University North

Scientific Research and Artistic Strategy of University North

for the period 2021-2027

Koprivnica and Varaždin, December 2021

Publisher: University North

For the publisher: Prof. Dr sc. Marin Milković

Editors:

Prof. Dr sc. Marin Milković

Prof. Dr sc. Anica Hunjet

Prof. Dr sc. Damir Vusić

Prof. Dr sc. Mario Tomiša

Prof. Dr sc. Ino Husedžinović

Prof. Dr sc. Ante Čikić

Assoc. Prof. Dr sc. Ante Rončević

Assoc. Prof. Dr sc. Iva Rosanda Žigo

Proofreading:

Prof. Maja Krulić Gačan

The scientific research and artistic strategy of University North for the 2021-2027 period was adopted at the 2nd session of the University North Senate in the 2021/2022 academic year, held on 22 December, 2021.

Koprivnica and Varaždin, December 2021

FOREWORD

The establishment of University North is a fundamental factor in the equal development of the higher education network in the Republic of Croatia, but also an important element of equal development in the region of northwestern Croatia, in economic, cultural, social and general societal aspects.

The historical, ethnological and cultural prerequisites for the development of northern Croatia are important in the establishment of University North. A favourable social atmosphere was created, with the outright support of the Varaždin and the Koprivnica-Križevci counties, the founding cities of Varaždin and Koprivnica, and representatives from the economy and the political structures from northwestern Croatia who also gave their support.

Since we strive for a society of knowledge, education itself plays a very important role through scientific research and artistic work. Scientists and teachers should strive for new scientific knowledge by applying scientific methods in their field of research and by transferring knowledge which is crucial for the progress of the economy and the wider community.

Therefore, it is precisely with the comprehensive strategy of polycentric development of science, art and higher education in the Republic of Croatia that University North needs to formulate useful knowledge in an appropriate manner, and determine the models of using research in order to connect it with the economy, culture, and especially future development projects. Decisions on learning outcomes are based on the proposals by experts and will continue to be taken in cooperation with labour market representatives, the scientific and academic community, both in the country and in the EU, and the executive and legislative authorities.

In today's era of globalisation and regional integration of the European space, the cultural and artistic sectors need to be linked to the economy and tourism, helping general development and contributing to employment, including the financial aspect thereof. The digital transformation and application of new technologies in the economy and the education sector create new opportunities to foster open science, strengthen scientific excellence, and connect the academic, research and business sectors through investment in research and innovation development. In particular, University North encourages the development and implementation of ideas that support the development of a globally competitive, green and digital economy with the primary goal of cross-sectoral interaction.

CONTENTS

1. INTRODUCTION

University North is a public higher education institution registered in the court register of the Commercial Court in Varaždin under registration number: 060260692, and in the Register of Higher Education Institutions under registration number: 336, maintained by the Ministry of Science and Education. The university is organized as an integrated structure based on two equal university centres: the Varaždin University Centre and the Koprivnica University Centre. Starting from the 2021/2022 academic year, classes are also held at a separate location in Đurđevac. The university was established with the purpose of educating competent personnel in the technical, biomedical, biotechnical, social and humanistic fields, interdisciplinary sciences and arts, and with its activities and scientific achievements, it seeks to contribute to the improvement of the economy of the northwest region.

University North has 31 study programmes, 17 of which are undergraduate and 10 graduate, one postgraduate specialist study of Entrepreneurship and EU Funds, and three doctoral studies, two of which are international joint doctoral studies, and one is organized by University North at the Koprivnica University Centre.

Undergraduate study programmes offered at University North: Undergraduate professional study programme in Electrical Engineering; Undergraduate professional study programme in Multimedia, Design and Application; Undergraduate professional study programme in Mechanical Engineering and Manufacturing; Undergraduate professional study programme in Civil Engineering; Undergraduate professional study programme in Logistics and Mobility at the Varaždin University Centre; Undergraduate professional study programme in Logistics and Mobility at the Koprivnica University Centre; Undergraduate professional study programme in Nursing; Undergraduate professional study programme in Mechatronics; Undergraduate professional study programme in Physiotherapy; Undergraduate university study programme in Communication , Media and Journalism; Undergraduate university study programme in Media Design; Undergraduate university study programme in Music and Media; Undergraduate professional study programme in Business and Management; Undergraduate professional study programme in Food Technology; Undergraduate university study programme in Geodesy and Geomatics; Undergraduate university study programme in Environment Protection, Recycling and Packaging, and Undergraduate professional study in Computer and Information Science.

Graduate study programmes offered at University North: Graduate university study programme in Multimedia; Graduate university study programme in Mechanical Engineering; Graduate university study programme in Civil Engineering; Graduate university study programme in Sustainable Mobility and Logistics Management; Graduate university study programme in Nursing - Management in Nursing; Graduate university study programme in Communication, Media and Journalism; Graduate university study programme in Media Design; Graduate university study programme in Business Economics; Graduate university study programme in Public Relations and Graduate university study programme in Packaging, Recycling and Environmental Protection.

Postgraduate study programmes offered at University North:

- Postgraduate specialist study programme in Entrepreneurship and EU Funds
- Postgraduate university doctoral study programme in Media and Communication

- Postgraduate international (joint) doctoral university study programme in International Economic Relations and Management
- Postgraduate international cross-border interdisciplinary (joint) doctoral study programme in Educational and Communication Sciences.

University North adopted and implemented the Scientific Research Strategy document for the 2014-2019 period (hereinafter: Scientific Research Strategy) for the purpose of strengthening and systematic implementation of scientific activity. In addition to its core teaching activity, the University contributes to the development of a culture of knowledge through its comprehensive scientific research and artistic activity.

The University operates in the region of northwestern Croatia and is complementary in its mission to the development needs of the region. It has highly-educated, scientific, artistic and professional staff, and a quality structure of various study programmes in the field of technical sciences, biomedicine and healthcare, biotechnical, social and human sciences and in the field of art. It continuously invests in the academic advancement of teachers, increasing the number of publications and teaching materials for employees, and provides significant financial resources for further development of laboratory activities and equipment for new laboratories.

University North encourages the development of projects and research with an emphasis on digital reforms and innovations in the green and digital transitions, and scientific projects funded by the Croatian Science Foundation, international projects, and the involvement of foreign scientists and experts in research are used as indicators of research excellence, in order to achieve international recognition and ensure competitiveness and sustainability.

The Scientific Research and Artistic Strategy of University North for the 2021-2027 period (hereinafter: the Strategy) relies on the relevant strategic documents of University North, as well as on the principles from EU documents. Furthermore, the Strategy is based on a self-analysis of the current situation (SWOT analysis), and on the observation of modern global trends in the fields of science and art in which it operates.

1.1. LEGAL ACTS

- University North Statute - Class: 602-04/18-02/8, Reg. No.: 2137-0336-09-18-18 of 7 November 2018, https://www.unin.hr/wp-content/uploads/Statut_izmjene-i-dopune_studeni-2018_pro%C4%8Di%C5%A1% C4% 87eni-tekst.pdf
- University North Code of Ethics - Class: 602-04/14-02/88, Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Eti%C4%8Dki-kodeks-Sveu%C4%8Dili%C5%A1ta-Sjever.pdf
- University North Code of Ethics for Scientific Activity - Class: 602-04/14-02/89, Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, Amendments to the Code of Ethics of Scientific Activity of the University of North - Class: 602-04/18-02/09, Reg. No.: 2137-0336-09-18-45 entered into force on 29 December 2019, https://www.unin.hr/wp-content/uploads/Eti%C4%8Dki-kodeks-znenjske-djelatnosti-Sveu%C4%8Dili%C5%A1ta-Sjever.pdf, https://www.unin.hr/wp-content/uploads/Eti%C4%8Dki-kodeks-znenjske-djelatnosti-SS_izmjene-i-dopune.pdf
- Ordinance on postgraduate university study programmes (doctoral study programmes) at University North - Class: 602-04/18-02/08, Reg. No.: 2137-0336-09-18-22 - entered into force on 7

November 2018, https://www.unin.hr/wp-content/uploads/Pravilnik_posljediplomski-sveu%C4%8Dili%C5%A1ni-studiji_pro%C4%8Di%C5%A1% C4% 87eni-tekst_studeni-2018.pdf

- Ordinance on rewarding published scientific papers, visibility of scientists and accepted patents established by University North employees, and Amendment to the Ordinance on rewarding published scientific papers, visibility of scientists and accepted patents established by University North employees - Class: 602-04/20-02/15; Reg. No.: 2137-0336-09-20-12 - entered into force on 24 March 2020, https://www.unin.hr/wp-content/uploads/Pravilnik-o-nagra%C4%91vanje_znanstveni-radovi_vidljivost_patenti1.pdf
- University North Senate Rules of Procedure - Class: 602-04/15-02/10, Reg. No.: 2137-0336-15-05-1-2 - entered into force on 10 October 2015, https://www.unin.hr/wp-content/uploads/Poslovnik-o-radu-Senta-Sveu%C4%8Dili%C5%A1ta-Sjever.pdf
- Ordinance on election to scientific, scientific-teaching, artistic-teaching, teaching and associate titles and corresponding positions - Class: 602-04/16-02/09, Reg. No.: 2137-0336-09-16-14 - entered into force on 30 April 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-izboru-u-znenstvena-znenstveno-nastavna-umjetni%C4%8Dko-nastavna-nastavna-i-suradni%C4%8Dka-zvanja-i-odgovorju%C4%87a-radna-mjesta1.pdf
- Ordinance on the procedure for the re-election of persons elected to scientific teaching, artistic teaching, and teaching positions - Class: 602-04/16-02/07, Reg. No.: 2137-0336-16-09-13 - entered into force on 9 March 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-postupku-reizbora-osoba-izabanih-na-znanstveno-nastavna-umjetni%C4%8Dko-nastavna-i-nastavna-radna-mjesta.pdf
- Ordinance on the procedure for testing special knowledge, skills and abilities - University undergraduate department of media design - Class: 602-04/16-02/12, Reg. No.: 2137-0336-09-16-16 - entered into force on 6 July 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-provjere-posebnih-znanja-MED.pdf
- Ordinance on student disciplinary liability - Class: 602-04/13-02/30, Reg. No.: 2137-0336-14-01-2 - entered into force on 9 April 2014, Amendments to the Ordinance on student disciplinary liability - Class: 602-04/17-02/10, Reg. No.: 2137-0336-09-17-18 entered into force on 21 November 2017, https://www.unin.hr/wp-content/uploads/Pravilnik-stegovna-odgovornost-studenata.pdf,https://www.unin.hr/wp-content/uploads/Pravilnik-o-izmjama-i-dopunama-Pravilnika-o-stegovna-odgovornost-studenata.pdf,
- Ordinance of the Centre for Publishing and Media Studies of University North - Class: 602-04/13-02/27, Reg. No.: 2137-0336-14-01-2 - entered into force on 9 April 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-Centra-za-izdava%C4%8Dke-i-medijske-studije.pdf
- Ordinance of the Centre for Digital Publishing - Class: 602-04/16-02/07, 2137-0336-16-09-18 - entered into force on 9 March 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-Centra-za-digitalno-nakladni%C5%A1tvo.pdf
- Ordinance on publishing activity - Class: 602-04/18-02/09, Reg. No.: 2137-0336-09-18-47 - entered into force on 29 December 2018, https://www.unin.hr/wp-content/uploads/Pravilnik-o-izdava%C4%8Dkoj-djelatnosti_new_December-2018..pdf
- Mobility ordinance - Class: 602-04/13-02/28, Reg. No.: 2137-0336-14-01-2 - entered into force on 9 April 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-mobilnosti.pdf
- Ordinance on the establishment and operation of a quality assurance system at University North - Class: 602-04/13-02/26, Reg. No.: 2137-0336-14-01-2 - entered into force on 9 April 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-ustroju-i-djelovanju-sustava-kvalitete.pdf
- Rules of procedure of the Council for Interdisciplinary Science - Class: 602-04/17-02/01 Reg. No.: 2137-0336-09-17-15 - entered into force on 4 February 2017, https://www.unin.hr/wp-

content/uploads/Pravilnik-o-radu-Vije%C4%87a-podru%C4%8Dja-interdiciplinarno-podru%C4%8Dje-znanost.pdf

- Rules of procedure of the Council for Social Sciences and Humanities - Class: 602-04/17-02/01 Reg. No.: 2137-0336-09-17-14 - entered into force on 4 February 2017, https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu-Vije%C4%87a-podru%C4%8Dja-dru%C5%A1tvene-i-humanisti%C4%8Dke-znanost.pdf
- Rules of procedure of the Council for Natural Sciences, Biomedicine and Healthcare - Class: 602-04/17-02/01 Reg. No.: 2137-0336-09-17-18 - entered into force on 4 February 2017,https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu-Vije%C4%87a-podru%C4%8Dja-prirodne-znanost-i-biomedicina-i-zdravstvo.pdf
- Rules of procedure of the Council for Arts - Class: 602-04/17-02/01 Reg. No.: 2137-0336-09-17-17 - entered into force on 4 February 2017, https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu-Vije%C4%87a-artificial%C4%8Dkog-podru%C4%8Dja.pdf
- Rules of procedure of the Council for Technical Sciences - Class: 602-04/17-02/01 Reg. No.: 2137-0336-09-17-16 - entered into force on 4 February 2017, https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu-Vije%C4%87a-podru%C4%8Dja-tehni%C4%8Dke-znanost.pdf
- Ordinance on student teaching assistants- Class: 602-04/14-02/87 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-demonstraturama.pdf
- Ordinance on awarding the Rector's Award - Class: 602-04/15-02/49 Reg. No.: 2137-0336-15-05-2 - entered into force on 18 December 2015, https://www.unin.hr/wp-content/uploads/Pravilnik-o-dodjeli-Rektorove-nagrade.pdf
- Ordinance on financial operations - Class: 602-04/15-02/46 Reg. No.: 2137-0336-15-05-2 - entered into force on 18 December 2015, https://www.unin.hr/wp-content/uploads/Pravilnik-o-financijskom-poslovanju.pdf
- Ordinance on the financing of the student assembly, student programmes, projects and other student activities, and on the disposal of student assembly funds - Class: 602-04/16-02/07, Reg. No.: 2137-0336-16-09-11 - entered into force on 9 March 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-financiranju-studentskog-zbora-te-programa-studentskih-udruga-i-drugih-studentskih-organizacija.pdf
- Ordinance on the selection and evaluation of scientific projects - Class: 602-04/14-02/90 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-izboru-i-vrednovanju-znanstvenih-projekata.pdf
- Ordinance on the use of sabbatical and educational leave - Class: 602-04/14-02/85 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-kori%C5%A1tenju-slobodne-studijske-godine-i-dopusta-radi-usavr%C5%A1avanja.pdf
- Ordinance on rewarding teacher excellence - Class: 602-04/14-02/84 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-nagra%C4%91ivanju-izvrsnosti-nastavnika.pdf
- Ordinance on the evaluation of the work of assistants, postdoctoral researchers and mentors - Class: 602-04/14-02/96 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-ocjenjivanju-rada-asistenata-poslijedoktoranada-i-mentora.pdf
- Ordinance on the establishment of the centre as an organisational unit - Class: 602-04/14-02/97 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-osnivanju-centra-kao-ustrojstvene-jedinice.pdf

- Ordinance on business and professional secrecy - Class: 602-04/14-02/92 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-poslovnoj-i-profesionalnoj-tajni.pdf
- Ordinance on the procedure of student evaluation of teaching and courses - Class: 602-04/14-02/94 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-postupku-studentskog-vrednovanja-nastavnog-rada-i-kolegija.pdf
- Ordinance on working with volunteers - Class: 602-04/14-02/82 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu-s-volonterima.pdf
- Rules of procedure for the university library - Class: 602-04/14-02/81 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu-sveu%C4%8Dili%C5%A1ne-knji%C5%BEnice.pdf
- Amendments to the Ordinance on the content and form of diplomas, diploma supplements, certificates and authorisations- Class: 602-04/15-02/4 Reg. No.: 2137-0336-15-01 - entered into force on 13 March 2015, https://www.unin.hr/wp-content/uploads/Pravilnik-o-sadr%C5%BEaju-i-obliku-diploma-dopunskih-isprava-o-studiju-potvrda-i-uvjerenja.pdf
- Ordinance on disciplinary and material liability of employees - Class: 602-04/16-02/07, Reg. No.: 2137-0336-16-09-22 - entered into force on 9 March 2016, https://www.unin.hr/wp-content/uploads/Izmjene-i-dopune-pravilnika-o-sadr%C5%BEaju-i-obliku-diploma-dopunskih-isprava-o-studiju-potvrda-i-uvjerenja.pdf
- Study Ordinance - Class: 602-04/20-02/17 Reg. No.: 2137-0336-09-20-34 - entered into force on 24 July 2020, https://www.unin.hr/wp-content/uploads/Pravilnik-o-studiranju1.pdf
- Statute of the University North Student Union - dated 29 March 2016, https://www.unin.hr/wp-content/uploads/Statut-studentskog-zbora-Sveu%C4%8Dili%C5%A1ta-Sjever.pdf
- Ordinance on the protection of archival and registry material - Class: 602-04/14-02/93 Reg. No.: 2137-0336-14-01 - entered into force on 13 June 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-za%C5%A1titi-arhivskog-i-registraturnog-gradiva.pdf
- Ordinance on occupational safety - Class: 602-04/15-02/9, Reg. No.: 2137-0336-15-05-1-2 - entered into force on 10 October 2015, https://www.unin.hr/wp-content/uploads/Pravilnik-o-za%C5%A1titi-na-radu.pdf
- Rules of procedure - Class: 602-04/15-02/8 Reg. No.: 2137-0336-15-05-1-2 - entered into force on 10 October 2015, https://www.unin.hr/wp-content/uploads/Pravilnik-o-radu.pdf
- Ordinance on the appearance of University North publications - Class: 602-04/14-02/103 Reg. No.: 2137-0336-14-01 - entered into force on 26 July 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-izklu-izdanja-Sveu%C4%8Dili%C5%A1ta-Sjever.pdf
- Ordinance on the organisation and systematisation of jobs at University North - Class: 602-04/16-02/09, Reg. No.: 2137-0336-09-16-16 - entered into force on 30 April 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-ustroju-i-sistematizacija-radnih-mjesta-Sveu%C4%8Dili%C5%A1ta-Sjever-pro%C4%8Di%C5%A1% C4% 87eni-tekst.pdf
- Rules of procedure for the departments' expert councils at University North - Class: 602-04/15-02/94 Reg. No.: 2186-0336-15-05-01-3 - entered into force on 24 July 2015, https://www.unin.hr/wp-content/uploads/Poslovnik-o-radu-Stru%C4%8Dnih-vije%C4%87a-Odela.pdf
- Ordinance on the use of technical equipment (computers and AV equipment) at University North in the Koprivnica University Centre - Class: 011-01/14-01/1 Reg. No.: 2137-0336-14-02 - entered into force on 20 December 2014, https://www.unin.hr/wp-content/uploads/Pravilnik-o-kori%C5%A1tenju-tehni%C4%8Dke-opreme-ra%C4%8Dunalne-i-AV-opreme-na-Sveu%C4%8Dili%C5%A1tu-Sjever-u-Sveu%C4%8Dili%C5%A1nom-centru-Koprivnica.pdf

- Ordinance on the system of evaluating University North study programmes - Class: 602-04/16-02/12, Reg. No.: 2137-0336-09-16-24 - adopted on 6 July 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-vrednovanju-studijskih-programa_izmjene_srpanj-2016.pdf
- Ordinance on awarding the honorary title: *professor emeritus* - Class: 602-04/15-02/48 Reg. No.: 2137-0336-15-05-2 - entered into force on 25 December 2015, https://www.unin.hr/wp-content/uploads/Pravilnik-o-dodjeli-po%C4%8Dasnog-zvanja-professor-emeritus.pdf
- Rules of procedure on the conditions of use for company vehicles, landlines and mobile phones, IT and other equipment, business and credit cards, means of representation and the method of approving business trips - Class: 602-04/15-02/47, Reg. No.: 2137-0336-15-05-1 - entered into force on March 17, 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-uvjettima-kori%C5%A1tenja-slu%C5%BEbena-vozila_Fixed-and-mobile_telephones_informati%C4%8Dke-i-ostale-op_____opreme_Poslovni-kreditnih-kartica_sredstva-rezentcije-te-na_____%C4%8Dinu-odobravanja-slu%C5%BEbe.pdf
- Ordinance on student organisation records - Class: 602-04/16-02/07, Reg. No.: 2137-0336-16-09-9 - entered into force on 9 March 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-evidencije-studentskih-organizacija.pdf
- Ordinance on office operations - Class: 602-04/16-02/07, Reg. No.: 2137-0336-16-09-16 - entered into force on 9 March 2016, https://www.unin.hr/wp-content/uploads/Pravilnik-o-uredskom-poslovanju.pdf
- Ordinance on academic recognition of foreign higher education qualifications and periods of study - Class: 602-04/17-02/02 Reg. No.: 2137-0336-09-17-29 - entered into force on 28 March 2017, https://www.unin.hr/wp-content/uploads/Pravilnik-o-akademskom-priznavanje-inozemnih-visoko%C5%A1kolskih-kvalifikacija-i-razdoblja-studija.pdf
- Ordinance on the implementation of the simple procurement procedure - Class: 602-04/18-02/09, Reg. No.: 2137-0336-09-18-22 - entered into force on 20 December 2018, https://www.unin.hr/wp-content/uploads/PRAVILNIK-O-PROVEDBI-POSTUPKA-JENNOSTAVNE-NABAVE.pdf
- Ordinance on the use of video surveillance systems - Class: 602-04/18-02/06, Reg. No.: 2137-0336-09-18-73 - entered into force on 28 August 2018, https://www.unin.hr/wp-content/uploads/PRAVILNIK-o-kori%C5%A1tenju-sustava-video-nadzora.pdf
- Ordinance on internal audit - Class: 602-04/18-02/06, Reg. No.: 2137-0336-09-18-74 - entered into force on 28 August 2018, https://www.unin.hr/wp-content/uploads/Pravilnik-o-unutarnjski-reviziji_SS.pdf
- Ordinance on personal data protection at University North - Class: 602-04/18-02/06, Reg. No.: 2137-0336-09-18-71 - entered into force on 28 August 2018, https://www.unin.hr/wp-content/uploads/PRAVILNIK-o-za%C5%A1titi-osobnih-podataka-na-SS.pdf
- Ordinance on final and graduate theses for University North study programmes - Class: 602-04/20-02/18 Reg. No.: 2137-0336-09-20-3 - entered into force on 1 August 2020, https://www.unin.hr/wp-content/uploads/Pravilnik-o-zavr%C5%A1nom-i-diplomskom-radu-na-studiskim-programima-Sveu%C4%8Dili%C5%A1ta-Sjever.pdf
- Ordinance on support for scientific research and artistic work at University North - Class: 602-04/21-02/03, Reg. No.: 2137-0336-09-21-9 - entered into force on 20 May 2021, https://www.unin.hr/wp-content/uploads/PRAVILNIK_O_POTPORAMA_ZNANSTVENIM_ISTRA%C5%BDIVANJIMA_I_ARTIFICIAL%C4%8CKOM_RAD_ALL%C4%8CILI%C5%A0TA_SJEVER1.pdf

2. ABOUT THE STRATEGIC SCIENTIFIC RESEARCH PROGRAMME

Pursuant to the Act on Scientific Activity and Higher Education, scientific activity and higher education represent activities of special interest to the Republic of Croatia and are an integral part of the international, especially European, scientific, artistic and educational space.
The scientific activity is based on:

- freedom and autonomy of creativity
- scientists' ethics
- publicity of work
- connection to the education system
- international quality standards
- encouraging and respecting the specificities of national content, and
- protection of intellectual property.

