university in North Macedonia drives seamless transition to remote learning with Microsoft 365 (14.08.2020) link https://customers.microsoft.com/en-us/story/836725-goce-delcev-university-of-stip-higher-education-microsoft-365-en-macedonia

3 Provision of guiding principles for digital transformation and AI in Western Balkans

The workshop had 47 excellent presentations of digital transformation (DT), data and AI in the Western Balkan (WB) countries. Additionally, the workshop brought in light ideas for future directions of digital transformation in the WB. As in the rest of the world, because of COVID-19 pandemic, many sectors were forced into accelerated digital transformation achieving valuable benefits. One example is education where there was a rapid adoption of distance learning platforms. The distance learning platforms will modernise education in the WB region and the idea is not only to keep the present development but to go further and offer advanced digital tools that will be of benefit for students, and the interested citizens and society as a whole. These ideas are supported by the initiatives of open science, open publishing, open access of the scientific results and open research infrastructure. Implementing these changes in WB education and research activities will bring it closer to the European educational area.

Digital and green transition are clearly European priorities nowadays. It is emphasized through the Berlin declaration on Digital Society and Value based Digital Government in 2020 and in the European Green Deal in 2019. Many resources will be available in the next few years to support achievement of these ambitious goals. WB countries should build their capacities for these opportunities and foster their development and deployment.

Both goals, digital and green, bring many challenges and opportunities. EC and EU Member States are already doing a lot in this direction. However, examples and good practices presented in the last 3 days clearly show that WB but also Ukraine, Moldova and Turkey are not lagging behind.

The workshop presented DT, data and AI applications in many areas such as: government and public administration including public services, agriculture, geospatial sector, urban planning, education, banking sector, crisis management and start-ups. However it was noted that additional activities are needed to spread DT to other fields of society, governmental services and to improve access of the citizens to data, information and services. Exchange of the experience and good practices between the EU and WB countries and other countries that participated in the workshop will bring further development of DT, data and AI.

The result of the workshop are the guiding principle for DT, data and AI in the WB:

- DT, data and AI will be important factors to boost economic recovery and resilience in the future. The DT can bring a number of benefits for WB countries and their citizens. Transforming the governmental and/or local administration services into digital services is an important direction determined during these 3 days.
- Promoting and supporting the young and innovative entrepreneurs, supporting the development of technological parks and increasing the capacities of the existing ones is direction that will help establishment of the new start-ups and small companies in the dynamic markets with high opportunity for quick growth.
- A number of WB researchers and research groups are active in the field of DT, data and AI. Regional cooperation, internationalisation and open science principles can further boost these activities and make WB an important part of the European Research Area.
- The movement from open data to free data was not presented at the workshop. Data accessibility remains the problem in some countries. The quick opening of the data sources by the public data owners is essential for better and faster implementation of AI in a number of sectors. Free data can boost the interest for data science among young students to develop AI solutions.
- WB countries are on different levels of development and implementation of the DT, data and AI. The promotion of regional cooperation and establishment of the international institutes that will be centres for promoting excellence in these fields and will operate regionally is one of the possible solutions to improve the level of development in all WB countries.
- The Berlin process should consider the existing potentials in DT, data and AI in various fields and support on-going process on country level, and hopefully number of further initiatives on regional level.
- Geospatial information and location data are becoming part of activities of many sectors. Therefore intensification of cooperation, communication and coordination and further work on geospatial data

information is required to make data available for all interested parties. United Nations Global Geospatial Information Management (UN GGIM) can be a good platform for this.

The WB countries DT, data and AI initiatives should be based on open data access, (preferably free data), regional cooperation, cooperation with EU member states, participation in the existing and future EU programmes, instruments and opportunities and promote national and regional policies. Therefore, the WB national policies and development of specific action plans should be alighted toward EU initiatives.

3.1 Identification of good practices in WB countries

The six Western Balkan (WB) countries participants presented 28 papers in the workshop. More specifically, 20 presentations from North Macedonia, 4 presentations from Serbia and one from Albania, Bosnia and Herzegovina and Kosovo and none from Montenegro. Therefore, the distribution of the papers and participants from WB was not in favour of assessing the situation in each of the countries equally. The COVID-19 pandemic had influenced the workshop participation.

During the workshop number of AI use cases were presented, starting from languages translation, speech to text, image processing, urban living, crop yield forecasting, monitoring, control and analytical functions of the marketing sector, measuring the facial physiological responses, facial muscle activations, and motions from the user to recognize emotions, protection of the vulnerable Internet users at Human-Computer Interaction level and others. The workshop demonstrated that AI in WB countries have already moved from research to the implementation within various sectors, such as agriculture, urban living, internet use, marketing, languages etc.

The authors from North Macedonia made presentations addressing the digitization and digital transformation process in a number of sectors such education including the higher education, but also the primary education by implementing the geospatial technology for studying the natural and social subjects in primary schools. Some papers from this group address the digital transformation in public administration, banking sector, participatory urban planning, crisis management system and national population register and digital identity. Moreover, many governmental services are already transformed to digital. There was a presentation on collaboration platform as a driver of the digital transformation in geospatial data and two already completed projects: National spatial data infrastructure (NSDI) geoportal and LiDAR distribution portal. Moreover, two presentations were discussing digital transformation of the geospatial data and development of the digital landslide susceptibility map of North Macedonia and creation of the national cadastres of degraded areas in Serbia and North Macedonia. Two presentations have addressed digital transformation by implementing the machine learning for early season crop yield forecasting and use of remote sensing in Google Earth Engine for assessing the effects of rapid urbanization on land surface temperature.