The primary mission of University North is the education of high quality and internationally recognised and socially responsible researchers for the needs of science and Croatian society as a whole, especially the northern region of Croatia, in the technical, biomedical, biotechnical, social and humanistic fields, interdisciplinary sciences and arts. This stems from the scientific vision of the University, according to which this institution holds a leading role and has recognisable quality in scientific research, artistic, professional and socially responsible activities and higher education of university staff in the technical, biomedical, biotechnical, social and humanistic fields, interdisciplinary sciences and arts.

In its primary activity of higher education, University North is currently established as the dominant technical, social and biomedical higher education institution, and thus significantly contributes to the development of regional economic operators. The institution educates deficient staff, stands out for its diversity and number of study programmes, and is the only higher education institution in the region that has more than 500,000 inhabitants.

By publishing and disseminating the results of scientific work at University North, the importance of scientific disciplines in the national and international public is promoted by attempting to influence the development of society with the results of scientific research.

The educational process is carried out in accordance with the Bologna system of higher education, the mobility of students and teachers among related institutions of higher education is encouraged, and the institution continuously invests in the development of laboratories for the needs of scientific, artistic and professional work. Cooperation between students and teacher mentors and mentors from economic operators is also encouraged, as is the transfer of knowledge through publishing and cooperation with entities from the economy. The scientific mission of University North is in line with the general mission of the institution, which prioritizes the training of competent scientific, artistic and professional staff capable of responding to the demands of modern trends in the economy, science, culture and society in general. Furthermore, the mission of University North is to organise and conduct scientific research, develop knowledge and transfer technologies to the economy and society in general.

The scientific research and artistic strategy of University North emphasises the importance of proactively maintaining acquired values and developing new innovative and creative values. The strategy also emphasises the need to build and preserve own visibility in the academic and social community. The slogan of such a scientific strategic orientation is: innovative, creative and recognisable. In accordance

with the above, this University fosters the principles of quality in scientific research, scientific-teaching work and the principles of ethics, creativity and transparency, insists on cooperation with other national and international higher education scientific-teaching and research institutions, and insists on the development and preservation of good academic and interpersonal relations.

By developing the quality of scientific research, we want to be a recognisable institution due to adequate undergraduate, graduate, postgraduate specialist and doctoral education, our scientists, projects and publications. With its research capacities, knowledge and scientific excellence, the University wishes to assume the role of connecting science to the economy. Multidisciplinarity, which would provide solutions for a wide range of socially useful topics, is one possible future for the University.

In addition to the scientific and educational aspect, University North strives to achieve recognition through continuous development in the artistic field, by opening new study programmes and educating competent staff in this field, thus contributing to the development of culture in the region and beyond.

2.1 SWOT ANALYSIS

In accordance with the basic scientific research and artistic strategy of University North, below is an analysis of the scientific and artistic potential of the scientific organisation and its position in the scientific and business environment (SWOT). The SWOT analysis covers the strengths and weaknesses, opportunities and obstacles in the path of science development at University North.

Meeting the objectives set out in this document is possible by examining the national, regional and international environment. Therefore, we present a SWOT analysis of the scientific and artistic potential of the University, and its position in the scientific and business environment.

Table 1 SWOT analysis

STRENGTHS	WEAKNESSES
- Linking different scientific fields and fostering interdisciplinarity - Number of papers co-authored with students, a large number of ambitious and interested students - Space equipped for scientific research and artistic work (digital printing, studio, various technical, information and other (similar) measurements, experiments and simulation (etc.) studies) - Laboratories - The existence of laboratory and field equipment used for scientific/artistic purposes (doing research for the purposes of final/graduate theses, doctoral dissertations, writing scientific, research or artistic works, etc.), and can be used for scientific/artistic research whose results can also be applied in the economy - Existence of quality international contacts with universities and other institutions - High motivation of young scientific staff - University support for the application and implementation of scientific research and artistic projects - A large number of younger scientists and artists - Satisfactory number of experienced scientists with the appropriate scientific-teaching title (from assistant professor to professor emeritus) ready for mentoring and development assistance - Disposal of part of own financial resources - Pronounced mobility of teachers and students	- Smaller number of applications and participation in international scientific research and artistic projects. - Less popularisation activities and insufficient participation of teaching staff in them. - Lower interest of the economy to participate in scientific research and artistic activity - Fewer incoming mobility for scientists, researchers and artists - Absence of a single interdisciplinary scientific journal of the University within which it would be possible to aggregate all scientific contributions created within the institution. - The absence of a universal system for evaluating works of art.

- Financial rewards for scientists - journals: *Tehnički glasnik* is mainly specialised in the technical field of science, *Podravina* specializes in social sciences, and *In Media Res* is focused on the humanities. - Development of study programmes in the art field through cooperation with compatible institutions.	
OPPORTUNITIES	**THREATS**
- Development of young scientists - Creation of a quality database for the purpose of facilitating the monitoring of scientific research and artistic work. - Collecting data on scientific papers of scientists at the institution through the CROSBI database. - Linking the institution's projects and scientists with the resulting works through the POIROT project activity database. - Linking CROSBI and POIROT databases with the new MOZVAG2 interface, which enables automatic verification of data related to scientific activity at the institution. - Creating an environment in which awareness of the importance of scientific research and artistic activity is encouraged. - Use of EU funds. - Connecting with the economy in activities important for the local community. - Cooperation with other international institutions on the implementation of scientific, research and artistic projects. - Intensification of Mobility. - Education through various workshops, seminars and courses on the topic of applying scientific research and artistic projects to tenders.	- Restrictions of funds for scientific research and artistic activity at the state level. - Competition for awarding scientific research and artistic projects. - Restriction of new employment. - Excessive impact of unfavourable actions connected to the recession and the financial situation from a closer and wider environment; decline in researcher motivation (due to intrinsic reasons or conditioned by the influence of the system – lack of appreciation and recognition of work, unfavourable working conditions, financial demotivation, etc.). - Failure to achieve the conditions for successful and recognizable scientific action (unsatisfactory management of procedures and possible corrections, lack of realistic concretisation of the strategy, implementation of plans, tactics and realistic measurable and corrective operationalisation).

- Orientation towards excellence and innovation. - Signing of new general contracts on international and domestic cooperation (Erasmus, bilateral and other contracts and similar exchanges of students, teachers, researchers and staff), and creation of new cooperation. - Increase in the number of study programmes at the university level. - Popularization of science (Researchers' Night, Science Festival). - Connecting scientists through organisation and participation in international conferences.	

3. STRATEGIC FRAMEWORK (SCIENTIFIC AND ARTISTIC EXCELLENCE AND VISIBILITY)

The starting point for the preparation and elaboration of the Scientific Research and Artistic Strategy of University North 2021-2027 are the relevant European strategic documents, which are also the basis for national and institutional documents. In addition to the necessary harmonisation of the research strategy with the legislation and practice of the European academic area, the Scientific Research and Artistic Strategy of University North 2021-2027 recognised and respected the relevance and all the specifics of the University in defining the strategic framework and the main determinants of the development of scientific research and artistic activities of the University in a given study programme, in order to achieve scientific research and artistic excellence. The Scientific Research and Artistic Strategy of University North 2021-2027 is based on the following documents:

- The Lisbon Strategy (2005)
- European Charter for Researchers and Code of Conduct for the Recruitment of Researchers (EC, 2005)
- Development of Scientific Strategies and Governance at European Universities (EUA 2006)
- EC - Improving knowledge transfer between research institutions and industry across Europe (EC, 2007)
- Recommendations based on the discussion of Innovation, Research University and Knowledge-Based Enterprise (CASA, 2008)
- EUROPE 2020 (EU, 2010)
- Science and Educational Policies in Central and Eastern Europe, Balkans, and Caucasus and Baltic Countries (UNESCO, 2010)
- Ordinance on the conditions for issuing a licence for scientific activities, the conditions for re-accreditation of scientific organisations and the content of the licence (2010)
- Strategic document: Network of Higher Education Institutions and Study Programmes of the Republic of Croatia (2011)
- EU – Guide to Research and Innovation Strategies for Smart Specialisations (RIS3) (EU, 2012)
- Criteria for the establishment of scientific centres of excellence in the Republic of Croatia (ASHE, 2012)
- Principles and criteria for evaluation of scientific organisations in the Republic of Croatia (2013)
- Criteria (indicators) for financing scientific activities (MSE, 2013)
- Science and Society Action Plan (MSE)
- Horizon 2020 – Financial instrument for the implementation of the Innovation Union (EU, 2013)
- Plan for the development of scientific research and innovation infrastructure in the Republic of Croatia (MSE, 2014)
- Education, Science and Technology Strategy of the Republic of Croatia (2014)
- The Scientific Research and Artistic Strategy of University North 2014-2019
- Supplement to the Scientific Research and Artistic Strategy of University North 2014-2019 for Social Sciences
- Supplement to the Scientific Research and Artistic Strategy of University North 2014-2019 for Technical Sciences
- Supplement to the Scientific Research and Artistic Strategy of University North 2014-2019 for Humanities

- Supplement to the Scientific Research and Artistic Strategy of University North 2014-2019 for Biomedicine and Healthcare
- Supplement to the Scientific Research and Artistic Strategy of University North 2014-2019 for Arts
- Scientific Research Strategy for the Postgraduate Doctoral Study in Media and Communication 2019-2023
- Scientific Research Strategy for the Postgraduate international (joint) doctoral university study programme in International Economic Relations and Management 2019-2023.

The starting point in the development of the Scientific Research and Artistic Strategy of University North 2021-2027 are the goals and results defined and achieved in the Development Strategy of University North 2014-2019, and the changes and challenges faced by the European and global scientific research area - in particular the need to include scientific research activities of the University in the promotion of national and global economy, as well as the requirement to include scientific research efforts of the University in solving regional, national and international socio-economic challenges with regard to digital and technological changes, globalization, urbanization, demographic and global climate change.

Current and future national, European and global trends in the scientific research space (e.g. Altmetrics: changes in the methodology of monitoring and measuring the scientific research activities of the University, and Webometrics: ranking of scientific research activities of the University, were analysed in defining the vision, mission and strategic goals and activities. All those are in accordance with the Supplement to the Scientific Research and Artistic Strategy of University North for Social Sciences; Supplement to the Scientific Research and Artistic Strategy of University North for Technical Sciences; Supplement to the Scientific Research and Artistic Strategy of University North for Humanities; Supplement to the Scientific Research and Artistic Strategy of University North for Biomedicine and Healthcare, and Supplement to the Scientific Research and Artistic Strategy of University North for Arts.

4. VISION, MISSION AND QUALITY POLICY OF UNIVERSITY NORTH

"The vision of University North is to be the leading educational, scientific, professional and socially responsible higher education institution for the education of personnel in the technical, economic, biomedical and health fields, biotechnical and interdisciplinary sciences, and the art field, in northwestern Croatia.

Graduates of University North are, and will remain, desirable and employable experts due to the high level and breadth of acquired knowledge and competences, ready for independent and creative work in their profession. Part of the work that University North carries out is to foster the principles of quality in higher education, the principles of ethics, creativity, transparency and cooperation with other higher education institutions and, above all, good interpersonal relations."

The vision of University North focuses on achieving excellence in scientific research activities with the aim of improving the importance of the University in the national, European and global scientific research area. The vision of the University in the field of scientific-research and artistic activity is that it should be internationally acclaimed and recognisable for its scientific research activity (publication, visibility of research results), in order to provide economic and social benefits to the regional, national and international community.

"The mission of University North is the training of competent professional staff for the needs of the real economy and the healthcare system in the region of northwestern Croatia through the quality performance of professional and graduate study programmes in line with the requirements of the Bologna Declaration. In the implementation of this goal, University North is established as a dynamic organisation that constantly monitors, applies and integrates scientific and professional knowledge in the modernisation of existing and development of new study programmes, promotes the concept of lifelong learning and deepens and maintains links with the economy and the cooperation with related higher education institutions nationally and internationally."

The scientific and research mission of the University is to carry out world-renowned and recognisable scientific and research activities and innovations, and to connect scientific and research activities with the regional and national community and industry, in order to create added economic, social and cultural value. There is a need to involve scientific, teaching, administrative and technical staff as an active participant in the realisation of the scientific and research mission of the University. The obligation of the University is to provide scientific and financial support to the development of teachers' careers, and support the training of administrative and technical staff in order to continuously improve the scientific and research mission of the University. Furthermore, the scientific and teaching staff are obligated to increase scientific publications, project activities (applications for national and international scientific research and artistic projects), and to participate in education programmes for scientific, artistic, teaching, administrative and technical staff, especially in mobility programmes of the European Research Area.

"With its undergraduate, graduate and postgraduate study programmes, University North wants to meet the needs, requirements and expectations of students and the economy, as well as the community at large. It fulfils its obligations on the basis of modern knowledge of the profession, available resources, programmes and the principles of higher education in the European area. We are developing University North into a modern, European higher education institution that will be recognised for its teaching and

professional achievements. To this end, we cooperate with other universities, colleges, polytechnics, institutions and economic operators on the continuous improvement of teaching processes and programmes, and on the harmonisation of curricula with the principles of the Bologna Declaration and the generally accepted guidelines and standards in education. The quality management system at University North is based on ESG and ISO guidelines and standards, i.e. on documenting, monitoring and periodic review of study programmes, student assessment, teaching and administrative staff expertise and quality, learning and student support resources, as well as access to information and public information. The basic principles of operation for the quality assurance system include effective and efficient teaching processes, systematic and team approach, continuous improvement of all activities, and the involvement of all stakeholders, especially students. Students are the focus of all activities at University North. Our students' opinions about the teachers, programmes and the manner of education are very important to us, as are the opinions of our alumni and their employers. In recognising the importance of their satisfaction, we strive to take improvement measures to exceed their expectations.

Through its activities, University North takes measures for ensuring transparency of work, independence, impartiality and preservation of the integrity of the University and its employees. In doing so, it is very important for us to maintain a uniform financial balance of operations and raise employee standards and conditions for the implementation of the education process, which is in line with the Development Strategy."

5. ENVIRONMENTAL CHALLENGES, ANALYSIS OF SCIENTIFIC POTENTIAL AND FINANCIAL RESOURCES ALLOCATED FOR RESEARCH AT THE UNIVERSITY LEVEL

5. 1. ENVIRONMENTAL CHALLENGES

The challenges in the national and global research space today are greater than before due to the consequences of globalisation and modern technological challenges — the so-called Fourth Industrial Revolution. In these conditions, ensuring scientific excellence is the basis for the execution of study programmes in order to provide future students with knowledge, skills and abilities that will enable them to enter the labour market more easily.

Since University North is a young public university in Croatia, it strives for scientific and international recognition. It encourages the connection of researchers in a particular field of science and art, as well as in interdisciplinarity and at the individual level of each researcher.

The University's scientists publish papers in internationally recognised high-level journals, so they can be considered competitive in the European research area. It is necessary to systematically develop and encourage quality in research work and productivity, given that the majority of scientific publications at the University are below the level of European competitiveness.

University North faces the challenge of increasing scientific productivity by raising the number of papers published by scientific and teaching staff per year in internationally recognisable journals indexed in databases (Current Contents Connect and Web of Science (consisting of SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC) and SCOPUS) in accordance with the Decision of the Government of the Republic of Croatia on programme funding for public higher education establishments in the Republic of Croatia in the academic years 2018/2019, 2019/2020, 2020/2021 and 2021/2022 of 27 September 2018. The reference database for STEM sciences is the Web of Science (WoS), and for other fields of science the reference databases are WoS or SCOPUS.

The Ordinance on rewarding published scientific papers, visibility of scientists and accepted patents by employees of University North regulates, in more detail, the monetary rewarding of authors/inventors of published scientific papers and the visibility of scientists, i.e. accepted patents at University North. The Office for Science and Arts should work on the tasks of introducing Altmetrics, Webometrics and citation in the Google Scholar database, and other international cited databases.

5.2 ANALYSIS OF SCIENTIFIC POTENTIAL

The following is an overview of the indicators in the five-year development period of University North from 2015 to 2021.

Table 2 Overview of basic data in the five-year period of the University's activities

Indicator	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Number of teaching staff:						
Permanently employed	136	136	150	164	173	210
External associates	104	93	116	187	251	257
External Mentor Associates for practical exercises	113	135	155	201	238	263
Number of non-teaching staff:	35	36	38	41	46	54
Number of study programmes	15	15	20	26	26	26
Number of students enrolled	2912	2888	2947	3477	4053	4366
Number of participants in lifelong learning programmes	10	0	8	0	0	0
Number of library users	3952	4187	4443	4862	4794	7453
Space m²	9355	9355	13 255	13 255	13 255	13 255
Incomes and receipts (HRK) as of 31 December 2015 - 2019	30,086,483.00	43,813,796.00	44,520,655.00	48,629,855.00	55,609,510.00	63,105,284.00

Expenditure and expenses (HRK) as of 31 December 2015 - 2019	30,553,002.00	36,413,825.00	45,242,050.00	43,850,199.00	54,590,207.00	57,849,321.00

Current situation in the field of research and art at the University. Structure of teaching staff as of 31 December 2020.

Table 3 Structure of University researchers by title as of 31 December 2020.

Employees by title	Total at the University
Full Professor with Tenure	19
Full Professor - first election	14
Associate Professor	30
Assistant Professor	66
College Professor with Tenure	0
College Professor	1
Senior Lecturer	23
Lecturer	30
Assistant	8
Total employees teaching science and art subjects teaching and associate titles	191

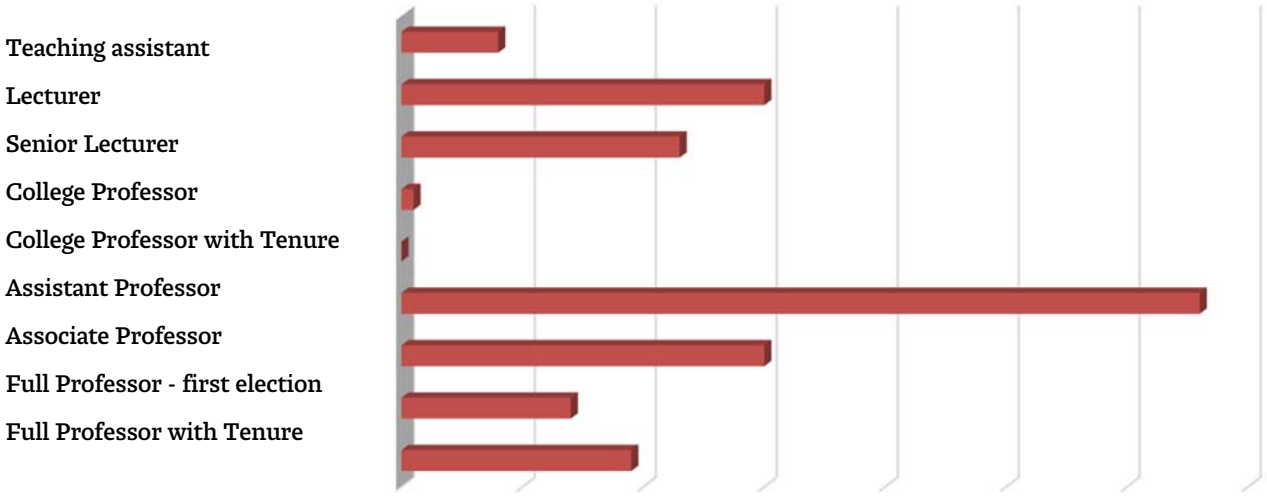

Chart 1 Structure of University researchers by title as of 31 December 2020.

Table 4 Structure of administrative and technical staff as of 31 December 2020.

Schedule by job type	Total
Type I jobs	15
Type II jobs	12
Type III jobs	17
Type IV jobs	7
Total	51

Table 5 Structure of researchers according to scientific fields as of 31 December 2019.

Field of science	Number of researchers	Percentage
Natural	5	3%
Technical	59	35%
Biomedicine and Healthcare	22	13%
Biotechnical	4	2%
Social	40	23%
Humanities	13	8%
Arts	9	5%
Interdisciplinary Sciences	19	11%
Total	171	100%

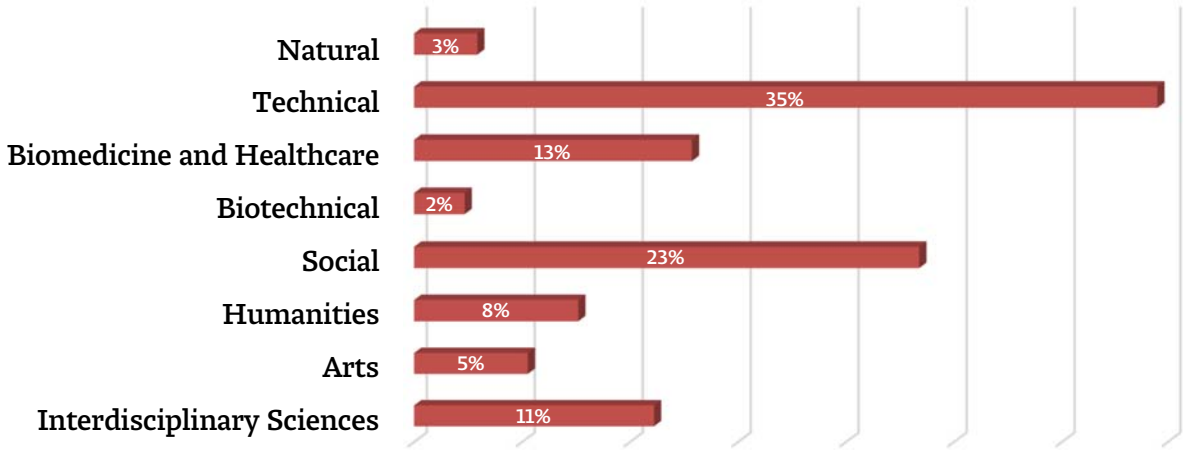

Chart 2 Structure of researchers according to scientific fields as of 31 December 2019.

Table 6 Structure of researchers according to scientific fields as of 31 December 2020.

Field of science	Number of researchers	Percentage
Natural	6	3%
Technical	68	36%
Biomedicine and Healthcare	21	11%
Biotechnical	5	3%
Social	44	23%
Humanities	13	7%
Arts	11	6%
Interdisciplinary Sciences	23	12%
Total	191	100%

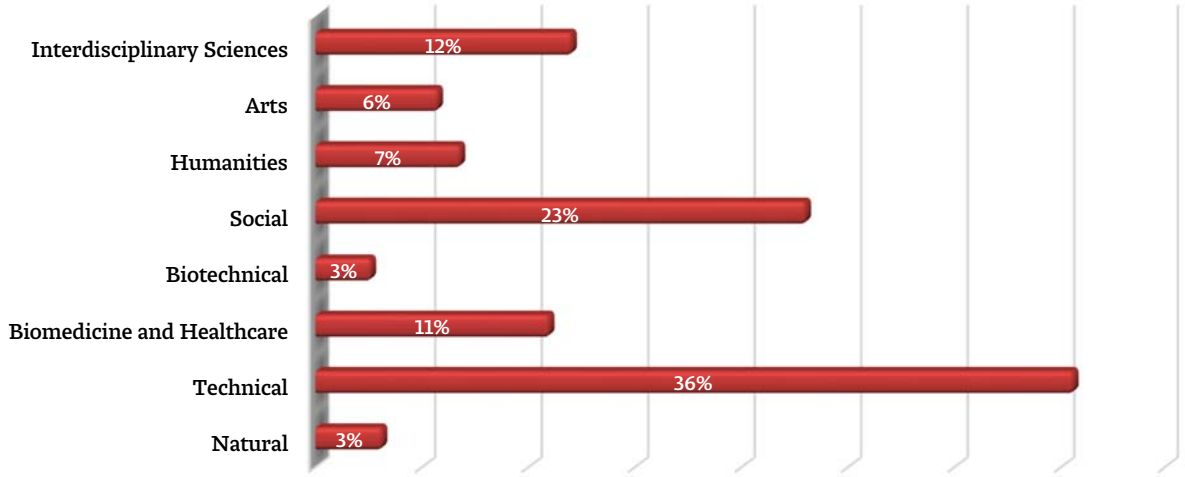

Chart 3 Structure of researchers according to scientific fields as of 31 December 2020.

Table 7 Indicators for the implementation of scientific activity - natural, technical, biotechnical sciences and biomedicine

	Indicators for the implementation of scientific activity	2015	2016	2017	2018	2019
1.1	Number of scientific papers published in journals indexed in the Web of Science database	0	15	64	96	121
2.1	Number of national competitive science projects contracted	0	2	1	0	0
2.2	Number of international competitive scientific projects contracted	0	0	2	0	0
2.3	Scientific books	5	2	3	8	1
2.4	Number of incoming mobility (longer than one month)	0	0	0	1	0
2.5	Number of outgoing mobility (longer than one month)	0	0	0	0	0
3.1	Number of contracted projects between the institution and the economy (including international projects), state administration bodies and local government, and self-government units, civil sector and NGOs	0	1	2	2	0
4.1	Activities for the popularisation of science	1	2	1	1	3

Table 8 Indicators for the implementation of scientific activity - social sciences and humanities, and interdisciplinary sciences

	Indicators for the implementation of scientific activity	2015	2016	2017	2018	2019
1.1	Number of scientific papers published in journals indexed in the Scopus database	3	10	59	19	58
2.1	Number of national competitive science projects contracted	0	0	0	0	0
2.2	Number of international competitive scientific projects contracted	1	0	0	1	0
2.3	Scientific books	6	3	4	5	3
2.4	Number of incoming mobility (longer than one month)	0	0	0	0	0
2.5	Number of outgoing mobility (longer than one month)	0	0	0	0	0
3.1	Number of contracted projects between the institution and the economy (including international projects), state administration bodies and local government, and self-government units, civil sector and NGOs	0	0	0	1	0
4.1	Activities for the popularisation of science	1	2	1	1	3

Table 9 Indicators for the implementation of artistic and scientific activity - arts

	Indicators for the implementation of artistic and scientific activity	2015	2016	2017	2018	2019
1.1	Number of works of art executed, produced, exhibited, published, presented to the public (artwork is considered to be the result of artistic and creative activities according to the fields of Art Content contained in the Ordinance on Scientific and Artistic Areas (e.g. solo or group exhibition, presence of works in the exhibition or collection, graphic map, concert, film, performance, multimedia project, dance performance, conservation and restoration work, etc.)	25	43	15	23	17
1.1.1	At an international festival, parade, exhibition or similar event	7	8	5	12	11
1.1.2	At a national festival, parade, exhibition or similar event	16	27	19	25	13
1.1.3	Audio-visual recordings	15	10	16	4	1
1.1.4	Number of other works presented in the Republic of Croatia and abroad	19	29	13	20	19
1.2	Number of awards, prizes or nominations for artistic work	1	1	0	1	0
1.2.1	Highest national vocational awards and prizes (including lifetime achievement awards)	0	0	0	0	0
1.2.2	At an international festival or exhibition	3	9	4	9	8
1.2.3	At an event of national importance	0	1	0	6	0
1.3	Number of artistic research projects	6	9	8	11	11
1.3.1	Artistic research projects at the home university and beyond	3	5	6	7	8
1.3.2	Artistic research workshops and seminars	1	3	3	6	3
1.4	Number of artistic and professional meetings, jury tribunals, judging committees participated in	4	9	7	5	6
1.4.1	International and national juries	5	10	8	7	7
1.4.2	Participation in the judging committees of artistic and artistic/scientific projects	0	0	0		
1.4.3	Participation or organisation of artistic or artistic/scientific conferences and workshops	2	1	1	2	2
1.5	Books	0	0	0	0	1
1.5.1	Authored art publications	0	2	0	0	0

1.5.2	Scientific books related to art, the artistic, scientific or interdisciplinary field (one or more authors) that present the results of research and knowledge important for the national and/or international cultural context published in the Republic of Croatia	0	0	0	0	1
2.1	Number of incoming mobility (longer than one month)	0	0	0	0	0
2.2	Number of outgoing mobility (longer than one month)	0	0	1	1	0
3.1	Number of contracted projects between the institutions and organisations from the culture sector, the economy (including international projects), state administration bodies, local government and self-government units, civil sector and NGOs	5	7	8	6	7
4.1	Activities for the popularisation of science	5	6	8	5	13

Table 10 Number of postgraduate study programmes, doctoral students, postgraduate students, defended dissertations and postgraduate specialist papers

Indicators of scientific activity	2017/2018	2018/2019	2019/2020	2020/2021
Number of postgraduate study programmes	1	3	3	3
Number of doctoral students	7	40	63	96
Number of postgraduate students studying specialist subjects	0	17	29	45
Number of doctoral students from the University	4	7	7	5
Number of postgraduate students from the University studying specialist subjects	0	2	3	4
Number of defended dissertations	0	1	1	2
Number of defended postgraduate specialist theses	0	0	1	5

Table 11 Number of active mentorships for doctoral students

Mentorships	2017	2018	2019	2020
Number of active mentorships for doctoral students	4	5	33	34
Number of active counsellors for doctoral students	0	32	25	25
Proportion of teachers who are active mentors to doctoral students in the total number of teachers (in %)	2.7	3	27	27

Table 12 Number of projects involving teachers/associates

Provision of scientific, advisory and professional services	2015	2016	2017	2018	2019	2020
Number of projects involving teachers/associates	4	3	5	15	8	6
Number of teachers/associates participating in projects	10	11	25	42	23	19
Proportion of teachers/associates participating in projects in the total number of teachers/associates (in %)	7.35	8.09	16.67	25.61	13.29	9

Table 13 Number of titles of publications published by the University

Publishing	2015	2016	2017	2018	2019	2020
Number of titles (all types of publications) published by the University	11	5	7	13	4	19

5.3 FUNDING ALLOCATED FOR RESEARCH AT UNIVERSITY LEVEL

Every teacher and associate at University North is provided with financial support for the needs of research work and attending conferences. Since 2016, the Ministry of Science and Education allocates funds for scientific activities to University North. In 2016,117,000 HRK were allocated to the University for these purposes, and additional funding was provided by the University in the amount of 9,053.38 HRK. In 2017, the University received funds from the Ministry of Science and Education in the total amount of 200,000 HRK and additional funding was provided by the University in the amount of 816.38 HRK. In 2018, the Ministry of Science and Education allocated 277,845 HRK to the University for scientific activities, and additional funding was provided by University North in the amount of 414,868 HRK. In 2019, the Ministry of Science and Education allocated a total of 800,000 HRK for scientific activity and additional funding was provided by the University in the amount of 626,271.58 HRK, of which 178,999 HRK were allocated to doctoral students and mentors of University North. In 2020, funds were allocated to support scientific research and artistic work in accordance with the Decision of the University North Senate on the final allocation of funds in the total amount of 1,863,231.90 HRK.

Table 14 Support for scientific research and artistic work 2016. - 2020

FIELD OF SCIENCE	Number of supports 2016	2016 amount in HRK	Number of supports 2017	2017 amount in HRK	Number of supports 2018	2018 amount in HRK	Number of supports 2019	2019 amount in HRK	Number of supports 2020	2020 amount in HRK
Technical sciences	4	64,918.29	5	79,322.18	11	199,686	12	477,344	17	650,945
Biomedicine and Healthcare	0	0	0	0	3	80,000	3	190,000	4	266,000
Biotechnical sciences	0	0	0	0	0	0	2	42,000	2	130,000
Social sciences	3	43,528.49	5	89,054.74	16	224,451	8	239,678.99	14	498,276.90
Humanities	0	0	0	0	5	74,845	5	177,259.59	5	168,010.00
Arts	1	17,606.60	2	32,439.46	7	113,731.00	3	119,990.00	6	150,000.00
Total	8	126,053.38	12	200,816.38	42	692,713.00	33	1,246,272.58	48	1,863,231.90

Table 15 Support for scientific research in postgraduate doctoral study programmes, 2019

		Number of supports	Amount in HRK
1	Doctoral students and mentors at the doctoral study programme: Media and communication	18	90,000.00
2	Doctoral students at the doctoral study programme: Media and Communication	4	59,999
3	Doctoral students and mentors at the joint doctoral study programme: International Economic Relations and Management	3	30,000
Total		25	179,999

6. DEVELOPMENT PROJECTION (STRATEGIC OBJECTIVES AND ACTIVITIES)

In the planned strategic period of the University, it is necessary to significantly improve and enhance the current position. According to the analysis conducted to develop this strategy, it is evident that the University has the potential to improve international visibility. In order to achieve this, it is necessary to increase the number of employees in the Office for Science and Artistic Work, the Office for International Cooperation and the Office for EU Funds, Development Projects and Cooperation with the Economy, and improve the quality of scientific research work, teaching processes, administration, quality management processes, and to build innovative scientific research structures in support of scientific research and artistic work.

In addition to these objectives, it is necessary to strengthen the partnership with the economy, the public sector and the local community, in order to secure the necessary financial resources. In order to achieve these goals, the efforts of every scientist at the individual level, every department and the University as a whole are needed.

The main outcomes for the area of research are:

- To achieve the highest quality research according to international standards
- To contribute to the knowledge fund and the social and economic progress of the Republic of Croatia, the European Union and globally.

To achieve this, it is necessary to ensure: scientific teaching staff, cooperation with academic and economic entities, and financial resources.

Special attention is given to the **STEM* *** field, which includes the field of biomedicine and health care, natural, technical and biotechnical sciences, arts and STEM – the interdisciplinary field of science.

Core funding of the material costs of scientific and artistic activities is calculated on the basis of the number of full-time employed scientists (elected to a scientific or artistic title) in a particular field, and is proportional to the number of papers published in journals introduced in the Web of Science database for STEM sciences, i.e. the number of papers published in journals introduced in the Web of Science database and the SCOPUS database for social sciences, humanities, interdisciplinary sciences and arts, published over the period of one year according to the following table:

*STEM - Science, Technology, Engineering and Mathematics. Includes areas of science, technology, engineering and mathematics

Table 16 Core funding of material costs of scientific and artistic activities

FIELD	STEM (BIOMEDICINE, BIO-TECHNICAL, NATURAL, TECHNICAL), ARTS, STEM - INTERDISCIPLINARY	SOCIAL, HUMANITIES, INTERDISCIPLINARY (SH)
AMOUNT	13,500 HRK	7,500 HRK

The number of published scientific papers is submitted to the Ministry of Science and Education for each (previous) calendar year no later than the end of February. The basis for the payment of core funding

of the material costs of scientific and artistic activity in each academic year is the data from the previous calendar year.

The total annual funds for core funding of the costs of scientific activity must not be less than 800,000 HRK for the University.

Universities that conclude programme contracts will be provided additional funding based on results, in addition to the core funding of the material costs of scientific activity. The funding of the scientific activity based on results may amount to up to 20% of the core funding of the costs of scientific activity, and is based on the value of the contracted national and international competitive scientific projects, i.e. their share in the total revenue. When calculating the share in total revenues, the value of each individual contracted project is taken only once in the year in which the project contract has been signed. Total revenues consist of funds allocated from the State Budget and all other revenues of universities, according to the share of completed doctoral students not employed in the system of science and higher education in relation to the total number of completed doctoral students in one academic year, and according to the number of published papers in the first quartile (Q1) in journals introduced into the Web of Science database according to FTE.

Additional funding of material costs of artistic activity based on results is calculated in such a way that it is proportional to the number of permanent employees in the artistic teaching profession, the number of students, and vice versa proportional to the number of external associates. The total amount for all higher education institutions for additional funding of material costs of artistic activity based on results cannot exceed 10,000,000 HRK per year.

The main strategic aim of the Scientific Research and Artistic Strategy of University North 2021-2027 is:

To establish University North as a scientific research centre of scientific and artistic excellence, and to raise scientific productivity in the Web of Science database for better visibility at national, European and global levels in the future time period.

Direct scientific and research goals as a basis for the University's scientific research action plan

The strategic objectives of scientific research and artistic activity are defined at the level of:

1 General strategic aims

2 Scientific topics in a particular field of science or art

6.1 GENERAL STRATEGIC AIMS

Strategic aim 1: RESEARCH EXCELLENCE AND ENSURING INTERDISCIPLINARITY

Strategic aim 2: ENSURING THE QUALITY OF SCIENTIFIC ACTIVITIES

Strategic aim 3: INTERNATIONAL COOPERATION

Strategic aim 4: TEACHING TRANSFERABLE SKILLS AND COOPERATION WITH THE ECONOMY

Strategic aim 5: DIGITAL TRANSFORMATION AND SUSTAINABILITY

Strategic aim 6: INVITING INSTITUTIONAL ATMOSPHERE

Strategic aim 7: POPULARISATION OF SCIENCE, ART AND PROMOTION OF UNIVERSITY NORTH

Strategic aim 1: RESEARCH EXCELLENCE AND ENSURING INTERDISCIPLINARITY

To foster scientific excellence, the University must provide the basic prerequisites for creating a stimulating scientific research environment. In order to create these conditions, it is necessary to establish a scientific research profile for each department, and to encourage and reward the excellence of scientific teaching staff in scientific research. Since the Ordinance on the rewarding of published scientific papers, visibility of scientists and accepted patents established by employees of University North has been adopted, it is necessary to introduce and monitor independent research work and increase financial resources for research and build a scientific research structure.

The role of University North is to provide material conditions for the work and advancement of all scientists working at University North, encompassing all relevant fields of science and art. Software and hardware support for research purposes should be provided, including research software, computers, audio and video aids, e-learning interfaces, advanced learning systems and smartboards. Furthermore, it is very important to make research literature available, such as journals, books and subscriptions to prominent databases of scientific research journals.

It is important to ensure the unhindered development of young assistants and scientists as well as their advancement, which will increase the number of internationally visible and recognisable papers published, and thus the scientific international recognition of the University. The University is obliged to ensure the establishment of several internationally recognised journals published by the University, in which scientists from the University will publish their papers, in order to acquire the conditions for selection to a higher title in accordance with the regulations and legal conditions.

The future vision of the University is to strengthen interdisciplinary research that will contribute to the added value and quality of scientific work, and increase the strategic challenges of today.

Implementation of activities to achieve the stated aims:

1. To establish a scientific research fund to provide: funds for access to scientific databases, funds for printed scientific literature, funds for applying to international research projects, rewarding scientists for work in international research and development projects, funds for institutional one-year grants for increasing scientific productivity and funds for career development of young scientists.
2. To increase the number of doctoral students at the postgraduate university doctoral study programme in Media and Communication and joint doctoral studies, and longer ingoing mobility in the duration of at least one semester.
3. To promote the internationalisation of higher education to attract foreign students (especially doctoral students) and teachers.
4. To work on the preparation of international projects.
5. To create a University bibliographic centre and continuous development of the e-library project.
6. To increase the number of employees in the Office for Science and Arts and the Office for International Cooperation.
7. To ensure the support of the information system for the systematic collection of information (scientific repository) in cooperation with the library.

Indicators for achieving the aims:

- Funding for scientific research and artistic activities awarded by the University.
- Funding for scientific research and artistic activities awarded by the public sector, the economy and international programmes.
- Number of scientific research projects involving University scientists.
- Number of scientific research projects funded by the public sector, economy and international programmes.
- Number of doctoral students at the University.
- Number of doctoral students employed by the University.
- Number of doctoral students financed by the public sector, economy and international programmes.
- Proportion of teachers who are active mentors to doctoral students.

Strategic aim 2: ENSURING THE QUALITY OF SCIENTIFIC ACTIVITIES

Efficiency and quality in the scientific research process, including the teaching process, the administrative-technical and management process, and the quality management process, are the main prerequisites for ensuring the quality of scientific activity of the University.

Further enhancement of the quality of scientific research will be carried out through the continuation and strengthening of activities to create an atmosphere at the University that encourages internationally competitive quality research in all fields of science, and in accordance with the positive experiences of the world's highest quality scientific organisations.

It is necessary to ensure quality as a driver of change at the level of higher education institutions and higher education systems.

External independent quality assurance of higher education institutions to link education and science to the labour market is important.

The high quality of tertiary education is a guarantee of acquired knowledge, skills and competences of graduate experts, and thus of a competitive economy.

The scientific research process at the University depends on individual initiatives of scientists at the University. As the University prepares for re-accreditation, it is important to develop a Scientific Research and Art Strategy for the 2021-2027 period. Scientific recognition, citation of scientists and scientific reach of the University are important criteria for future funding of the University.

By rewarding published scientific papers, visibility of scientists and accepted patents, University North encourages an increase in scientific productivity, which leads to a greater recognition of the University.

Evaluation of scientific excellence and productivity should include the quality of papers and advancement to higher titles of teachers according to the available coefficients for scientific and teaching staff with the highest quality papers, and with the highest impact factors, published in the Web of Science database, their quartile position and paper citation. The quantitative indicator of scientific productivity will be a ranking criterion defined on the basis of qualitative and quantitative (scientometric) criteria, and the creation of a ranking scale of scientific productivity at the University that will need to be updated every year. The list thus determined will be the basic criterion for advancement to a higher title with positively evaluated student surveys.

The criteria of excellence must be evaluated when selecting and appointing to a specific function (quality of works and success in guiding young scientists).

Implementation of activities to achieve the stated aims:

1. Support to scientific and teaching staff in disseminating the results of research of published papers with the aim of increasing the impact factors of the papers and international scientific recognition of the University by introducing the Alternative Metrics system (Google Scholar, ResearchGate and others).
2. Increasing the library fund in support of scientific research, teaching process and publication in achieving excellence in all scientific fields at the University.
3. The aim is to introduce the general public to the best scientific papers, monographs, textbooks, best student works, the Science Festival, and the University student radio.

4. The introduction of a system of international evaluation and ranking of the scientific excellence of the University is possible through constant assessment of the quality of scientific and teaching work at both the national and international level. Evaluation should be carried out throughout the University in order to introduce quality improvement measures in certain parts, and to achieve an appropriate international position by defining concrete activities and procedures for improving the scientific research activity of the University.
5. The introduction of the DOI (*Digital Object Identifier*) system for scientific publications of the University is required.
6. Regular monitoring, updating and support to scientists when entering papers in the CROSBI database.
7. Regular monitoring, updating and support to scientists when entering papers in the CROSBI database.
8. Linking CROSBI/POIROT projects.

Indicators for monitoring the achievement of aims:

- Number of published papers in journals indexed in bibliographic databases that are recognised as the highest category in certain areas.
- Number of published papers in journals indexed in the CC/SCI/SSCI/ESCI and SCOPUS bibliographic databases.
- Number of published papers in journals indexed in bibliographic databases that are recognised as the highest category in certain areas, as well as the number of scientific-teaching and teaching staff.
- Number of scientific papers published in conference proceedings that are referenced in the CC/SCI/SSCI/ESCI databases for the field of STEM sciences, and in the CC/SCI/SSCI/ESCI and SCOPUS databases for social sciences and humanities.
- Amount of funding for scientific activities and number of scientific-teaching and teaching staff.
- Number of scientific conferences and Science Festivals held.
- Proportion of teachers involved in international scientific research and art projects.
- Total amount of funding of art projects at the University in one year.
- Number of realized projects in the art field.
- Number of papers by scientists entered in the CROSBI database.
- Percentage of projects entered in the POIROT database.

Strategic aim 3: INTERNATIONAL COOPERATION

International cooperation and internationalisation are key factors that guarantee and improve the quality of higher education institutions, which gives institutions recognition throughout the world, but also in Croatia. The aim is to strengthen international cooperation as much as possible, i.e. the internationalisation of activities and programmes.

University North is open to establishing international cooperation and intensifying partnerships with similar institutions in Europe and around the world, developing international education programmes, opening and increasing enrolment quotas for incoming students and participating in international projects, especially in the field of research and higher education.

By encouraging and implementing active international cooperation, the University becomes internationally visible and recognised.

Through active international cooperation and continuous informing of target groups through trainings, workshops and conferences, the University encourages its teaching and non-teaching staff and students to participate in international projects, and to realise outgoing and incoming mobility within the Erasmus+ and CEEPUS programmes for the purpose of acquiring and disseminating new knowledge and experiences.

The implementation of sustainability in mobility programmes encourages green mobility with the aim of creating a strategy for a green future.

As education is the basic activity of the University, it is necessary to monitor exceptional teaching, scientific and work achievements at all levels to reward students, as well as the teaching and non-teaching staff. Best published scientific work should be rewarded, the publication of scientific papers by students and teachers should be encouraged, and administrative and technical staff who have significantly improved the processes related to scientific research should be rewarded. A special reward should be awarded to scientists who promote the international visibility of the University in the European and global research area.