The authors from North Macedonia made presentations in theoretical background for Applications of Deep Learning Based Semantic Segmentation of Images, Horizontally scalable lambda architecture for processing and analysing multivariate time-series data, Programming Logic in Artificial Intelligence: a metamorphosis of M-mode to I-mode, or discuss on state with the most exciting disruptive technologies for accounting researchers and professionals at the global level (big data, data analytics, cloud, artificial intelligence and blockchain). Three papers addressed companies and products developed using digital services, artificial intelligence and machine learning. First one is based on AI for direct and personalized marketing of the products in real time during the shopping. Second one is AI that can analyse facial movements and associate data collected from sensors to predict emotional status. The third one is AI image recognition software that detects fashion items in images and enables fashion retailers to delight shoppers by saving their time and effort in search for the desired products.

The authors from Serbia had 4 presentations at the workshop. First one was about the establishment of national cadastres of degraded areas. Second one about geospatial data as a core instrument to transform the country. Geospatial data is considered as a key element to map and monitor the resources of an entire nation, allowing for the quantitative documentation of policy implementations on the ground. Serbia is supported by the FAO, World Bank and other development partners to improve the use of available geospatial data and technology and to strengthen government capacity to make best use of available data and technology. Republic Geodetic Authority (RGA) is a national Spatial Data Infrastructure (SDI) coordinator and the INSPIRE National Contact Point. The RGA is a special governmental organization, which performs state survey, maintenance of real estate cadastre and management of geospatial data at the national level. The RGA plays an important role in making the geospatial information available, to support the government and municipal authorities as well as the general public and businesses. One presentation was addressing the challenges of Digital Government Transformation, as a tool for improving the public sector services and reducing existing administrative burden that can lead to increased savings in money and time for public administration, businesses, and citizens. Although, there is

significant support and interest from many stakeholders (EC, UNDP, World Bank; Chamber of Commerce and Industry of Serbia, NGO's as NALED) to enable digital transformation, Serbia still faces challenges with successful development of e-services. Interoperability is one of the key challenges and it is acknowledged as the first action and goal to achieve in "Program for e-government development of Serbia". The fourth presentation presented the results from the project CASPER on the use of AI to filter the content displayed to the user and the content sent by the user via the Internet. The experimental use of pilot software confirmed that AI can be successfully used to protect vulnerable categories of users from inappropriate content and malicious activities on the Internet.

The author from the Federation of Bosnia and Herzegovina presented the process of data integration and interoperability of public land administration services as instruments for providing better and easily accessible services to the end users of the public land administration.

The author from Albania presented a use case of AI as a tool for improvement of urban living.

The author from Kosovo presented an implementation of AI in speech-to-text technology in Albanian language.

4 Conclusions

Digital technologies, data and AI have changed our societies. Europe's ambition is to become the world-leading region for developing and deploying cutting edge, ethical and secure AI, as well as to promote a human-centric approach in the global context. Therefore, it is important for the WB (WB) region to follow, adopt and benefit from these emerging technologies.

The WB countries are candidates and potential candidates for accession in the EU. These countries are at different stages in the EU accession process. The collaboration and exchange on the good practices between experts from WB and EU can positively influence the process. Therefore, the Directorate Growth and Innovation of the Joint Research Centre of the European Commission based in Seville (Spain) and Ispra (Italy) and The Digital Economy Unit (JRC B6) of the Directorate Growth and Innovation JRC B6 together with the UN Food and Agriculture Organisation, World Bank, UN-GGIM-Europe, UN Economic Commission for Europe, and the Ss. Cyril and Methodius University in Skopje jointly organised a workshop: Digital Transformation, Data and AI in the Western Balkans that took place in Skopje from December 9 to December 11, 2021 in Skopje, Republic of North Macedonia.

The Workshop brought together a variety of stakeholders, representing the public sector, civil society, academia and business. The workshop successfully enabled:

- Presentation of WB AI solutions in education, research, services offered by governments and companies and development of new and innovative businesses.
- Exchange of ideas and good practices between EU and WB experts in the topics related to digital transformation, data, AI and innovative services and applications based on above mentioned technologies.

The workshop was organised as a hybrid event, with 53 participants being with physical presence and 102 participants online.

The workshop hosted participants from 12 countries, EU member states: Bulgaria, Croatia, Slovenia and Italy; candidate and potential candidate countries Albania, Bosnia and Herzegovina, Kosovo (This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence), North Macedonia, Serbia and Turkey; European neighbourhood policy countries associated to Horizon 2020: Moldova and Ukraine. The participants during these three days discussed the state of play in digital transformation in the respective countries, implementation of AI in education, society, public services, business, etc.

This report was prepared by 88 different authors, from governmental bodies, non-governmental organisations, higher education institutions, research institutes, public bodies, private companies, emerging business and start-up's. The workshop have successfully:

- Updated participants on the EU's policy on digital transformation, data and artificial Intelligence.
- Discuss about main factors that can help or hinder the adoption of digital transformation in WB.
- Present the state-of-play, opportunities, trends and impacts of Digital transformation, Data and AI in WB.
- Discuss on the added value of the adoption of the digital technologies and AI including drivers, enablers, barriers and risks in the WB.
- Discuss regional differences in the attitudes towards digital technologies and AI.

The participants expressed interest for future development of the initiated topics and activities. Moreover, there is readiness for undertaking the steps toward development of the national and multilateral projects that will boost the process of digital transformation in the region.

The opportunities offered by different programmes (Horizon Europe), various components of the Instrument for Pre-Accession Assistance (IPA) and some other EU programmes and instruments are considered as good opportunities for upgrading the regional cooperation and cooperation of the region with the EU member states.

Moreover, the participants pointed out that Berlin process and Open Balkan initiative can be very good instruments for boosting the activities on national and regional level.

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