Implementation of activities to achieve the stated aims:

1. To increase research and development capacities and scientific research and innovation work by encouraging new ideas and developing new products in order to improve the Croatian economy.
2. To encourage applying for international scientific projects with the aim of raising the visibility of the University in the international, European and global research environment.
3. To invite visiting professors, distinguished international scientists from the diaspora and beyond.
4. To increase the number of employees in the Office for Science and Artistic Work, the Office for International Cooperation and the Office for EU Funds, Development Projects and Cooperation with the Economy, in order to intensify the activities related to the application, management, monitoring, oversight, sending the necessary documentation and administrative actions related to the projects. In this case, the project manager would have the role of supervising and coordinating activities, while all administrative actions around the projects would be performed by the said offices.

5. To enable smart specialisation through the production and public sector and increase the number of lifelong learning programmes in order to acquire appropriate knowledge and skills for the needs of the labour market. Furthermore, activities on the dissemination of knowledge should be strengthened by organising science festivals, conferences, symposia and others.
6. To design scientific research that will result in scientific discoveries in the field of science for which the University is accredited.
7. Recruitment and retention of the best students at the University by engaging in scientific research work to ensure the development of scientific youth.
8. To invite distinguished world scientists to work at the University.

Indicators to be monitored in order to achieve the above aims:

- Number of doctoral students who spent at least three months in training outside the Republic of Croatia during their doctoral studies.
- Number of doctoral students and teachers from abroad who have spent at least three consecutive months at the University.
- Number of PhDs who will be in training outside the Republic of Croatia for at least six months after the doctoral study.
- Number of best students and doctoral students involved in scientific research, and number of awards awarded.
- Number of international scientific projects submitted.
- Number of awards for inclusion in European research projects.
- Number of participants in international scientific conferences.
- Number of published papers in foreign journals.
- Number of visiting professors who are distinguished international scientists.

Strategic aim 4: TEACHING TRANSFERABLE SKILLS AND COOPERATION WITH THE ECONOMY

With its research capacities, knowledge and scientific excellence, the University wishes to assume the role of connecting science with the economy. Knowledge, expertise and interdisciplinary approach in solving project tasks located in University laboratories represent the potential for cooperation with the economy with increasing initiative in research, development and innovation.

It is important to stimulate the strengthening of the economy through investment in research, development of innovation, strengthening scientific excellence and encouraging open science and better integration of the academic, research and business sectors. This will enable the creation and use of knowledge and increase productivity through digital transformation and the application of new technologies in the economy.

In particular, ideas related to the development of a globally competitive, green and digital economy will be encouraged, based on an export-oriented, greener and smarter economy, and on people innovation and new technologies with the primary goal of cross-sectoral interaction.

With the rapid advancement of science and technology and the challenges of globalisation, the acquisition of knowledge, the creation of new knowledge, their application, renewal and increase become a fundamental global challenge. Scientific research work and transferring its results into goods, services and processes is a fundamental lever in creating a competitive economy and knowledge society. The scientific research system will be improved in order to achieve European and global standards of excellence in all scientific disciplines.

Public-private partnership between the University, the Ministry of Science and Education, Koprivnica-Križevci County, Varaždin County and the economy should provide more funds for financing collaborative projects in all areas of science and art, related to the University. This would result in the creation of innovative and competitive companies and would lead to the strengthening of the economy in both counties.

Implementation of activities to achieve the stated aims:

1. To increase the number of workshops and other teaching activities aimed at teaching transferable skills.
2. Involvement of associates from the economic sector in the organisation and management of workshops.
3. Evaluation of the success of the classes held.
4. To increase the number of ECTS credits acquired through informal forms of education in the workplace.
5. Involvement of industry and labour market representatives in scientific projects.
6. Promotion of all levels of study among students and employees of public, commercial and other scientific institutions who may be interested in enrolling in study programmes in order to attract as many quality candidates as possible.
7. To create a networking framework for the application of research results in the economy.

Indicators to be monitored in order to achieve the above aims:

- Number of workshops and other activities held, and number of participants.

- Number of economic sector associates involved.
- A database of conducted and processed surveys after lectures, and by semester.
- Recorded number of ECTS credits recognised in accordance with participation in informal forms of education.
- Number of companies and labour market representatives involved in scientific projects.
- Records of promotional activities.
- Establishment of digital information centres, competence centres and technology transfer centres.

Strategic aim 5: DIGITAL TRANSFORMATION AND SUSTAINABILITY

Digital transformation covers a large number of processes, interactions, technological updates, changes, internal and external factors, industries, etc. While there are common challenges and goals and traits in organisations around the world, there are also huge differences across industries, regions and organisations.

Technological changes in information and communication technology, and digitalisation, are creating new and transforming traditional forms of work, and present great challenges for the traditional labour market.

University North will encourage the creation of a scientific and technological system that will be one of the key factors in the social and economic development of northwest Croatia, with an emphasis on digital reforms and innovations in green and digital transition as support to Europe's recovery after the crisis caused by the pandemic.

Efforts are needed to strengthen the mobility of researchers and the free movement of knowledge and technology, in particular through strengthening cooperation with the countries of the European Union.

Implementation of activities to achieve the stated aims:

1. Fostering sustainable mobility programmes.
2. Involvement of associates in workshops on innovative solutions to today's environmental challenges.
3. To encourage the use of sustainable resources, and resources, by digitising the business process.
4. To support the development of innovative methods of learning and teaching, and online cooperation.
5. To support digital opportunities (skills for the future).

Indicators to be monitored in order to achieve the above aims:

- Number of workshops held related to new learning methods.
- Number of seminars and workshops related to environmental awareness where innovative applicable solutions were presented.
- Number of digitised processes implemented in business.
- Number of innovative methods of learning and teaching.
- Number of scientific conferences held virtually with the participation of scientists.
- Number of virtual exhibitions of artists held.

Strategic aim 6: INVITING INSTITUTIONAL ATMOSPHERE

University North, the eighth public university in the Republic of Croatia, is established as a dynamic organisation that constantly monitors, applies and incorporates scientific and professional knowledge, promotes the concept of lifelong learning and deepens and maintains links with the economy and cooperation with related higher education institutions in the country and abroad.

The implementation of lifelong learning and skill development programmes and activities will be encouraged, in particular aimed at strengthening digital and entrepreneurial skills, and financial management and literacy skills.

University North provides students with the opportunity to study at the most modern standards, up to the highest academic level.

Implementation of activities to achieve the stated aims:

1. To draft and update regulations that regulate the rights and obligations of students at all levels of study.
2. To provide e-courses at the level of the entire study programme (Merlin)
3. To open AAI@EduHr electronic identities for students at all levels when enrolling in study programmes.
4. To introduce the ability to record classes using Google Meet, Zoom, webinars, etc.
5. To improve human resources by increasing lifelong learning programmes and improve knowledge and skills with an emphasis on entrepreneurial and digital skills as key prerequisites for strengthening small and medium-sized entrepreneurship.

Indicators to be monitored in order to achieve the above aims:

- Evaluation of surveys on an annual basis.
- A list of open courses on the Merlin e-learning system, and a list of students and teachers using the system.
- Number of students enrolled.
- Recordings of lectures held and a list of listeners (students).
- Number of participants in lifelong learning programmes.

Strategic aim 7: POPULARISATION OF SCIENCE, ART AND PROMOTION OF UNIVERSITY NORTH

Improving the perception of science as a socially useful activity enables the development and progress of the community, thus achieving competitiveness in the knowledge market. The popularisation of science and art among scientists and artists fosters competitiveness in order to motivate scientists and artists to strive for new ideas in the realisation of their projects.

At the national level, the University will play a key role in popularising science and raising awareness of the importance of knowledge, scientific research and artistic work for the development of society and culture.

Transparency and recognition of the University is achieved by organising open days of the University for each university centre at least once a year, and by introducing the public to scientific achievements and presenting university publications realised in the previous year.

University North is a dynamic organisation that continuously monitors, applies and integrates scientific and professional knowledge, and implements them in its work.

Implementation of activities to achieve the stated aims:

1. Open Days of the University.
2. To organise activities for the popularisation of science (Science Festival, Researchers' Night).
3. Collaboration with secondary schools.
4. To hold conferences by which the University is the organiser/co-organiser.
5. Erasmus Info Day.

Indicators for achieving the aims:

- Number of workshops/lectures held at the Open Days of the University.
- Number of workshops/lectures held at the Science Festival.
- Number of workshops/lectures held within the Researchers' Night.
- Number of conferences by which the University is the organiser/co-organiser.
- Number of presentations held by University North in secondary schools.
- Number of Erasmus Info Days held.

6.2 SCIENTIFIC TOPICS PER INDIVIDUAL FIELD OF SCIENCE OR ART

The Scientific Research and Artistic Strategy of University North is focused on the scientific improvement and affirmation of existing educational programmes, excellence and measurable quality, as well as applicability in the national and international environment.

The University is active in the field of science and art.

The University was issued permits by the Ministry of Science and Education, i.e. certificates on the fulfilment of the conditions for performing scientific or artistic activities, as follows for:

1. Social Sciences – April 15, 2016
2. Arts – April 15, 2016
3. Technical Sciences – July 28, 2016
4. Humanities - 27 February 2018
5. Natural sciences, Biomedicine and Healthcare - April 10, 2018.

Below are specified and detailed scientific topics in which the research holders are scientists in certain fields of science, i.e. art.

6.2.1 STRATEGIC PROGRAMME OF SCIENTIFIC RESEARCH IN THE FIELD OF TECHNICAL AND BIOTECHNICAL SCIENCES

The Scientific Research and Artistic Strategy of University North emphasises the importance of maintaining acquired and developing new innovative, creative and recognisable values with a high degree of involvement in technical-technological achievements, and comprehensive social and sociological progress. It emphasises the need to build and preserve its own recognition in the academic and social community. University North nurtures and improves the principles of quality in scientific research and scientific teaching work, and the principles of ethics, creativity, transparency, develops and improves cooperation with other international and national higher education scientific teaching and research institutions, economic operators, and nurtures and develops academic respect and excellent interpersonal relations.

Scientific research in the field of technical and biotechnical sciences is characterised unambiguously and synergically by the following keywords: advanced manufacturing processes and technologies, industry 4.0, graphic and electronic design, ecological engineering, machine learning and artificial intelligence, general and energy digitisation, energy efficiency, renewable energy sources and energy transfer, simulation, modelling, automation, graphic design and industry, digital printing, logistics and mobility, food quality and health safety, interdisciplinarity, excellence and applicability.

The strategic goals of scientific research in the field of technical and biotechnical sciences from 2021 to 2027 at University North are grouped according to the fields of technical and biotechnical sciences with a visible connection between individual research topics and pronounced multidisciplinarity. Commitment to further modernisation and development of study programmes in the STEM field, connection with the economy of the region and the wider area, and recognition of scientists and experts of University North and their directly applicable results was emphasised.

Research is focused on new technologies, digitisation, green transition through advanced and applicable forms of renewable energy, possible forms and modification of methods of development of applicable advanced automated production processes, intelligent logistics and mobility, energy efficiency, environmental engineering, materials and packaging, development of simulation and applicable algorithms of interdisciplinary content, development and improvement of digital printing and contribution to the graphic industry and application and development of supervised machine learning with the application of the reach of artificial intelligence. Research in the field of biotechnical sciences is aimed at improving and developing the quality and health safety of food products, and the scientific and applicable contribution of individual components and compounds.
The prominent goals of scientific research in the field of technical and biotechnical sciences in the stated period at University North are:

- Positioning and development of logistics and logistics systems in a modern business environment.
- Logistics as an interdisciplinary phenomenon.
- Sustainable logistics of urban and rural environments.
- Development and application of new digital technologies in logistics transformation according to logistics 4.0 and logistics 5.0.
- Development of supply chain management and operations management.
- Organising sustainable urban mobility.

- Standards for the implementation of measures for sustainable urban mobility.
- Intelligent mobility.
- Spatial-traffic interaction.
- Minimum standards of public transport availability.
- Development of analytical and computer modelling of anisotropic grain side pressure material on rigid parallel walls.
- Development and implementation of anisotropy modelling of bulk material strength by discrete element method – DEM.
- Research of combined operation for small hydropower plants and solar photovoltaic plants.
- Solar photovoltaic pumping in water supply systems.
- Conducting testing and assessment of the technical condition of historical buildings in cultural and historical environments.
- Analysis of the technical condition and plan for the rehabilitation of buildings damaged by the 2020 Zagreb earthquake.
- Analysis of a large amount of synchronised measurements.
- Exploring and proposing adaptive machine learning methods in predicting outcomes in sport using an optimal time frame and utility index.
- Research of the information system for monitoring and evaluating basketball players and teams using a comprehensive efficiency index – the foundation for the future basketball expert system.
- HbbTV technology-based application interface design.
- Optimisation of graphic image preparation for digital and print media.
- Determining the quality criteria for bitmap image reproduction in standardised systems.
- Research of the influence of the occurrence of psychophysical visual effects in the cross media reproduction system on the perception of the observer's colour experience.
- Research of print quality in digital printing (electrophotography and inkjet).
- Research of the durability of the printed colour in protected printing.
- Optimisation of the parameters of thermal processes in material processing.
- Research of the influence of additive process parameters and heat treatment parameters on the structure and properties of materials for technical and biomedical products.
- Determination of the reproduction quality due to deformation of the raster element in flexoprint.
- Researching the impact of the printing media on the quality of line and text reproduction in flexography.
- Analysis of the influence that the composition of the activation coating has on the properties of welded joints in A-TIG welding of Cu-ETP copper.
- Analysis of the influence that the composition of the activation coating has on the properties of welded joints in A-TIG welding of stainless steel.
- Analysis of the impact of welding parameters in MIG welding of stainless steels.
- Analysis of the impact of machining parameters on the wear of the cut tool during machining by separating stainless steel particles.
- Exploration and reduction of losses in production processes using the LEAN concept principle.
- Quality management in industry 4.0.

- Investigation of the impact of processing parameters on the thread quality of a large cross-section made by peeling on a classical lathe.
- Construction and manufacture of devices for testing the mechanical properties of rockwool.
- Packaging engineering in the role of environment protection.
- Development of a conceptual, mathematical and computer model of DOC decay in baled, mixed municipal waste.
- Antimycotoxic food protection.
- Quality and health safety of food products in gastronomic trends.
- Specialised plant metabolites as useful molecules for the food industry.
- Application of micro-reactors for the implementation of chemical and biochemical reactions.
- Sensory properties of food.
- Antimicrobial properties of newly synthesised compounds and extracts.
- Plant metabolomics.

The realisation and fulfilment of these goals will be facilitated by the implementation of scientific research activities at University North, including partner and collaborative institutions and companies (universities, faculties, institutes, polytechnics, specialised companies, production and processing entities, technology companies and innovation centres...) in Croatia and abroad, education of students at the undergraduate, graduate and postgraduate levels, and strong popularisation of science. Research activities, publication of results and achievements in Croatia and abroad, and possible forms of applicability and creativity of new or modified forms of technical solutions and/or products, will contribute to the development of University North and the achievement of general strategic aims. Scientific research contributing to the technical and biotechnical field will enable interdisciplinarity and greater flexibility in the breadth and depth of research excellence. Scientific projects funded by the Croatian Science Foundation and University North, international projects and applicable technical and technological economic projects, as well as the involvement of foreign scientists and experts in research are indicators of research excellence, which achieves international recognition, sustainability and constant competitiveness. Given the integrative nature of research and the involvement of experts from collaborative institutions, it will be possible to transfer and exchange knowledge, develop skills and tools, and achieve results from University North to partner institutions and entities with the aim of possible applicability and achieve greater efficiency and cost-effectiveness. The transfer of knowledge, innovation, digital technical and technological skills will enable the development of appropriate graduate studies, strengthening economic cooperation in the region and wider area, and lifelong education on new and innovative technologies used in practice. At all levels of study, students will be provided with new and modified teaching content (amendments to the teaching content of individual courses and additional new courses), and through the availability and openness of the University, all interested parties and the general public will be provided with additional education by engaging in popular scientific workshops and lectures held every year at University North (Open Days, Science Festival).

TECHNICAL SCIENCES:

Strategic direction	POSITIONING AND DEVELOPMENT OF LOGISTICS AND LOGISTICS SYSTEMS IN A MODERN BUSINESS ENVIRONMENT
Summary of the direction	Logistics is one of the fundamental professions of the future, as evidenced by the fact that the European Union has declared the development of logistics as one of the most promising sectors. From the definition of logistics, it can be concluded that it also includes economic categories that take place in accordance with economic laws. Logistics should also be viewed through the institutional framework in which it operates, which includes international norms and contracts, national legislation (laws, ordinances, etc.), procedures, methodologies, etc. Thus, legal sciences and practice essentially determine logistics. Logistics is an interdisciplinary activity that covers a wide area and has a complex structure – supply chains, procurement, production, warehouse, distribution, retail, traffic and transport, reverse logistics, environmental management, waste management, cost management, organisation, information management, circular economy, human resources management, quality management, safety management, risk management and the like. By understanding the modern approach to supply chains and logistics as a phenomenon, we come to another global phenomenon and a view of the economy - the phenomenon of the circular economy. It can be concluded that logistics is an important activity of a complex structure, an interdisciplinary science classified in the field of technical sciences, but it has numerous points of contact and common phenomena with economic sciences, legal sciences and others. Therefore, logistics research should be conducted understanding its context. Within logistics, urban logistics is gaining importance. Urban logistics is defined as the framework for optimising the logistics activities of city administrations and organisations in urban areas, taking into account the transport environment, the supply and consumption of energy within the market economy, as well as all issues related to the quality of life of the inhabitants of cities. Research in the field of sustainable urban logistics will cover the areas of harmonisation of the needs of urban space users with its physical limitations. New models of understanding urban logistics and other activities, creation and development of the theory of strategic logistics management in urban space and strategic approach in organising and managing modern logistics organisations are expected as the results of the research. In addition to the above, more and more attention will be focused on the area of logistics of small towns and villages, as one of the preconditions for preventing emigration, especially in relation to young people from rural areas of Croatia. As the world enters a new digital age, where it is no longer enough to have systems by which logistics organisations are interconnected at the micro and macro level, it is now necessary to harmonise them through the development of new logistics models and solutions for the shared use of currently available resources and, with the sharing economy, to increase the usefulness of the entire system while reducing overall costs and impacts on society and the environment (an example of this is the Physical Internet initiative). Logistics 4.0. includes logistics activities, concepts, processes and procedures related to industry 4.0, with emphasis on networking, virtual organisation, green (reverse) logistics, based on digitisation, computing and internet connection. Technological advances, especially the so-called SMART

	technology has a great impact on all areas of human activity, including logistics. Logistics 5.0 in the circular economy of a product or service, using smart technology, enables real-time monitoring and management of the entire supply chain (from production, through distribution and consumption) and back (reuse, refinement, recycling and disposal) using reverse logistics, and keeping sustainability in mind. Every organisation is part of a supply chain, and every supply chain is as effective as its weakest link. Therefore, it is necessary to continuously ensure smooth and timely flows of information, goods and finances within the entire supply chain in order to meet the requirements of end users, so that the chain as a business structure retains and develops its competitiveness in the market. Understanding global trends, customer demand and resource availability are key to managing operations, which aim to meet customer needs in a timely and cost-effective manner. The increasing complexity of supply chains results in the increasingly frequent interweaving of several different horizontal and vertical stakeholder integrations in supply chains, which in turn encourages reflection on the evolution of supply chains into integrated digital supply networks. Keywords: logistics, logistics 4.0, logistics 5.0, urban logistics, sustainable logistics, *SMART* logistics, digital transformation, supply chains and networks, sustainable and smart cities, circular economy.

Topic 1	LOGISTICS AS AN INTERDISCIPLINARY PHENOMENON
Objectives	1 In accordance with the requirements of sustainable development and new business concepts, it is necessary to establish a new definition of logistics and, in the context of industry 4.0, to explore and model logistics systems and processes, as well as the impact of logistics on competitiveness and quality of life on a global scale (1). 2 Ensure the employment of competent staff and monitor their training for scientific research work in the formed scientific research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research work and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals(https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior, other ministries and the Government of the Republic of Croatia, the EU and the UN with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous

	publication of articles aimed at popularisation of science and profession in various publications). (7)
Activities	1 Scientific research activities are focused on the research of interdisciplinarity and the phenomenon of logistics (through understanding the context and its structure, elements of quality and development strategy, examples of good practice) and logistics processes and their mutual conditionality, as well as the results of the supply chain with the aim of developing reliability and finding solutions to the problem of sustainable development in the context of industry 4.0, and the phenomenon of the circular economy. (1) 2 Recruitment of competent staff and their training for scientific and research work in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research work on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities, taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility,and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences,

	continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for logistics 4.0, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0, implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6)

	7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories), as well as scientific-research achievements, organised or co-organised conferences in the scientific research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research.(7)
Number of researchers	11
Collaborative institutions	IAQ – International Academy for Quality Croatian Chamber of Economy Podravka Fortenova Group Faculty of Economics Osijek Faculty of Transport and Traffic Sciences in Zagreb University of Žilina, Slovakia Dm Croatian Post L'Oreal Schrack Zračna luka Zagreb d.o.o.

Topic 2	**SUSTAINABLE LOGISTICS OF URBAN AND RURAL ENVIRONMENTS.**
Aims	1 Define and modernise the concepts of urban and rural logistics, as well as develop the knowledge necessary for analytical reflection in the management of logistics processes related to the behaviour of logistics systems in sustainable urban and rural space (1) 2 Ensure the employment of competent staff and monitoring their training for scientific research in the established scientific research infrastructure of the department (laboratories, scientific laboratories, etc.) (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific professional infrastructure, joint scientific

	research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Activities	1 Scientific research activities are aimed at defining and researching within the framework of sustainable urban logistics with the aim of recognising connections between logistics and other factors of sustainable urban environment management, while developing specific models for optimising logistics systems during the planning phase and improving existing ones, with the application of state-of-the-art software for creating computer simulations (linking logistics with urban factors, exploring the mutual conditionality of social and logistics processes, reliability, development strategies through a systematic approach, good practice) (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific

	research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific-research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility, and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for urban logistics and laboratory for sustainable and smart cities, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific-research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3)

	4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0, implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities conducted in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories) as well as scientific research achievements, number of conferences organised or co-organised in the scientific research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research. (7)
Number of researchers	11 teachers and associates
Collaborative institutions	Croatian Chamber of Economy Faculty of Transport and Traffic Sciences Zagreb, Department of Logistics Faculty of Economics Osijek International cooperation with universities developing programs and research in the field of logistics 4.0 Private and public organisations engaged in logistics activities City, municipal and county administrations in Croatia and abroad

Topic 3	DEVELOPMENT AND APPLICATION OF NEW DIGITAL TECHNOLOGIES IN LOGISTICS TRANSFORMATION ACCORDING TO LOGISTICS 4.0 AND LOGISTICS 5.0
Aims	1 Explore new digital technologies that transform logistics and supply chains, increase sustainability (simulation software, sensor technologies, etc.) and develop new digital models to increase the efficiency of management and utilisation of existing capacities of logistics processes in the real sector and merge them into a common network of development of a humanitarian logistics model in crisis situations, with detection and prevention of grey economy within logistics processes (1) 2 Ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Active participation in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior, other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable

	systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Activities	1 Scientific research activities aimed at developing new digital models for managing digital logistics systems and simulating the usability of existing capacities in the real sector if they were located in one common system with central management, but also for controlling and combating illegal activities in logistics processes, as well as an operational logistics solution for crisis situations, the development of the concept, tools and logistics methodology 4.0 and 5.0 2 Recruitment of competent personnel and their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific laboratories, etc.), equipping laboratories for the study and development of simulations of logistics processes and systems, training in the development and application of virtual simulation logistics models and their optimisation (2) 3 Signing of contracts with selected relevant partners for scientific research work on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis

	on the field of logistics, sustainable mobility, and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research work, laboratory for SMART logistics and digital transformation models, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research number of concluded contracts with selected institutions on mutual cooperation through defined common thematic scientific-research areas, number of international scientific research projects, number of realized mobility of scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of realised scientific research and professional projects, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific-research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0, implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities conducted in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of

	Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories) as well as scientific research achievements, number of conferences organised or co-organised in the scientific research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research work. (7)
Number of researchers	11 teachers and associates
Collaborative institutions	Croatian Chamber of Economy Faculty of Economics Osijek Faculty of Transport and Traffic Sciences Zagreb, Department of Logistics International cooperation with universities developing programmes and research in the field of logistics 4.0 and 5.0 Local and international, private and public organisations and institutions engaged in logistics activities

Topic 4	**DEVELOPMENT OF SUPPLY CHAIN MANAGEMENT AND *OPERATIONS MANAGEMENT***
Aims	1 Research, define and design a new model of supply networks based on the achievements of computerisation and automation within digital transformation and the methodology of effective management of rapid changes in business caused by the development of disruptive technologies at the organisation level, as well as of tools in the system of analysis and management of competitiveness with regard to supply networks (1) 2 Ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3)

	4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Active participation in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior, other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Activities	1 Scientific research activities aimed at researching and developing the concepts of supply chain management, supply networks and operations, researching trends and the impact of the global configuration of activities in supply chains and new developments on the management of complex business structures, and proposing models of economic configuration of activities at the global level, research and defining the parameters of integration of digital supply networks and key parameters of operation management and their impact on the efficient operation of complex supply networks, research of existing models and development of the methodology for the implementation of operational management systems in complex business structures (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application

	to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility,and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for the development of sustainable supply chains and networks, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (2)

	3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0, implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories) as well as scientific research achievements, number of conferences organised or co-organised in the scientific research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research. (7)
Number of researchers	11

Collaborative institutions	Croatian Chamber of Economy Faculty of Economics Osijek Faculty of Transport and Traffic Sciences Zagreb, Department of Logistics International cooperation with universities developing programmes and research in the field of logistics 4.0 and 5.0 Local and international, private and public organisations and institutions engaged in logistics activities

Topic 5	**STANDARDS FOR THE IMPLEMENTATION OF SUSTAINABLE URBAN MOBILITY MEASURES**
Aims	1 Ensure adequate availability of both densely populated urban and very sparsely populated rural areas by meeting all the social and economic needs of the population, while respecting the principles of security and sustainability of the system through certain measures and objectives of sustainable urban mobility plans, with a view to ensuring the reduction of greenhouse gas emissions through the use of mass forms of public passenger transport (1) 2 Ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Active participation in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior, other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the

	procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Activities	1 Based on the current examples of good practice in Croatia and the European Union, where functional regions are the basic framework for planning regional transport systems, and in part of public passenger transport planning as well, the current measures for the implementation of sustainable mobility in urban areas will be analysed and new innovative concepts of integrated urban mobility will be scientifically developed through a competence centre (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0, of acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable

	systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for sustainable urban mobility, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0, implemented laboratory infrastructure for the application of intelligent transport systems and technology of industry 4.0, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students,scientific-research and professional activities conducted in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izizazov-global-objectives-sustainable-development-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional

	documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories), as well as scientific research achievements, number of conferences organised or co-organised in the scientific research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research, number of lectures held and workshops participated in within the CIVINET Slovenia - Croatia - SEE network. (7)
Number of researchers	11 teachers and associates
Collaborative institutions	City of Koprivnica City of Varaždin Varaždin County Koprivnica-Križevci County Rail Alliance CIVINET SLO-HR-SEE Croatian Railways Primorje-Gorski Kotar County Crtorad d.o.o. County Road Administration of Primorje-Gorski Kotar County Cyclists' Union Municipality of Gornji Kneginec Municipality of Sračinec

Strategic direction	ORGANISING SUSTAINABLE URBAN MOBILITY
Summary of the direction	The concept of Sustainable Urban Mobility Plans (SUMP) is the current approach to integrated mobility planning, but it is currently less known and used in our region. SUMPs are focused on fostering urban mobility in cities through specific measures and targets. The strategic programme plans activities of collecting and analysing factors that affect urban mobility, analysing and processing traffic flow parameters of all traffic participants (personal vehicles, public urban transport, cyclists and pedestrians) by counting in peak and off-peak periods of the working day, recording GPS trajectories of public urban transport vehicles, personal vehicles and bicycles. The plan of the programme is to create the conditions for changing the way travel is distributed. It is necessary to reduce the share of personal vehicles in urban traffic and to highlight public urban transport as the dominant mode of travel, especially for work and school commuting trips and the like. In order to ensure equal development, it is necessary to ensure adequate availability of both densely populated urban and very sparsely populated rural areas. In doing so, the primary goal is to meet all the social and economic needs of the population, while respecting the principles of security and sustainability of the system. It is precisely in order to ensure the reduction of greenhouse gas emissions that it is necessary to encourage the use of mass forms of public passenger transport, for which adequate preconditions must necessarily be provided. Intelligent mobility refers to the movement of people and goods in an easier, more efficient and environmentally friendly way that creates solutions that are significantly different from the mode of transport we use today. To achieve this, it is necessary to use expertise and an interdisciplinary approach, as opposed to the traditional approach so far. Intelligent mobility, often referred to as ITS - Intelligent Transport Systems, involves the integration of smarter information and communication technology with transport infrastructure, vehicles and users. It enables the exchange of vital information on roads, our supply chains and transport services, and enables people to get more out of their transport networks, while increasing safety and reducing the impact on the environment. ITS represents a key step forward by changing the approach and trends in transport, and transport research and technology aimed at solving the escalating problems of congestion, pollution, transport efficiency, safety and security of passengers and goods. Furthermore, it is true that congestion, high operating costs and environmental concerns make owning passenger cars less desirable, and as technology begins to offer more attractive alternatives, consumers are increasingly moving away from certain modes of transport. This leaves room for new mobility providers to enter the market through ride-sharing and e-riding services, bike and car-sharing schemes and on-demand bus services, offering a wider range of choices. People are becoming more familiar with concepts such as the concept of Mobility as a Service (MaaS) – it combines public, private and shared mode of transport by providing multimodal, integrated and digital solutions for the mobility of people and goods based on their travel needs. Such a service can limit the number of vehicles on the roads by reducing congestion and pollution in our cities.

	Road planning and design is a very complex task that occurs at different levels, starting from the planning consideration of the development of the area as a whole to the concrete technical solutions of individual elements and facilities. Transport studies used as expert bases for the preparation of spatial planning documentation do not sufficiently appreciate the relationship between the purpose of the space and the need for its better transport integration, in accordance with the needs of the economy, and to the satisfaction of the population, which results in poor quality and in practice inapplicable spatial planning solutions. For the entire planning process, the most important thing is to emphasise the continuity of conscious and rational decision making, which means constantly reviewing and refining the planned solutions. In general, transport planning presupposes a set of institutionalised capital investment proposals to increase the quality of transport services over a period of time. The fundamental paradigm of modern development is related to ensuring adequate availability of all spatial contents. It is precisely the quality planning and dimensioning of the transport network that has a direct impact on meeting the primary needs of ensuring optimal traffic availability. Keywords: sustainable mobility, transport planning, integrated transport, intelligent transport systems, transport safety, transport policy

Topic 6	**INTELLIGENT MOBILITY**
Aims	1 Explore and develop the concept of Intelligent Mobility, which includes the integration of smarter information and communication technology with transport infrastructure, vehicles and users, using intelligent transport systems and anonymised mass data groups, with the aim of increasing safety and reducing environmental impact (1) 2 Ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of

	scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Activities	1 Using drones, radar devices and traffic cameras using software tools to monitor and model traffic flows, applied scientific research will further analyse and propose new models for their operational and efficient use in order to make automated vehicles and advanced connectivity systems safer, easier to share and more accessible to all citizens (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0, and of the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5)

	6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for intelligent mobility, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools, implemented laboratory infrastructure for intelligent mobility, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, scientific research and professional activities conducted in line with the UN-defined Sustainable

	Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories), as well as scientific research achievements, number of conferences organised or co-organised in the scientific research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research, number of lectures held and workshops participated in within the CIVINET Slovenia - Croatia - SEE network. (7)
Number of researchers	10 teachers and associates
Collaborative institutions	City of Koprivnica City of Varaždin Varaždin County Koprivnica-Križevci County Rail Alliance CIVINET SLO-HR-SEE Croatian Railways Primorje-Gorski Kotar County Crtorad d.o.o. Altpro d.o.o. County Road Administration of Primorje-Gorski Kotar County Municipality of Gornji Kneginec Municipality of Sračinec

Topic 7	**SPATIAL-TRAFFIC INTERACTION**
Aims	1 The aim is to create a model that can be applied in everyday spatial and traffic planning by analysing the best European practices in transport planning and to structure and assess the needs for movement with regard to individual spatial zones, density of zones and population using scientific research for quantified structuring of spatial and traffic solutions at all levels. (1)

	2 Ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Plan and implement training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Active participation in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior, other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Activities	1 Empirical scientific research will be carried out using traditional methods of counting traffic, anonymised data sets from base stations as the basis for assessing traffic demand, which will analyse the gravitational impact of traffic zones with regard to their purpose and propose a framework and method for optimal dimensioning of traffic needs when drafting new generation spatial planning documents. (1)

	2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for traffic-spatial planning and design, the availability of relevant sources of global scientific research literature, the secured

	funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0, implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories), as well as scientific research achievements, number of conferences organised or co-organised in

	the scientific-research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research, number of lectures held and workshops participated in within the CIVINET Slovenia - Croatia - SEE network. (7)
Number of researchers	10 teachers and associates
Collaborative institutions	City of Koprivnica City of Varaždin Varaždin County Koprivnica-Križevci County Rail Alliance CIVINET SLO-HR-SEE Croatian Railways Primorje-Gorski Kotar County Crtorad d.o.o. County Road Administration of Primorje-Gorski Kotar County

Topic 8	**MINIMUM STANDARDS OF PUBLIC TRANSPORT AVAILABILITY**
Aims	1 By conducting reference empirical research on the needs for movement in correlation with the size and structure of communities, as well as general social and economic trends, use it as a basis for making scientifically based conclusions and improve and create new knowledge in the field of transport planning in order to help the line ministry, regional and local community and other scientific and professional institutions dealing with the problem of public passenger transport to adequately analyse and adequately dimension the minimum needs of the population and economy for movement, respecting the primary condition of ensuring adequate and even conditions for living and working in the entire territory of the Republic of Croatia. (1) 2 Ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 Select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4)

	5 Plan and implement training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Activities	1 Preparation of scientifically based models for establishing minimum standards for the availability of public passenger transport and designing guidelines for the implementation of the methodology for defining minimum standards for the availability of public passenger transport at all levels (national, regional and local) with special emphasis on multimodal and integrated transport solutions (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4)

	5 Training of employees for the application of new digital tools, intelligent transport systems and technology of industry 4.0, and of the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined sustainable development goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications, activities at the CIVINET Slovenia - Croatia - SEE academic network). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department, the number of newly employed competent staff for scientific research, laboratory for sustainable urban mobility, the availability of relevant sources of global scientific research literature, the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders, the number of accepted and applied national and international scientific research projects, the number of advancements of scientific research staff (aim 2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research, number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas, number of international scientific research projects, number of mobilities carried out by scientists, scientific and professional conferences and events, international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation, number of concluded contracts with selected partners in the public and real sector, number of joint thematic scientific research and professional areas, number of scientific

	research and professional projects carried out, formed professional-scientific working groups, number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out, realisation of scientific and professional conferences and events, number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools, implemented laboratory infrastructure for simulating trends in public city transport, procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, scientific research and professional activities conducted in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN, the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure, the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University, the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements, the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories), as well as scientific research achievements, number of conferences organised or co-organised in the scientific-research field and the field of scientific expertise, popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research, number of lectures held and workshops participated in within the CIVINET Slovenia - Croatia - SEE network. (7)
Number of researchers	10 teachers and associates
Collaborative institutions	City of Koprivnica City of Varaždin Varaždin County Koprivnica-Križevci County Rail Alliance CIVINET SLO-HR-SEE Croatian Railways Primorje-Gorski Kotar County Crtorad d.o.o.

	County Road Administration of Primorje-Gorski Kotar County Municipality of Gornji Kneginec Municipality of Sračinec

Topic 9	**ANALYTICAL AND COMPUTER MODELLING OF ANISOTROPIC GRAIN SIDE PRESSURE MATERIAL ON RIGID PARALLEL WALLS**
Summary	In the existing regulations, when calculating the lateral pressure of the material on the parallel walls, models of isotopic and homogeneous material are used, which is certainly far from the actual state of things. The proposed topic has so far been partially covered in the work of eminent scientists such as J. Nielsen, M. Molenda, A. Ramirez Gomez, A. Shkola and others. In order to solve the engineering problems of designing structures with parallel walls (silos, port extensions in seaports, supporting structures for bridges over rivers, etc.), it is necessary to model the realistic conditions of the pressure of materials on the walls of these structures, and propose an analytical and computer model, so that the engineers can ultimately use the ready-made formulas or the offered algorithm.
Aims	1 Determining the current state of the relevant regulations (EUROCODE) for the calculation of lateral pressure on parallel walls 2 Mastering computer software packages such as DeepEx and Plaxis to model the actual stress state of materials in rigid parallel walls 3 Creating an analytical and computer model that takes into account the specificity of each material 4 Convenient solution for engineering applications 5 Publication of category A papers and presentation of papers at international conferences.
Activities	1 Researching existing regulations and comparison of approaches to the calculation of lateral pressures. 2 Computer workshops for DeepEx and Plaxis software for modelling the actual state of stress of materials in rigid parallel walls, involving interested students doing master's theses. 3 Research and analysis of existing models and solutions. Setting up analytical and computer models according to existing scientific methodologies. Proposal to improve existing models and add new models. Brainstorming with team members. 4 Testing the obtained solutions on the existing results of experiments. Adaptation of validated scientific solutions to engineering use by tabulation and/or visualisation with graphs. 5 Application of theses and papers to international conferences, writing A and B category papers.
Indicators	1 Unification and comparison of relevant global regulations for the calculation of silo pressures. Assessment of compatibility, disadvantages and advantages. 2 Increasing the computer competence of team members, transferring knowledge to students and integrating the newly acquired knowledge into the curriculum of the appropriate course. Availability of relevant sources of global scientific research literature, number of advancements of scientific research staff. 3 Laboratory workstation for simulation and comparison of obtained lateral pressure calculation models 4 Examples of the implementation of the engineering method of calculation.

	5 Number of relevant partners for scientific research, number of mobilities carried out by scientists, scientific and professional conferences, and international visibility. Scientific research and professional activities conducted in line with the aims of scientific research.
Number of teachers and associates involved in the work	5 teachers and associates
Collaboration	Odessa State Academy of Civil Engineering and Architecture, Ukraine, Poltava National Technical Yuri Kondratyuk University, Ukraine

Topic 10	**ANISOTROPY MODELLING OF BULK MATERIAL STRENGTH BY DISCRETE ELEMENT METHOD – DEM**
Summary	The Discrete Element Method (DEM) is a numerical technique for simulating the behaviour of a set of independent particles. The DEM represents a very promising area in modelling and simulating the state of stress of discrete/bulk environments. The relevance of the method can be seen from the huge number of quotes and articles written in recent times by reviewing the WoS links, i.e., Science Direct https://www.sciencedirect.com/topics/materials-science/discrete-element-method. In this technique, each particle is displayed numerically and identified with its specific properties (e.g., shape, size, material properties, initial speed). The inner shape of the particle-containing container is used as a simulation area and is divided into a grid to determine the position of the particle. The particles are then subject to a small motion (based on Newton's laws) over a small time interval (iteration). A small movement will cause contact with other particles or domain boundaries. Each of these contacts is monitored and produces discrete reaction forces on each particle in contact. The DEM is used to model the interaction of particles in practice, and the method is applicable to a wider spectrum: dynamic and static processes in silos, geodynamic processes in soil, water filtration in soil, mixing of particles in manufacturing processes of pharmaceutical processes, including powder transfer, mixing of this powder into matrices and compaction of the powder into tablets and others. DEM models are detailed enough to represent phenomena including dispersion, segregation, particle packaging and layer thickening. The DEM method for simulating the stress state is very close to the real stress state of the bulk material, it allows detailed representations of the process with particles, taking into account all particle-particle and particle-geometry interactions, thereby taking the most possible factors into account in the overall analysis. A large number of eminent scientists such as M. Molenda, A. Ramirez Gomez, K. Soga, J. Bray, etc. are working on the analysis of the DEM method. Cooperation and consultation is planned with with colleague Assoc. Prof. A. Ramirez Gomez from

	the Technical University of Madrid, as well as with a team of scientists using the DEM method in construction geotechnical research https://www.cb-geo.com/.
Aims	1 Mastering DEM computer software packages such as Rocky DEM and YADE, stress states of incoherent materials in rigid parallel walls 2 Conducting DEM modelling and additional side pressure testing of bulk materials, samples including bulk materials used as raw materials in silos (homogeneous sand and some organic materials). 3 Analysis of the the state of silo stress using the DEM method and comparison with the previously obtained results from laboratory tests in the laboratory of the Department of Construction was supported by funding from 2018 and 2019. 4 Publication of category A papers and presentation of papers at international conferences.
Activities	1 Organisation of educational workshops for the use of DEM software. Involve students in the work. 2 Testing of non-coherent materials in a model with rigid parallel walls in the laboratory of the Department of Construction. Preparation of master's theses. 3 Computer DEM analysis of the state of stress in a discrete particle medium. Selection of rigidity parameters and operation parameters of the DEM analysis. 4 Publication of papers and applying to international conferences. Active work with master's students.
Indicators	1 Increasing the computer competence of team members, transferring knowledge to students and integrating the newly acquired knowledge into the curriculum of the appropriate course. Availability of relevant sources of global scientific research literature, number of advancements of scientific research staff. 2 Writing and preparation of scientific articles and master's theses based on the results of laboratory tests 3 Comparative analyses of laboratory and DEM research results. Conclusions on the practical applicability of the DEM analysis 4 Number of relevant partners for scientific research, number of mobilities carried out by scientists, scientific and professional conferences, and international visibility. Scientific research and professional activities conducted in line with the aims of scientific research.
Number of teachers and associates involved in the work	5 teachers and associates
Collaboration	Universidad Politecnica de Madrid (Technical University of Madrid), Spain Odessa State Academy of Civil Engineering and Architecture, Ukraine, Poltava National Technical Yuri Kondratyuk University, Ukraine

Topic 11	**COMBINED OPERATION FOR SMALL HYDROPOWER PLANTS AND SOLAR PHOTOVOLTAIC PLANTS**

Summary	The research analyses, the flows of watercourses and the intensity of solar radiation at selected locations in Croatia. The purpose of the analysis is to determine the energy potential of watercourses and solar radiation for the production of electricity, individually and in combination with the operation of the hybrid system. It is planned to improve the previous methods of sizing small hydropower plants, solar photovoltaic plants and the hybrid system which is a combination of the two systems. The research is interdisciplinary, i.e., a combination of civil engineering (primarily hydrotechnics and geotechnics), geodesy, energy and mathematics, as well as other professions as needed, with the involvement of economic operators.
Aims	-Dissemination of research results, involvement of students in scientific and professional work related to the topic of the project. - Applications for national and international scientific projects. Development of a pilot project of a hybrid energy system, and application of new special types of turbines for shallow watercourses. Commercialisation of research.
Activities	-Publication of papers in WoS journals and other publications, participation in national and international scientific conferences, all in co-authoring with national and foreign associates, as well as with students. - National and International mobility, and participation in the scientific, technical and administrative part when applying for national and international scientific projects. - Participation in project, contractor and supervisory activities during the implementation of the pilot project of the hybrid energy system, and consultation with associates not in the field of construction. -Integration into the market (economic sector) after testing, refinement and improvement of the pilot project.
Indicators	- Number of published papers in WoS journals and other publications, and number of participations in scientific conferences. - Number of mobilities carried out, and scientific projects obtained. - Success in the implementation of the pilot project. -Number of professional projects carried out, i.e., built hybrid systems, which are an indicator of the success of the application of new sizing methods. - Satisfactory operation of new types of turbines.
Number of teachers and associates involved in the work	10 teachers and associates
Collaboration	University of South Australia, Adelaide, Australia. Faculty of Mechanical Engineering, University of Prishtina, Prishtina, Kosovo. Ferdowsi University, Mashhad, Iran. Suresh Gyan Vihar University, Jaipur, India. Faculty of Geotechnical Engineering, University of Zagreb, Varaždin, Croatia. Tidal Energy Pty Ltd, Gold Coast, Australia (business entity planning to test special types of turbines for shallow watercourses).

Topic 12	SOLAR PHOTOVOLTAIC PUMPING IN WATER SUPPLY SYSTEMS
Summary	The application of solar photovoltaic energy for the operation of pumping stations that pump drinking water to consumers in the water supply system is analysed. The emphasis is on defining the principles that connects the power of the solar photovoltaic system with the volume of the water reservoir and the power of the pumping station. Previous research has found that such legality has not been defined and investigated in literature, nor in real cases. A combination of the use of solar photovoltaic energy in combination with classical energy from the electricity grid is also being considered.
Aims	-Dissemination of research results, involvement of students in scientific and professional work related to the topic of the project. - Applications for national and international scientific projects. - Commercialisation of the project.
Activities	- Publication of papers in WoS journals and other publications, participation in national and international scientific conferences, all in co-authoring with national and foreign associates, as well as with students. - National and International mobility, and participation in the scientific, technical and administrative part when applying for national and international scientific projects. - Participation in project, contractor and supervision activities during the realisation of the construction of new water supply systems powered by solar photovoltaic energy, as well as in the upgrading of existing ones using classical electricity.
Indicators	- Number of published papers in WoS journals and other publications, and number of participation in scientific conferences. - Number of mobilities carried out, and scientific projects obtained. - Number of professional projects carried out, which are an indicator of the success of the application of new sizing methods.
Number of teachers and associates involved in the work	8 teachers and associates
Collaboration	Faculty of Civil Engineering, University of Mostar, Bosnia and Herzegovina. Ferdowsi University, Mashhad, Iran. Faculty of Mechanical Engineering, University of Prishtina, Prishtina, Kosovo. Faculty of Geotechnical Engineering, University of Zagreb, Varaždin, Croatia.

Topic 13	TECHNICAL CONDITION AND PLAN FOR THE REHABILITATION OF CULTURAL AND HISTORICAL BUILDINGS IN THE AREA OF VARAŽDIN AND MEĐIMURJE COUNTIES DAMAGED BY THE 2020 PETRINJA EARTHQUAKE
Summary	On 28 December 2020, at 6:28 am local time, a strong earthquake of magnitude ML=5.0 occurred near Petrinja. In addition to the narrow epicentral area of Petrinja, Sisak, Glina and the surrounding area, the earthquake was felt

	throughout central Croatia. A series of aftershocks followed. The very next day, on 29 December 29 2020, a devastating earthquake of magnitude ML=6.2 occurred in the same area at 12:19 am. In addition to significant material damage, the earthquake also claimed seven human victims. This earthquake in the said epicentral area was followed by strong aftershocks within the pronounced seismic sequence, which will last during 2021, and possibly longer. The Petrinja earthquake of magnitude ML=6.2 is one of the two strongest instrumentally recorded earthquakes that have occurred on the territory of the Republic of Croatia since the beginning of the 20th century, when the instrumental recording of earthquakes in Croatia started. Only the 1942 earthquake near Imotski 1942 was of the same magnitude, and it occurred on the same date: 29 December. So far, the strongest instrumentally recorded earthquake in the Pokuplje area was the historical 1909 Pokuplje earthquake of magnitude ML=5.8, on the basis of which our celebrated geophysicist Andrija Mohorovičić discovered the existence of discontinuity within the Earth's interior. This discontinuity between the Earth's crust and the mantle is therefore called the Mohorovičić discontinuity. This research will deal with the degree of damage to individual representative facilities, categorised according to the types and protection of facilities (conservation protection, etc.), categorisation of damage, types of damage, classification of damage and defects according to static danger (load-bearing walls, partition walls and other constructive elements), non-destructive and destructive methods of measurement and with recommendations for remediation based on the rules of the profession, seismic danger and the need to strengthen buildings against potential earthquakes and approximate today's standards in construction. A different approach will be determined for individual buildings, those protected within the cultural and historical unit, and buildings protected as individual cultural assets, as well as the types of remediation allowed in such environments.
Aims	– determining the current condition of selected buildings damaged by the earthquake; – categorisation of damage, cracks, and further hazards to the static system; – field and laboratory measurements of the state of the material and load-bearing system inside buildings; – analysis of the complete building system and safety for further use; – analysis of the usability status of an individual facility; – recommendations for resolution; emergency measures and long-term measures; – capacity calculations and alignment with today's standards; – recommendations for reinforcement and raising the static level of building capacity, and necessary measures (global, common).
Activities	– selection of earthquake damaged buildings for the subject of full diagnostics and analysis – graduation of buildings according to the level of protection – building as an individual cultural property – buildings protected within a cultural and historical whole

	– preparation of the study of the assessment regarding the condition of the load-bearing structure of the selected facility (church, palace, other protected facility) – drafting a proposal (project) for the rehabilitation of the selected facility – statistical analysis of types of damage and remediation – fieldwork – laboratory work – procurement of field and laboratory equipment – preparation of studies, articles and monographs
Indicators	– diagnostics of individual buildings – preparation of studies and damage studies – preparation of studies, types and remediation studies of types – introduction of new, modern methods of remediation in cultural-historical facilities – collaboration with the conservation institutes – procurement of measuring equipment for non-destructive and destructive tests – preparation of articles, monographs and studies at the end, and during the research
Number of teachers and associates involved in the work	2 teachers 2 associates
Collaboration	– Conservation Office Zagreb, – The Odessa State Academy of Civil Engineering and Architecture – City of Varaždin; – Varaždin County; – City of Čakovec and City of Prelog; – Međimurje County – Varaždin diocese; – Ministry of Culture and Media of the Republic of Croatia

Topic 14	**ANALYSIS OF LARGE QUANTITIES OF SYNCHRONISED MEASUREMENTS**
Summary	The research group will study the issues of supervision, protection and management of the advanced electricity network, and the development of analytical methods for real-time operation. Since PMUs are sampled every 20 ms, a large amount of data (Big Data) is collected, which should be analysed in real time with the purpose of reducing (optimising) costs. In-depth analyses and machine learning will be used to analyse the collected data in real time.

Aims	It is expected that this research will improve knowledge about the possibilities of using machine learning, artificial intelligence and in-depth analysis of large amounts of data, in order to preserve the basic property of running the electricity network, regardless of the increasing volume of collected data, and this is real-time action with the aim of minimising losses. Machined raw synchronised measurements are used for the purpose of monitoring and managing advanced electricity networks (Smart Grids) with a high share of renewable energy sources. One of the objectives is to use and process synchronised measurements in order to prepare active renewable sources for participation in the provision of ancillary services. In order to analyse and process large quantities of synchronised measurements, a theoretical concept was developed, which consists of: ***System Model Database*** The configuration of the entire software system in the PDC, except for data in special configuration files related to executable files (.config extension), must be saved in a single database that is edited through a special application for administrators. The database must be able to store at least: 1. Data necessary for inputting the electricity system model 2. The electricity system model 3. The electricity system parameters 4. Interactive dynamic vector diagrams of the electricity system 5. Various scripts to support dynamic interactive displays ***Service for data collection and distribution*** The collection of measured values from external data sources as well as calculated values and the distribution of these data to other parts of the system must take place through a central service for data collection and distribution. ***Historical data service*** Each measured and calculated value in the system must be able to be stored in an archive for later use. It must also be possible to determine what data is archived and how long it is kept in the archive. ***A Short-Term Historical Database*** The historical data service must store all measured and calculated values in a short-term historical database.

	Long-term Historical Database Data from the short-term database is transferred to a long-term historical database for which the data retention interval will be much longer than that for the short-term historical database. The developed concept is applicable for the analysis of various data on the power system in real time.
Activities	The following activities have been carried out: - Key data of synchronised measurements in the power system have been identified - Synchronised measurement package decoding has been performed - Decoded data have been prepared for processing using modified algorithms for monitoring, protection and control of the power system - The processed data has been prepared for export to different clients and operational environments
Indicators	So far, the following papers have been published in this area: Skok, Srđan; Srpak, Dunja; Havaš, Ladislav; Srpak, Josip Monitoring and Protection of Dynamic Angular Stability Based on Synchronised Measurements. // Elektrotehniški vestnik, 87 (2020), 3; 95-101 (international review, article, scientific) Skok, Srđan; Srpak, Dunja; Havaš, Ladislav; Kondić, Veljko Synchronised Measurements Processing Methodology as a Tool for Monitoring Power System Oscillations. // Technical Journal: scientific-professional journal of technical faculties of the University of Osijek, 27 (2020), 2; 450-457 doi:.org/10.17559/TV-20191217235337 (international review, article, scientific) Skok, Srđan; Havaš, Ladislav; Radosevic, Vedran; Cvitanovic, Matej Impact of Electromobility to the Power Distribution System. // 2020 IEEE PES/IAS PowerAfrica Nairobi, Kenya, Kenya: IEEE, 2020, pp. 150-155 doi:10.1109/PowerAfrica49420.2020.9219914 (lecture, international review, comprehensive work (in extenso), scientific) Havaš, Ladislav; Srpak, Josip; Šumiga, Antonija; Skok, Srđan DEVELOPING AND TESTING WIND TURBINE MODELS AT UNIVERSITY NORTH. /EDULEARN20 /Proceedings / Gómez Chova, L. ; López Martínez, A. ; Candel Torres, I. (eds.).

	Valencia: IEEE, 2020, pp. 8771-8777 doi:10.1109/PowerAfrica49420.2020.9219914 (lecture, international review, comprehensive work (in extenso), scientific)
Number of teachers and associates involved in the work	4 teachers and associates
Collaboration	Energy Institute Hrvoje Požar HEP-Distribution System Operator University of Manchester - UK Institute of Electrical Engineering University of Zagreb - Faculty of Electrical Engineering and Computing

Topic 15	**Adaptive method for predicting sports outcomes based on utility index and optimal time window**
Summary	Using machine learning methods to predict outcomes takes more and more momentum each day. In the context of sports, the prediction has become interesting to the general public most often in the form of sports betting, and sports managers use the results of machine learning for the purpose of selecting players. In addition to predicting outcomes, the evaluation of the performance of players and teams is a very important element of the analysis. This research provides an overview of existing methods and algorithms for evaluating the performance of players and teams, as well as an overview of areas related to predicting outcomes using machine learning methods, primarily focused on team sports. In addition, the research also deals with the preparation of data, i.e. the selection of the most important parameters of statistics, which are later used to predict the outcome of basketball matches. The final goal of the research is to propose, and later upgrade, a parameter adaptation algorithm tailored to each team, in such a way that it gives as accurate results as possible predicting the outcome of matches applicable to all team sports, and expandable to any process that can be divided into components.
Aims	The doctoral dissertation was written and scientific articles related to the topic of the doctoral dissertation were published. Doctoral dissertation:

	● Horvat, T.. "Adaptive method for predicting sports outcomes based on utility index and optimal time window." Faculty of Electrical Engineering, Computer Science and Information Technology in Osijek, September, 2020. <u>Papers published so far:</u> 1. Horvat, T.; Havaš, L.; Srpak, D.. "The Impact of Selecting a Validation Method in Machine Learning on Predicting Basketball Game Outcomes", *Symmetry*. Vol. 12(3). March 2020 2. Horvat, T.; Job, J.. "Importance of the training dataset length in basketball game outcome prediction by using naive classification machine learning methods", *Elektrotehniški vestnik - Journal of Electrical Engineering and Computer Science*. Vol 86(4), pp. 197-202, December 2019 3. Horvat, T.; Havaš, L.; Srpak, D.; Medved, V.. "Data-driven Basketball Web Application for Support in Making Decisions" *7th International Conference on Sport Sciences Research and Technology Support,* Wien, Austria, 2019, pp 109-112 4. Horvat, T.; Job, J.; Medved, V.. "Prediction of Euroleague Games based on Supervised Classification Algorithm k-Nearest Neighbours", *6th International Congress on Sport Sciences Research and Technology Support,* Seville, Spain, 2018, pp 203-207 5. Horvat, T.; Havaš, L.; Medved, V.. "Web Application for Support in Basketball Game Analysis", *Proceedings of International Congress on Sport Sciences Research and Technology Support (icSports 2015),* Lisbon, Portugal, 2015, pp 225-231 6. Horvat, T.; Job, J.. "The Use of Machine Learning in Sport Outcome Prediction: A Review", *Wiley Interdisciplinary Reviews: Data Mining & Knowledge Discovery*. <u>Papers related to the topic that are in the process of review:</u> 7. Horvat, T.; Job, J.. "Using of data-driven machine learning algorithm and NBA efficiency index for predicting NBA games outcome", *Elektrotehniški vestnik*. A paper related to the entire doctorate and further work on the proposed adaptive algorithm for predicting outcomes are planned.
Number of teachers and associates involved in the work	4 teachers and associates
Collaboration	In the form of research, cooperation was achieved with: ● Faculty of Electrical Engineering, Computer Science and Information Technology in Osijek (FERIT) - Assoc. Prof. Josip Job. ● Faculty of Kinesiology in Zagreb (KIF) - Prof. Dr sc. Vladimir Medved

Topic 16	**Information system for monitoring and evaluating basketball players and teams using a comprehensive efficiency index – the foundation for the future basketball expert system**
Summary	This topic is the subject of research of a scientific project within which the *Basketball Coach Assistant* (*BCA*) information system is designed and implemented, which enables the monitoring of expanded statistics of basketball players and teams, and the determination of their comprehensive performance. Within this system, a new, comprehensive CPE (Comprehensive Player Efficiency) index has been set up to monitor the performance of basketball players, which includes the standard indices of the same purpose used so far, and the corresponding CTE (Comprehensive Team Efficiency) index for the performance of the entire basketball team . By optimising the parameters of this index, it is possible to adjust it statistically to match outcomes. According to the same principles, it is possible to develop information systems for use in other team sports.
Aims	To develop an information system that will enable monitoring of expanded statistics of basketball players and teams and determine their overall performance. The system is called *Basketball Coach Assistant* (BCA). According to the same principles, it is possible to develop information systems for use in other team sports. Refine and mathematically formulate a new, comprehensive, CPE index (*Comprehensive Player Efficiency*) for monitoring the performance of basketball players, which includes the previously used indices of the same purpose and, in addition, creating an index that will be created according to the special requirements of coaches or statistics of basketball matches. *Objectives, exhaustive list:* ● introduction of a comprehensive performance index of basketball players (CPE index) and teams (CTE index), as a more precise indicator of the players' quality, in which certain elements of the game can be emphasised or suppressed, and comparison of these indices with standard, NBA and PIR indices; ● statistical linking of the CTE index with the results of specific matches through the concept of relative match result and establishing the coefficient of their linear correlation; ● creating the basis for further automation of optimisation of CPE index parameters, in which the function of the goal is the maximum coefficient of linear correlation between the relative CTE index and the relative result in the games played.
Activities	● Designing and implementing the BCA information system and thus motivating the development of a new, comprehensive, CPE index of the efficiency of basketball players. ● Writing and publishing scientific articles in (WoS) renowned publications. ● Participation in international scientific conferences (online).

Indicators	● Published papers in renowned (WoS) publications: – two (2) papers. ● Participation in the international scientific conference: – one (1) scientific conference. ● Developed BCA information system that is ready for use and is in further development.
Number of teachers and associates involved in the work	3 teachers and associates
Collaboration	-

Topic 17	**HbbTV technology-based application interface design**
Summary	HbbTV (Hybrid broadcast broadband TV) technology has been gaining popularity in the Republic of Croatia after the transition to a new generation of terrestrial television broadcasting, which ended on 12 November 2020. The technology enables interactive services related to TV channels that are primarily broadcast in the terrestrial digital television network, but it is also applied in satellite and cable TV networks. HbbTV technology is currently used commercially in Croatia by Nova TV and EVOTV pay-TV platform. Furthermore, HAKOM stipulated that televisions and digital receivers must support HbbTV technology in order to be harmonised for the Croatian market. HbbTV navigation is designed to make application management adapted to the use of the remote control. Colour buttons (red, green, yellow and blue) that have been used for decades to navigate the teletext, as well as the most commonly used buttons: up, down, left, right and OK (or confirmation) are used. This creates prerequisites for rapid adaptation to the management of HbbTV applications by traditional teletext users, but also by all demographic groups, including the older population. A TV with a remote control is also an acceptable interface for users who have never acquired the knowledge necessary to use Internet applications on a computer or mobile phone. Therefore, HbbTV applications are ideal for overcoming the digital gap in the population mentioned, enabling them to use graphically rich interactive services in a way that is similar to the use of textual and quasi-interactive teletext services. The development of HbbTV applications is similar to the development of web applications designed to run in a web browser on a computer. It allows almost the same flexibility in the development of functionality, with adaptations to the typically lower processing power of the TV in relation to the computer, and to the limitations of the remote control in relation to the keyboard and mouse. Unlike user access to web applications, for which it is necessary to have at least basic knowledge of using a computer or smartphone and knowledge of the URL or

	address of the website where the application is launched, HbbTV applications are available usually by pressing the red button on the remote control. The notification of the existence of the HbbTV application with a call to press the red button on the steering wheel can be discretely displayed while watching a television programme, or immediately after switching to a television channel. The launch of the HbbTV application is therefore almost trivial even to inexperienced users, unlike Internet applications for which it is necessary to have significant prior knowledge inaccessible to a large part of the population, usually the elderly. HbbTV applications related to a TV channel are an interactive complement to linear audio-video content with functions that include a modern substitute for info services provided by an outdated teletext service, a video store, watching a programme that was broadcast in the past, games, surveys, integration with social networks and the like. HbbTV services do not have to be connected to a TV channel, but can be presented on digital television independently in the form of a portal where commercial services can be presented, as well as information services of the state, county or city and public institutions such as schools and universities. This spreads the use of HbbTV applications to all social groups. HbbTV technology is applicable to large markets, to all social groups, and commercial and public services. Despite the technological and market potential, the development of HbbTV applications and their use in the Republic of Croatia remains relatively low. The research and testing covered by this topic is necessary in order to investigate the perception and behaviour of users when using applications, and to establish recommendations for the graphical interface design, navigation and programme logic in order to make the use of HbbTV applications simple and to make users perceive HbbTV applications as useful, but also fun. These are the prerequisites for increasing usage and the basis for successful market acceptance of future applications, which allows financing of further development.
Aims	The research objectives are: (1) qualitative research of the level of user acceptance and user perception of the usability of existing HbbTV applications; (2) make recommendations to improve the user experience when using HbbTV applications, including the user interface, navigation and programming logic; (3) specify the optimal interface design to enable application acceptance and a high level of usability; and (4) modify application interfaces and apply the design in accordance with the results of the research and determine the change in user perception. The project would include several iterations of the following phases: 1. Analysis and measurement of acceptance and usability of existing HbbTV applications 2. Design of a new interface according to the results of scientific research 3. Modification of existing applications and measurement in laboratory conditions 4. Implementation on a commercial platform (evotv or Varaždin TV) and measurement of usability and acceptance of HbbTV applications in a commercial environment.

Number of teachers and associates involved in the work	Research team: ● Docent Dr. sc. Domagoj Frank (Head of Research), as part of his doctoral study researched the models for assessing user acceptance of technology and based on the results of the research, prepared a new research model adapted to the research of additional digital television services. The model has been successfully checked on the example of an electronic programme guide service. He is a longstanding director and member of the management board of HT produkcija d.o.o. (formerly HP produkcija d.o.o.), responsible for the launch of the platform of the terrestrial pay-TV EVOtv and its successful work so far. The EVOtv platform was the first in Croatia to launch HbbTV applications. ● Prof. Dr. sc. Damir Vusić (member of the research team) is a full professor at University North in the interdisciplinary field of science (fields of graphic technology and information, and communication sciences). One of the areas of his scientific research is related to the research of innovative user interfaces. Scientifically published research of user experience in the use of mobile devices by users with limited knowledge in mobile telephony technology was conducted, and the influence of the gemified system on the improvement of knowledge was investigated, i.e. the impact of instructional design and educational computer games on more efficient learning. In the context of the increasing importance of the application of e-learning, a research was conducted on the user experience of using the Yammer application, one of the applications used in the organisation of distance teaching. ● Docent art. Robert Geček (member of the research team) is an assistant professor of art in the field of visual communication design. He has been in the design business for over 25 years and has created many visual identities in Croatia and abroad. He has had solo and group exhibitions all over the world, and lately he has been working mostly on multimedia projects with students of Multimedia at University North, where he also serves as the Head of the Multimedia Department. He also received a PhD in the technical field of graphic technology science on the topic: "Determination of visual perception of organic and polygonal forms in graphic communication processes". ● Dražen Crčić, lecturer (member of the research team), teaches Introduction to Web Application Development at the Department of Computing and Informatics with the task of leading the implementation of HbbTV applications. ● The core of the research team will be assisted by assistants at the Department of Computer and Information Science: Albert Vučinović, Leon Horvat, Tomislav Štefančić and selected students of the Department of Computer and Information Science and the Department of Multimedia.

Collaboration	In this research, the plan is to expand cooperation with the Croatian Regulatory Agency for Network Activities (CRANA), which is interested in market development and wider adoption of HbbTV technology. Currently, a joint research by CRANA and University North is underway, which aims to determine the number of television receivers that are compatible with HbbTV technology. The technology partner will be App Stream d.o.o., which produced HbbTV applications for the EVOTV service and creates a reference development portal for the HbbTV standardisation body hbbtv.org. Varaždin TV will be a platform on which we will implement HbbTV applications and which allows us to quantitatively research the population of respondents in northern Croatia.

Topic 18	**OPTIMISATION OF GRAPHIC IMAGE PREPARATION FOR DIGITAL AND PRINT MEDIA**
Summary	The focus of research activities is on the selection of the optimal format of graphics records and associated compression metrics that largely meet the necessary standards required for publishing, archiving, encryption, protection and communication of content. By considering the reproduction outcomes in the observed settings, based on qualitative and quantitative indicators, guidelines for the application of new graphic formats will be determined, with the aim of optimising the reproduction system in the online and offline environment.
Aims	- To define standards for the use of digital images in systems that generate content in two different environments (web and printing) - To define the influence parameters on the level of applied compression on images
Activities	- determine the format and settings of digital image records that would be used as a standard for digital image preparation and within the framework of a new approach to document enrolment in a standardised e-learning system - create initial graphics samples over which the conversation and research will be conducted - define guidelines for the optimisation of graphic image preparation for digital and print media
Indicators	- presentation of results at conferences and workshops - collaboration with the real sector - characterisation of guidelines for determining reference optimisation methodologies
Number of teachers and associates involved in the work	3 teachers and associates

Collaboration	Collaboration with public economy Faculty of Graphic Art, University of Zagreb.

Topic 19	**DETERMINING THE QUALITY CRITERIA FOR BITMAP IMAGE REPRODUCTION IN STANDARDISED SYSTEMS**
Summary	The focus of interest is defining the standard of use of bitmap images in scientific, professional and educational literature that is increasingly appearing in the web environment. Considering the requirements for their publication, archiving, protection and simultaneous availability, it is necessary to define technical standards that are imposed on both authors and all users. The universality of the settings of these standards will be the main factor that will influence the formulation and design of new formats of both images and other multimedia content.
Aims	Characterisation and evaluation of the effectiveness of guidelines for determining the reference optimisation methodologies that will be applicable to future similar formats in cases of double or multiple reproduction in different systems, which will respond to requests for their publication, archiving, availability, protection and communication of content in standardised systems.
Activities	- determine the noise in the reproduction as a consequence of the reproduction systems themselves - determine the correlation between the original pixel tone values in the playback blackout density for multiple compression rates of the image format - define modulation transmission functions that will provide complete information on the achieved resolution and enable further statistical data processing - create activities necessary for optimal noise reduction, and thus increase the quality of reproduction
Indicators	- presentation of results at conferences and workshops - collaboration with the real sector - defining guidelines for the minimum common standard of image reproduction quality
Number of teachers and associates involved in the work	3 teachers and associates
Collaboration	Collaboration with public economy Faculty of Graphic Art, University of Zagreb.

Topic 20	**INFLUENCE OF THE OCCURRENCE OF PSYCHOPHYSICAL VISUAL EFFECTS IN THE CROSS MEDIA REPRODUCTION SYSTEM ON THE PERCEPTION OF THE OBSERVER'S COLOUR EXPERIENCE**

Summary	In today's modern multimedia environment, consumers are greatly influenced by design solutions whose role is to advertise and sell the product to the end consumer. By choosing a design solution, clients want to achieve the added value of their products. When designing a conceptual design, designers usually forget that such a solution also needs to be printed. In this next step of the printing process, big problems arise if the designers (accidentally or intentionally) come up with a conceptual solution that causes the appearance of background psychophysical visual effects in the printing process. Due to the occurrence of these effects, the observer may experience distorted perception of colour in the printing process. The research of visual effects in the cross media communication system on digital and analogue media will try to predict the power of the effect due to its occurrence depending on the medium on which the effect is manifested. Keywords: cross media, visual psychophysics, perception, colour
Aims	- To create reproductions - To determine the shift in colour experience when creating a design solution that causes the manifestation of a certain visual effect - To determine the strength of a certain visual effect on different media - To determine in which digital medium the evaluated effect is manifested the least. - To propose conceptual design solutions in which the evaluated effect is manifested the least.
Activities	- Create a conceptual design solution that causes the appearance of a certain psychophysical visual effect - Create playback on selected media (analogue) and compare the reproduction with the original on digital media - Define the target group for research purposes that needs to pass the test for defective colour vision - Define the computer screens and printing machines on which the research will be carried out - Determine the ideal digital medium on which the evaluated effect is least manifested - Determine the differences in the strength of the evaluated effect in the relation between the digital and analogue mediums - Create a model to predict the strength of the evaluated effect.

Indicators	- Number of published scientific papers in relevant databases - Presentation of results at a international conference - Collaboration with foreign universities - Collaboration with the real sector - Model proposal to predict the strength of the researched effects.
Number of teachers and associates involved in the work	5 teachers and associates
Collaboration	Faculty of Graphic Art, University of Zagreb. Óbuda University

Topic 21	RESEARCH OF PRINT QUALITY IN DIGITAL PRINTING (ELECTROPHOTOGRAPHY AND INKJET)
Summary	The focus of interest is on the study of the quality of digitally printed media, which is influenced by the chemical composition of the printing substrate, the formulation of toners and colours, and their interaction in the printing machine. These are also the settings of process parameters with which it is possible to achieve an increase in the quality of graphic products, and thus enable new printing media to adequately (optimally) accept toner, i.e., ink. As digital printing machines necessarily require connection to IT systems, software support is important in terms of achieving a satisfactory tonal range of colouring.
Aims	- To define methods for obtaining higher quality printed products - Development of guidelines for use on machines during the printing process.
Activities	- Create a conceptual solution of a test print for both types of printing - Produce prints on available paper substrates for both types of printing - Make print measurements for both types of prints - Compare the results obtained - Determine the best results - Suggest printing instructions in order to obtain the best possible print
Indicators	- Presentation of results at specific conferences and workshops - Collaboration with the real sector - Proposing instructions for printers
Number of teachers and associates involved in the work	3 teachers and associates
Collaboration	- Collaboration with public economy - CROATIAN CHAMBER OF ECONOMY - Faculty of Graphic Art, University of Zagreb

Topic 22	RESEARCH OF PRINTED COLOUR DURABILITY IN PROTECTED PRINTING
Summary	Tests of the luminosity of the printed colour as it performs the activation of high-energy light (UV radiation) with reference to the effects of the degradation of the printing colour and the printing substrate.
Aims	Persistence of colour and print of protected printing
Activities	- Create a conceptual solution of a test print - Produce prints on available paper substrates - Perform ageing and print measurements - Determine the best colour and material for printing
Indicators	- Presentation of results at specific conferences and workshops - Collaboration with the real sector - Proposing instructions for printers
Number of teachers and associates involved in the work	3 teachers and associates
Collaboration	Collaboration with public economy Croatian Chamber of Economy Faculty of Graphic Art, University of Zagreb.

Topic 23	OPTIMISATION OF THE PARAMETERS OF THERMAL PROCESSES IN MATERIAL PROCESSING
Summary	Mathematical models and computer simulation of thermal processes of materials consisting of heat transfer processes, phase transformations, material mechanics, fluid dynamics, multiphysics and numerical methods for computer implementation will be investigated. The theoretical basis of the steel and alloy cooling process will be explored for a more precise theoretical and physical interpretation of heating, cooling, melting, solidification, microstructure generation, stresses and distortions. The parameters of thermal processes of primarily metal materials will be optimised for use in cooling, improving, casting, welding, 3D printing, controlled cooling and applying metal and non-metallic layers to the surface of the product. The development of computer simulation of the behaviour of steel and alloys will refer to the prediction of mechanical properties and microstructure, the generation of thermal and structural stresses and distortions, and the prediction of deformation and material breakage. In order to set expressions and develop an algorithm for predicting the kinetics of austenite decomposition during thermal steel processes, it is accepted that the prediction of the kinetics of austenite decomposition during steel cooling (continuous cooling) can be based on the results of isothermal decomposition of austenite, applying the principle of additivity of changes in the microstructure. It is known that the principle of additivity of the evolution of microstructure

	was intuitively set. Most of the physical processes have been insufficiently investigated in theory.
Aims	- To set up methods and make tools for finding optimal parameters of heat treatment processes for materials that would enable more efficient industrial production - Optimisation of thermal processes during cooling, quenching and controlled cooling during heat treatment of metals, welding, casting and carbonation - To set up mathematical models for making computer programmes that avoid breakage and distortion of workpieces with the desired distribution of mechanical properties, including hardness, tensile strength, stretch limit and resistance to fatigue, crawling, corrosion or wear resistance. Can be achieved by controlling the microstructure and the distribution of residual stresses - To determine input characteristics by laboratory testing, and where this is not possible, statistical methods will be applied using inverse methods.
Activities	- Formation of an expert scientific team - In order to meet the main objective of the research, i.e., the establishment of methods and the creation of tools for predicting the behaviour of materials during thermal processing processes, numerical methods will be applied. Professional software packages will be used. Stochastic methods will be used to analyse stochastic phenomena of microstructure transformation - Selection of input values of all physical and mechanical properties of the material using the calibration process. Experimental methods will also be applied to verify the set mathematical models - Application of experimental methods in the verification of set mathematical models - Experimental research focused on materialographic testing of microstructure and testing of mechanical properties. Analysis of relevant parameters based on the planned experiment method - Preparation of scientific papers with colleagues from abroad, cooperation on projects and submissions to conferences - Dissemination of research results. Publishing papers in indexed journals and proceedings of international conferences - Providing institutional and financial support to scientists and experts from the institution and funding for external collaborators. - Cooperation with the economy, public sector and civil society in organising workshops - Participation in scientific conferences.
Indicators	- Number of published papers in indexed journals - Number of published papers in proceedings of international conferences - Number of quotes from scientists involved in the research

	- Institutional financial support provided to scientists and experts from the institution - Number of organised workshops - Number of visiting scientists from abroad - Number of joint works with colleagues from abroad - Number of submissions at conferences with colleagues from abroad - Number of scientists participating in scientific conferences - Number of students involved in scientific research - Number of new elective courses in cooperation with national and international faculties, teachers and the economy.
Number of teachers and associates involved in the work	3 teachers and associates
Collaboration	Technical University, Sofia, Bulgaria University of Technology, Gliwice, Poland Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split Faculty of Engineering, University of Rijeka

Topic 24	**RESEARCH OF THE INFLUENCE OF ADDITIVE PROCESS PARAMETERS AND HEAT TREATMENT PARAMETERS ON THE STRUCTURE AND PROPERTIES OF MATERIALS FOR TECHNICAL AND BIOMEDICAL PRODUCTS**
Summary	Additive manufacturing processes produce three-dimensional parts by gradually applying thin layers of material guided by a computer model. This unique feature enables the production of complex, purpose-built and unique parts directly from the construction computer model without the need to make expensive tools and parts such as moulds, rivets or engravings, which reduces the need for a large number of steps in the production process. Biomedical implants produced by additive procedures offer significant improvements in terms of osteointegration and biocompatibility, and the possibility of making them fully adapted to the anatomy of the patients. However, the precision of the production of functional products as well as their mechanical properties depend significantly on the accuracy or resolution of the device and on the parameters of the procedure, and the parameters of subsequent heat treatment (sintering, annealing, etc.). By optimising the process parameters, it is possible to influence the obtaining of various mechanical properties and microstructures at precisely defined places of the structure itself, and thus achieve optimal properties on a specific part of the product itself.
Aims	The objective of the research is to clarify the effects of individual parameters (energy, passage rate, layer thickness) of selective laser melting on the the microstructure, mechanical and tribological properties of metals for biomedical applications, and several types of steel that can currently be produced by these

	technologies. Examination of the influence of after-treatment parameters (annealing, deep cooling, precipitation annealing and ageing, austenitisation, etc., depending on the type of alloy) will provide insight into the behaviour of the microstructure and the properties of materials obtained by additive technologies in relation to conventional processing and production technologies.
Activities	- Formation of a research team - Preparation of the research plan, review of most current literature, selection of the parameters of the additive manufacturing process of test samples, selection of the parameters of subsequent heat treatment, measurement of mechanical and tribological properties, characterisation of microstructure and traces of wear, analysis of results, drawing conclusions, optimisation of the parameters of the additive manufacturing process, as well as subsequent heat treatment with the aim of achieving the best possible mechanical and tribological properties - Preparation of scientific papers with co-workers from abroad, cooperation on projects and publishing results at conferences - Dissemination of research results. Publishing papers in indexed journals and proceedings of international conferences - Providing institutional and financial support to scientists from the institution. - Cooperation with the economy, public sector and professional associations in organising scientific and professional conferences and workshops - Participation in scientific and professional conferences. - Application of scientific research projects, cooperation on scientific research projects of other institutions
Indicators	- Number of papers published in indexed journals - Number of papers in proceedings of international conferences - Citation of scientists and collaborators involved in the research - Number of organised scientific and professional conferences and workshops - Number of visiting domestic and foreign scientists in lectures - Number of joint works with co-workers from abroad - Number of scientific and professional conferences participated in - Number of students involved in scientific research - Institutional financial support provided to scientists and experts from the institution
Number of teachers and associates involved in the work	University North - 3 scientists and associates External associates - 8
Collaboration	- Institute of Metals and Technology, Ljubljana, Slovenia - Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb - School of Dental Medicine, University of Zagreb - Faculty of Metallurgy Sisak, University of Zagreb

	- Faculty of Engineering, University of Rijeka - Technoprogres d.o.o.

Topic 25	DETERMINATION OF THE REPRODUCTION QUALITY DUE TO DEFORMATION OF THE RASTER ELEMENT IN FLEXOPRINT
Summary	The research is related to the quality of reproduction in flexoprint in the area of light tones, especially the formation of the raster element due to inadequate press process settings and inadequate press pressure. Deformations of raster elements can lead to inconsistencies in the printing process such as the loss of bright tones or unpredictable increment of RTV. The research will be carried out on concrete examples of flexible packaging printed on transparent films using conventional AM raster technology and a photopolymer plate with a flattened shape of the top of the raster element. An image analysis of the deformation of the raster elements will be performed using the ImageJ software, based on a microscopic image taken on a print with visible deformation, and on a correctly printed reproduction. All significant parameters of the deformation of the raster element are evaluated, including the geometry and sharpness of the raster element and uniformity of colour density. Based on the obtained results, guidelines on how to make graphic preparation using the "bump-up" curve will be defined with the aim of securing a min. point in the press.
Aims	- To determine the quality of reproduction caused by deformation of the raster elements in the flexoprint - To analyse the causes of certain types of deformations of raster elements on the print, to determine the acceptability of the quality of the reproduction thus obtained, and find a solution for eliminating the problem - To analyse the deformation of the raster elements caused by worn printing plates and incorrect settings in the press - To investigate the uniformity of the coverage of the raster element on the print, based on the density of staining
Activities	- develop a test form that will enable the evaluation of the parameters describing the quality of reproduction in the press - specify the entire process in which the experiment will be conducted (making a polymer plate, specification of the printing process and anilox rollers) - print the test form in flexoprint using the appropriate dyes on the selected printing media - define the parameters of the measurement evaluation of the print that will allow determining the deformation of the raster element in the print - record certain characteristic print areas using a 200x magnification microscope - using image analysis and ImageJ software to analyse and determine the deformation of raster elements - perform a visual evaluation of the prints through 3 phases of the printing process given the size of the circulation

	- process the results of the research and graphically present them in such a way that they clearly show the impact of the defined parameters on the quality of reproduction - present the conclusions of the research
Indicators	- number of published scientific papers in relevant databases - presentation of results at an international conference - cooperation with other higher education institutions and the real sector - defining indicators that will contribute to optimising the production process and increasing the quality of the final graphic product
Number of teachers and associates involved in the work	3 teachers and associates

Topic 26	**STUDY OF THE RELATIONSHIP OF GEOMETRIC INCREMENT OF RASTERTON VALUE BETWEEN AM AND FM RASTER METHODS**
Summary	The printing process results in an increase in the physical size of the raster point, which is visible in the form of a circular cornice of a specific width. This difference with respect to the nominal size of the raster element is called the geometric increment of RTV. For a specific printing process, the width of the circular cornice is uniform and does not depend on the size or shape of the raster element or the type of raster. The geometric increment of RTV is directly related to the number of raster dots per unit area, i.e., the total length of the contours of the raster dots, which can be described with their range. The main goal of this study is to define the relationship between the geometric increment of RTV in AM and FM raster technology using a theoretical approach. Eight most common AM raster lines and six FM raster element sizes were selected for analysis. Based on mathematical models, using two independent analytical methods, formulas will be derived to calculate the transition points in % of RTV where the increment of RTV in both technologies has an identical value. The obtained values will serve as an important criterion when selecting raster technologies and defining the basic parameters of stripping.
Aims	- To define the relationship between the geometric increment of RTV in AM and FM raster technology using analytical methods - To define formulas based on mathematical models for calculating the transition point for all combinations of AM raster lineage, and FM raster element size - To analyse and compare the results of individual analytical methods - To define guidelines for the application of the transition point as one of the criteria for selecting raster technologies, and define the basic parameters of rastering in practice.

Activities	- analyse the observed problem with the aim of defining the research framework and individual phases of work - develop AM and FM raster grid models that will serve to define a theoretical approach in determining the geometric increment of RTV - define the values of individual research variables: AM raster lineaturation and FM raster element size - elaborate individual analytical methods and strategies connecting AM and FM raster technologies in terms of determining the key point at which the geometric increment of RTV in AM and FM raster is the same value - describe the selected strategies in detail and present the final formulas to be used in the study - using the formulas to calculate the key points based on the defined values for the AM raster lineage and the size of the FM dots - compare the results of the two selected methods and determine their applicability in determining the key point in both raster technologies - present a conclusion and a scientific contribution of the research
Indicators	- number of published scientific papers in relevant databases - presentation of results at an international conference - cooperation with other higher education institutions and the real sector - defining indicators that will contribute to optimising the production process and increasing the quality of the final graphic product
Number of teachers and associates involved in the work	-3 teachers and associates

Topic 27	**IMPACT OF THE PRINTING MEDIA ON THE QUALITY OF LINE AND TEXT REPRODUCTION IN FLEXOGRAPHY**
Summary	This study characterises and compares the quality parameters of the reproduction of small elements in flexoprint on coated and uncoated paper, and OPP foil. Reproduction of small elements includes the reproduction of lines, text, and micro dots that are an integral part of any image. It is necessary to create a monochrome test form and print with cyan UV dye. Samples for deformation analysis of small elements are recorded on prints with a magnification of 200x, and analysed using the ImageJ software. All important parameters of line and text deformation in print will be evaluated, including their geometric change, sharpness and bulkiness of the edge, and uniformity of colour density. The change in the size of small elements will be estimated based on the measurement of their surface area. The degradation of the edge of small elements in the press will be evaluated based on the measurement of the scope, and the creation of a 2D profile. The analysis of the uniformity of the dye layer on the print will be carried out by visual evaluation based on 3D topographic representations of the dye density. The analysis of the results will provide information on the importance of the interaction between the printing substrate and

	the dye, and indicate the principles of deformation of lines and text on the print. The scientific contribution of this paper is based on the comparison of qualitative parameters of reproduction of small elements, which can contribute to the optimisation of the production process and increase the quality of the final graphic product.
Aims	- To determine the impact of the printing media on the quality of reproduction of small elements such as thin lines and small text sizes, in order to compare qualitative reproduction parameters and optimise the production process - To explore how different types of printing media affect the quality of reproduction of small elements with an emphasis on geometric deformation, edge degradation and uniformity of colour density - To determine the level of deformation and degradation of small elements based on measurements of their surface and circumference, and imaging analysis of microscopic images from the print using the ImageJ software - To compare the deformation of small elements according to the width of the lines, the size of the text and the method of imprinting in the positive or negative - To visually compare the quality of reproduction and determine the impact on the visibility of small elements, the credibility of the form and the legibility of the text
Activities	- develop a test form that will enable the evaluation of the parameters describing the quality of reproduction of small elements in the press (lines and serif text in the positive or negative form) - specify the entire process in which the experiment will be conducted (making a polymer plate, specification of the printing process and anilox rollers) - print the test form in flexoprint using the appropriate dyes on three selected printing media (coated and uncoated paper, and OPP film) - define the parameters of the image evaluation of the print that will allow determining the quality of the reproduction of lines and text in the print - record samples for evaluation with a 200x magnification microscope, select two line thicknesses and two text sizes - using image analysis, and the ImageJ tool to analyse and determine the quality of line and text reproduction - process the research results and graphically present them in such a way that they clearly describe the quality of reproduction of small elements - present the conclusions of the research
Indicators	- number of published scientific papers in relevant databases - presentation of results at an international conference - cooperation with other higher education institutions and the real sector - defining indicators that will contribute to optimising the production process and increasing the quality of the final graphic product
Number of teachers and associates	- 3 teachers and associates

involved in the work	

Topic 28	ANALYSIS OF THE INFLUENCE THAT THE COMPOSITION OF THE ACTIVATION COATING HAS ON THE PROPERTIES OF WELDED JOINTS IN A-TIG WELDING OF CU-ETP COPPER
Summary	For welding copper alloys, the TIG welding process is most often applied. According to the experimental plan, the influence of the activation coating components on the properties of the Cu-ETP copper welded joint in the A-TIG welding process will be analysed. The analysis will determine the optimal composition of the welding coating on welds at the interface and angle joint, performed with the application of activation coatings. The advantages of the A-TIG welding process with active coating include the possibility of welding without joint preparation and greater penetration, which allows a smaller number of passages (thus increasing productivity).
Aims	The research will result in optimisation of the composition of the activation coating in order to obtain the most suitable coating for A-TIG welding of the Cu-ETP copper alloy. Optimisation will refer to the types of components and their shares in the overall mixture. The research will result in the publication of several scientific papers in journals indexed in the WoS CC database, and at international conferences. In the future, the results can also pass through industrial validation and lead to commercialisation through the production of activation coating with the support of one of the manufacturers of similar products, such as Elektroda Zagreb d.o.o.
Activities	1. Production of TIG welded joints without activation coating that will serve as a comparative basis 2. Production of activation coatings with particles of different components 3. Production of A-TIG welded joints using pre-made activation coatings 4. Visual inspection of welded joints 5. Testing the mechanical properties of all welded joints using the applicable standards 6. Analysis of macro and microstructure of welded joints 7. Systematisation of experiment results 8. Publication of scientific papers based on research results
Indicators	1. Number of TIG welded joints made without activation coating 2. Number of activated coatings made 3. Number of A-TIG welded joints made using pre-prepared activation coatings 4. Visual inspection results 5. Mechanical properties test results 6. Results of analysis of microstructure and macrostructure of welded joints 7. Aggregated results and conclusions on the experiments carried out 8. Number of published scientific papers based on research results

Number of teachers and associates involved in the work	5 teachers and associates
Collaboration	University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture University of Ljubljana, Faculty of Mechanical Engineering Elektroda Zagreb d.o.o. ALVITOM d.o.o.

Topic 29	**ANALYSIS OF THE INFLUENCE THAT THE COMPOSITION OF THE ACTIVATION COATING HAS ON THE PROPERTIES OF WELDED JOINTS IN A-TIG WELDING OF STAINLESS STEEL**
Summary	According to the plan of the experiment, the influence of the activation coating components on the properties of the welded joint of different stainless-steel alloys (AISI 304, AISI 309, AISI 316) in the A-TIG welding process will be analysed. The analysis will determine the optimal composition of the welding coating on welds at the interface and angle joint, performed with the application of activation coatings. The advantages of the A-TIG welding process with active coating include the possibility of welding without the preparation of the joint by machining, which is demanding for stainless steels due to increased wear of cutting tools. Welding will be carried out automatically to avoid the impact of welder error. All welded joints resulting from the state of the experiment will be tested by non-destructive methods and the microstructure formed in the welded joint will also be determined. Testing the mechanical properties of the base material and welded joints will determine the suitability of the selected welding and activation coating parameters. Corrosion tests will also be carried out in detail to determine the possible impact of the activation coating on the corrosion resistance of stainless steels.
Aims	The research will result in optimisation of the composition of the activation coating in order to obtain the most suitable coating for A-TIG welding of each individual stainless-steel alloy (AISI 304, AISI 309, AISI 316). Optimisation will refer to the types of components and their shares in the overall mixture. The research will result in the publication of several scientific papers in journals indexed in the WoS CC database, and at international conferences. In the future, the results can also pass through industrial validation and lead to commercialisation through the production of activation coating with the support of one of the manufacturers of similar products, such as Elektroda Zagreb d.o.o.
Activities	1. Production of TIG welded joints without activation coating that will serve as a comparative basis 2. Production of activation coatings with particles of different components 3. Production of A-TIG welded joints using pre-made activation coatings 4. Visual inspection of welded joints 5. Testing the mechanical properties of all welded joints using the applicable standards

	6. Analysis of macro and microstructure of welded joints 7. Systematisation of experiment results 8. Publication of scientific papers based on research results
Indicators	1. Number of TIG welded joints made without activation coating 2. Number of activated coatings made 3. Number of A-TIG welded joints made using pre-prepared activation coatings 4. Visual inspection results 5. Mechanical properties test results 6. Results of analysis of microstructure and macrostructure of welded joints 7. Aggregated results and conclusions on the experiments carried out 8. Number of published scientific papers based on research results
Number of teachers and associates involved in the work	7 teachers and associates
Collaboration	University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture University of Ljubljana, Faculty of Mechanical Engineering University of Novi Sad, Faculty of Technical Sciences Elektroda Zagreb d.o.o.

Topic 30	**ANALYSIS OF THE IMPACT OF WELDING PARAMETERS IN MIG WELDING OF STAINLESS STEELS**
Summary	According to the plan of the experiment, the influence of welding parameters on the properties of the welded joint of different stainless-steel alloys (AISI 304, AISI 309, AISI 316) in the MIG welding process will be analysed. This type of material has a wide application in industries, from food, petroleum, pharmaceutical, nuclear, etc. Creating mathematical models of the impact of welding parameters will contribute to increasing productivity and reducing waste of products with higher added value due to the relatively high price of such materials. The influence of parameters on mechanical properties and corrosion resistance will be analysed on welds in the interfaced and angled joint made with the application of full wire and powder filled wire. Welding will be carried out automatically to avoid the impact of welder error. All welded joints resulting from the state of the experiment will be tested by non-destructive methods and the microstructure formed in the welded joint will also be determined. Testing the mechanical properties of the base material and welded joints will determine the suitability of the selected welding and types of supplementary material parameters. Corrosion tests of the resulting welded joints will also be carried out in detail.
Aims	The research will result in the development of mathematical models that will be able to predict the impact of individual welding parameters on the properties of the resulting welded joint. The results will be shaped into scientific papers that will be

	published at scientific conferences and in scientific journals indexed in the WoS CC database.
Activities	1. Development of MIG welded joints with a variation of welding parameters using factor test plans using solid and powder filled wire as an additional material 2. Visual inspection of welded joints 3. Testing the mechanical properties of all welded joints using the applicable standards 4. Analysis of macro and microstructure of welded joints 5. Systematisation of experiment results 6. Development of mathematical models for predicting the impact of welding parameters 7. Publication of scientific papers based on research results
Indicators	1. Number of MIG welded joints made using solid and powder filled wire 2. Visual inspection results 3. Mechanical properties test results 4. Results of analysis of microstructure and macrostructure of welded joints 5. Aggregated results and conclusions on the experiments carried out 6. Number of developed mathematical models for predicting the impact of welding parameters 7. Number of published scientific papers based on research results
Number of teachers and associates involved in the work	5 teachers and associates
Collaboration	University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture

Topic 31	**ANALYSIS OF THE IMPACT OF MACHINING PARAMETERS ON THE WEAR OF THE CUTTING TOOL DURING MACHINING BY SEPARATING STAINLESS-STEEL PARTICLES**
Summary	The research will analyse the impact of the parameters in the processing by separating the particles in the processing of stainless steels AISI 304, AISI 309 and AISI 316 according to the experiment plan. This type of material has a wide application in industries, from food, petroleum, pharmaceutical, nuclear, etc. It is known that due to its physical properties, such as toughness, thermal conductivity coefficient and thermal capacity, these materials affect the increased wear of cutting tools when milling, turning and drilling. According to the experiment plan, the impact of the cutting speed, feed and cutting depth for each individual coating on the tool will be determined on the tool life and the resulting surface quality. Cutting tools from all experimental states will be analysed by measuring them using digital scales, visual control by

	magnification on a microscope, and 3D digitisation of shapes. Processed shapes will also be measured to determine the influence of parameters on the accuracy of processing. Creating mathematical models of the impact of processing parameters will contribute to increasing productivity and reducing waste of products with higher added value due to the relatively high price of such materials.
Aims	The research will result in the development of mathematical models that will be able to predict the impact of certain machining parameters on the tool life and the quality of the treated surface on stainless steels. The results will be shaped into scientific papers that will be published at scientific conferences and in scientific journals indexed in the WoS CC database.
Activities	1. Experimental drilling, milling and turning of raw material from different stainless steels with variation of processing parameters using factor test plans and different tools 2. Visual control of tools after processing and obtained treated surfaces 3. Analysis of the state of protective coatings and geometry of cutting tools by measurements on a microscope and 3D digitisation of objects 4. Systematisation of experiment results 5. Development of mathematical models for predicting the impact of processing parameters 6. Publication of scientific papers based on research results
Indicators	1. Number of processing performed or number of states of the experimental factor plan 2. Results of visual inspection of tools and treated surfaces 3. Results of tool analysis by measuring on a microscope and 3D digitisation of an object 4. Aggregated results and conclusions on the experiments carried out 5. Number of developed mathematical models for predicting the impact of welding parameters 6. Number of published scientific papers based on research results
Number of teachers and associates involved in the work	5 teachers and associates
Collaboration	University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture

Topic 32	**RESEARCH AND REDUCTION OF LOSSES IN PRODUCTION PROCESSES USING THE PRINCIPLES OF THE LEAN CONCEPT IN SMALL AND MEDIUM-SIZED ENTERPRISES**
Summary	Nowadays, the Lean concept is particularly prominent and increasingly popular for achieving business excellence and business improvement. It is a very specific methodology whose application requires a systematic approach based on the

	principles of continuous application. Compared to other concepts of improvement, the Lean concept has an advantage in that it equally and strongly improves companies that are in crisis, companies that are doing well, but want to achieve growth, and companies that are doing great business, but have a constant goal of improving business, quality and customer satisfaction. Like other methodologies, the Lean methodology represents a strategic orientation of the company aimed at increasing business efficiency, increasing customer satisfaction and maintaining a competitive advantage. It is defined as a concept aimed at reducing costs through improving the efficiency of business processes. The Lean methodology means less work and effort in processes, less space, investments, time, tools and devices, less supplies, waiting, etc. In short, the Lean concept strives to maximise value for the customer while minimising losses and waste, and optimising all processes. Global experience shows that the Lean methodology is successfully applied in the processes of improving and generally functioning large business systems and that the results are impressive. The methodology was created in the large business systems of Japan (TPS - Toyota). After that, it spread to the large business systems of the United States and Europe. It is designed and adapted for large companies. Like other successful solutions of large systems, the Lean concept gradually permeates SMEs. This has been particularly emphasised recently when this methodology began to be more intensively researched and applied in Europe and other regions where business systems are on average significantly smaller than in the USA. In the last twenty years or more, small and medium-sized enterprises (SMEs) have been the driving force behind the development of the economy. They employ new workers, adapt more easily to changes than large companies, require fewer resources in business, communication lines are shorter and faster, etc. However, their perceived role in generating income and investing in non-current assets should also not be overlooked. Global experience shows that the Lean methodology is successfully applied in the processes of improving and generally functioning large business systems, and that the results are impressive. The methodology was created in the large business systems of Japan (TPS - Toyota). After that, it spread to the large business systems of the United States and Europe. It is designed and adapted for large companies. Like other successful solutions of large systems, the Lean concept gradually permeates SMEs. This has been particularly emphasised recently when this methodology began to be more intensively researched and applied in Europe and other regions where business systems are on average significantly smaller than in the USA. In the last twenty years or more, SMEs have been the driving force behind the development of the economy. They employ new workers, adapt more easily to changes than large companies, require fewer resources in business, communication lines are shorter and faster, etc. However, their perceived role in generating income and investing in non-current assets should also not be overlooked. The western business world is delighted with the success of companies that have implemented or started implementing the Lean concept in their business processes. Professional journals offer education and literature about the Lean concept, presentations and professional seminars are organised in attractive

	places, Lean academies are launched in almost every country of the West, experiences of companies that introduced Lean are exchanged, huge profits are made thanks to the application of the conception, etc. What's that all about? What is so "magical" about the Lean methodology? Is it possible to apply this in our country and in other countries with a similar economic structure? In particular, the question arises as to how much the Lean methodology can help to improve business in SMEs? The research focuses on the most important aspect of the Lean concept. This refers to waste that occurs in all forms of business, including small and medium-sized enterprises. Their identification and identification of essential waste in small business systems can model the procedures for rapid intervention in terms of correction and prevention. In addition, it is possible to design a methodology that would help in the numerical monitoring of all undesirable phenomena. Waste (*muda* in Japanese) - includes consequences that occur in production processes under the influence of various factors that do not bring direct value to a product or service. Removing waste or reducing it is one of the most important goals of any process of improvement, including the Lean concept. By identifying and measuring waste, optimise the process of their reduction or elimination in order to raise the overall efficiency of production processes in mechanical production. The survey will be conducted in the real sector with a properly selected statistical sample, and the results will be compared with the survey data in other countries.
Aims	By identifying and measuring waste, optimise the process of their reduction or elimination in order to raise the overall efficiency of production processes in mechanical production-type SMEs. The research should be carried out in the real sector of the production type with a properly selected statistical sample, and the results compared with the survey data in other countries.
Activities	1 By reviewing the relevant scientific bases, we can come to know about the problem that will be investigated. In this regard, the scientific databases *Science Direct and Scopus* will be searched. This search would extend to papers using the *Google Scholar* browser, *where only peer-reviewed works would be taken into account. If necessary, other scientific bases would be explored.* 2 Explore in more detail the definitions and meanings of the term *Lean*, i.e., define it more clearly in the context of this research. 3 Briefly explore and present the historical development of the Lean concept in order to better understand the current and desired situation in terms of losses and overall efficiency of production processes. 4 Explore the basic principles on which the Lean concept is based, and link them to waste in production processes. 5 Investigate and define small business systems (SMEs) in terms of their specificity of business and features that distinguish them from large business systems. 6 Define an adequate sample and select small and medium-sized enterprises of mechanical engineering production to participate in the research.

	7 After collecting data and information from the real sector, carry out their processing and analysis and compare them with the results of other research. In doing so, conduct adequate statistical tests for quantitative and discrete variables. 8 Use the results of research and statistical analysis to design an appropriate waste monitoring model with specific criteria and benchmarks. 9 Propose appropriate tools and methods to eliminate and prevent waste. 10 Define the procedures for possible future research related to waste and the Lean concept in SMEs in general.
Indicators	-
Number of teachers and associates involved in the work	4 teachers and associates
Collaboration	– Companies in the Republic of Croatia that have started or plan to start implementing the Lean concept (Šestan-Busch d.o.o.; Oprema d.d.; Centrometal d.o.o.; Model pakiranja d.d.; Končar metalne konstrukcije d.o.o.; Strojarstvo Branilović d.o.o.; Derma d.d.; Pireko d.o.o.; Alpro Šardi d.o.o.; Vnuk d.o.o.; Kostwein d.do.o. ; etc.). – University of Slavonski Brod, Faculty of Mechanical Engineering in Slavonski Brod; – Lean Management Initiative – **Lean Spring Summit** (brings together experts and scientists from Croatia and Europe to present the **concept of the factory of the future**). – **County Chambers of Commerce.** – Scientific institutions (teachers who deal with the Lean concept in the field of their work).

Topic 33	**QUALITY MANAGEMENT IN INDUSTRY 4.0**
Summary	The term Industry 4.0 represents the transformation of business and production systems and their integration with information and communication technologies in order to increase their productivity and efficiency, as well as other performance indicators (cost-efficiency, profitability, etc.). The implementation of the concept of Industry 4.0 is a great challenge for companies in all aspects (financial, personnel, technological, information, etc.), and requires the cooperation of employees in the real sector, academia and producers of sophisticated production assets. Industry 4.0 is a segment of the fourth industrial revolution that is based on the development of fully automated and intelligent production capable of autonomous communication of all participants. The Fourth Industrial Revolution is not only about smart and connected machines and systems, as its scope is much wider. It is a combination of new technologies and their interaction between the physical, digital and biological domains, which distinguishes it from previous industrial revolutions. The changes brought about by the fourth industrial revolution provide many opportunities to improve business, communication and people's lives. The new industrial revolution enables: lower barriers between inventors and the

	market, active role of artificial intelligence, integration of different factors of techniques and domains, improvement of quality of life, and generally connected/networked lives of people. The purpose of Industry 4.0 is the implementation of highly efficient and automated production processes whereby individual products, and products at the customer's request will be produced according to mass adaptation strategies through self-regulating production in which people, machines, equipment and products will communicate with each other. Industry 4.0 seems to be the solution to global challenges such as reducing company de-localization, improving product personalisation, increasing flexibility in operational processes, sustainability of resource and energy efficiency, and increasing competitiveness. The main purpose of Industry 4.0 is to improve the efficiency and flexibility of companies to adapt to future requirements. The implementation of the Industry 4.0 concept is influenced by a number of internal and external aspects that need to be identified, analysed and viewed from several aspects. One of the very important elements of the internal context of Industry 4.0 is a quality management system, with all its elements of planning, assurance, control and improvement. Current knowledge in the Republic of Croatia and the world about Industry 4.0 shows that there is not enough relevant research on the place and role of quality control in these aspects of production. The research would contribute to the observation of the place and role of the quality management system in the industrial process management system based on the Industry 4.0 method.
Aims	Existing quality management methods and procedures should be adapted to modern production systems in Industry 4.0, and the possibilities of adapting and developing new procedures in ensuring and managing the quality of products and services in mechanical engineering-type companies should be considered and explored.
Activities	1. Exploring the concept and unambiguously defining the concept of Industry 4.0 in the context of industrial production and the Fourth Industrial Revolution. 2 Recording and observation of the current state of Industry 4.0 in the Republic of Croatia and developed EU countries. 3 Research of previous findings on quality control in modern production organised and based on the principles of Industry 4.0. 4 Identify transition periods from the classical industry to the Lean industry and then to Industry 4.0 and propose adequate quality assurance procedures. 5 Identify companies in the Republic of Croatia that use the principles of Industry 4.0 in their business and establish business cooperation. 6 Conduct research in selected companies and analyse them from the aspect of quality and other economic performance indicators.

	7 Propose an appropriate quality assurance model in companies applying Industry 4.0 principles.
Indicators	
Number of teachers and associates involved in the work	4 teachers and associates
Collaboration	– University of Slavonski Brod, Faculty of Mechanical Engineering in Slavonski Brod; – University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Institute for Quality – County Chambers of Commerce. – Companies in the Republic of Croatia that have started or plan to start implementing the Lean concept and are thinking about Industry 4.0. – Scientific institutions (teachers who deal with the Lean concept and Industry 4.0 in the field of their work).

Topic 34	**EFFECT OF MACHINING PARAMETERS ON THE QUALITY OF LARGE CROSS-SECTION THREADS MADE BY PEELING ON A CLASSIC LATHE**
Summary	Trapezoidal threads of greater length can be made by turning in such a way that the cutting tool removes excess material from the workpiece in several passages. A faster and more qualitative way of making such threads is with the help of thread peeling technology, where a rotating head with one or more cutting tools makes the appropriate thread. The procedure can be performed on special machines, which is more expensive, or on a classic lathe where a special device is mounted on a transverse support. In this way, it is possible to make threads of large depths, i.e., large cross-sections, in one or two passages. On this occasion, it is necessary to take into account the thread geometry and technical characteristics of the lathe, so that there is no collision between the tool, machine and workpiece during processing. For this reason, the angle of inclination of the tool must be adjusted to match the profile and the rise of the thread, and the direction and number of revolutions of the workpiece and tool must be adjusted. For this purpose, different diameters of pulleys, reducers and frequency regulators are used.
Aims	(1) To determine the optimal number of revolutions of the workpiece and tools in which the surface of the treated piece has the least roughness, and thus achieves the most efficient processing. (2) To determine the optimal number of revolutions of the peeler tool, in order to minimise vibrations when processing and thereby achieve better quality of the treated surface and longer life of the tool. (3) To determine the optimum feed, in order to ensure the maximum removal of materials and thus increase productivity

Activities	(1) Supply of the necessary tools and materials for the implementation of the scientific research. Procurement of a frequency regulator for adjusting the number of revolutions of the electric motor of the peeler, and a frequency regulator for adjusting the number of revolutions of the spindle of the lathe or workpiece. Procurement and installation of a reducer motor to further reduce the input speed of the lathe. Procurement of equipment and materials for hard soldering of wolfram carbide tiles to the holder (tool), and diamond grinding plates for the production of correct tool geometry. (2) Mounting the peeler on the cross-port of the lathe using special screws and adjusting the slope of the cutting tool according to the rise of the coil. Adjusting the feed size to ensure optimum processing speed with minimal vibration. (3) Procurement and installation of vibration measuring devices with a minimum of 2 probes, in order to measure vibrations on the peeler and workpiece. (4) Presentation of measurement results through at least one scientific paper published in a relevant journal represented in a world-renowned database.
Indicators	Key indicators that correspond to aims (1), (2), and (3): - Training of teaching staff for the use of new equipment for measuring physical quantities in real production, which is more demanding than laboratory measurements, due to the different forms of interference that occur during the processing process, which cannot be influenced. - Table of results with visible optimal processing parameters, which are applicable in practice to a particular machine, tool and thread geometry. - Collaboration with scientists from other higher education institutions in Croatia and abroad, and the exchange of theoretical and practical knowledge, resulting in the publication of at least one scientific paper in a relevant journal.
Number of teachers and associates involved in the work	4 teachers and associates
Collaboration	Faculty of Mechanical Engineering, Maribor Faculty of Engineering, Rijeka

Topic 35	**CONSTRUCTION AND MANUFACTURE OF DEVICES FOR TESTING THE MECHANICAL PROPERTIES OF ROCKWOOL**
Summary	The toughness of rockwool and the resistance to dynamic loads are properties whose monitoring could significantly affect the quality of rockwool products. In cooperation with the economy, quality research could be carried out, which could result in final, graduate and doctoral theses. As experts from the company Knauf Insulation d.o.o. are interested in cooperation, this research would contribute to a better connection of University North with the local economy.
Aims	1. To connect the acquired theoretical and professional knowledge and practical applications in the field of production engineering through the production of final theses that rely on technological problems in production.

	2. To strengthen the research potentials of all participants involved in the topic by means of research work. 3. Development of modified procedures for measuring mechanical properties.
Activities	- Study standard procedures for measuring toughness and resistance to dynamic loads - Construct and manufacture devices that would, according to standard procedures, measure the specified mechanical properties of rockwool - Perform a series of measurements of mechanical properties on samples - Involve students in activities, where possible - Describe the results and publish scientific papers.
Indicators	1. Key indicators that correspond to Aim 1: a large number of participants involved in the process of producing one or more final thesis, writing and publishing scientific and professional articles. 2. Key indicators that correspond to Aim 2: publication of final theses, professional and scientific articles 3. Key indicators that correspond to Aim 3: Construction and manufacture of devices for measuring mechanical properties according to standard or modified procedures.
Number of teachers and associates involved in the work	6 teachers and associates
Collaboration	These activities would be carried out in cooperation with experts from local companies in terms of procurement of materials, cutting services, sample materials and the like. It should also be noted that several students of University North are employed in local enterprises and could participate through the preparation of final and/or graduate theses.

Topic 36	**PACKAGING ENGINEERING IN THE ROLE OF ENVIRONMENT PROTECTION**
Summary	Research will be conducted on the preventive processes of environmental engineering in the design, production and application of packaging. In particular, modern engineering materials for packaging production will be explored. The environmental impact of the production, application and use of packaging will be researched. Technological conditions of more intensive introduction of modern packaging will be researched. The economic and environmental effects of replacing disposable packaging with reusable packaging will be researched. The effects of reusable packaging in energy saving, waste and pollution reduction, recyclability, green product, process design and corporate environmental management will be explored. Trends in the development of packaging design and graphics, new constructions and new materials from the perspective of the multifunctional role of packaging will be explored.

	Packaging in modern industrial production where it serves internal transport, storage of goods in warehouses, production facilities and assembly lines will be explored. Research will be done of measures for assessing the success of environmental process innovation with regard to emissions, waste and substance generation, intensification of the use of recycling and reuse of materials and improving the use of resources such as raw materials, water, fossil fuels and electricity.
Aims	- Assessment of economic and technological conditions for the introduction of modern packaging - To define the performance features that must be met by modern packaging - To set up innovative environmental processes that improve the environmental capability and competitiveness of a company - Assessment of improvements in waste generation reduction that can be achieved by introducing eco-innovations in packaging engineering - Identification of relevant indicators for the application of reusable packaging to enterprise production efficiency and environmental protection - To conduct at least one joint research with a foreign institution related to the topic of packaging engineering in the function of environmental protection - Involvement of scientists from other domestic and foreign institutions in research projects - Positively influence the behaviour and political preference of the public in the field of packaging engineering in the function of preserving the environment.
Activities	- Formation of an expert scientific team - Theoretical and experimental research of packaging engineering in the function of environmental protection - Preparation of papers with colleagues from abroad - Submissions at conferences with colleagues from abroad - Dissemination of research results - Publishing papers in indexed journals and proceedings of international conferences - Providing institutional and financial support to scientists and experts from the institution, and funds for external associates - Cooperation with the economy, public sector and civil society in organising workshops - Participation in scientific conferences.
Indicators	- Number of published papers in indexed journals - Number of published papers in proceedings of international conferences - Number of quotes from scientists involved in the research - Institutional financial support provided to scientists and experts from the institution - Number of organised workshops - Number of distinguished visiting scientists from abroad - Number of joint works with colleagues from abroad

	- Number of submissions at conferences with colleagues from abroad - Number of scientists participating in scientific conferences - Number of students involved in scientific research - Number of new elective courses in cooperation with national and international faculties, teachers and the economy.
Number of teachers and associates involved in the work	3 teachers and associates
Collaboration	Óbuda University Budapest, Hungary Silesian University of Technology, Gliwice, Poland

Topic 37	**Cinemetrics of Croatian film**
Summary	Measuring and visualising film data reveals the characteristics of films and creates their visual "fingerprint". Information such as editorial structure, colour, speech, or movement is extracted, analysed, and transformed into graphic representations so that films can be seen as a whole and easily interpreted or compared to each other. The cinemetrics of Croatian film is an "experiment" to determine whether the data inherent in the film can be used to create visibility of something that would otherwise go unnoticed.

Aims	- To measure and visualise film data in order to discover the characteristics of films and create a kind of unique "fingerprint" of Croatian film.
	- To extract and analyse information - such as the structure of editing, the use of colour, speech, or movement - and convert it into graphic representations so that films can be seen as a whole and easily interpreted or compared.
	- Experimental work and presentation of works in print and digital media.
	- In particular, make a comparison (similarities and/or differences):
	  - original versus remake
	  - films of the same genre/series
	  - different epochs of filmmaking
	  - all films by one director
	- To use informative graphics that use metadata related to film and cinema

Activities	1 Scientific research activities are focused on the research of cinemetrics (film statistics) with the aim of finding a pattern of film development, but also with significant film authors and data sciences. 2 Recruitment of a competent doctoral student and their training for scientific and research work with the aim of producing a doctoral thesis. 3 Signing of contracts with selected relevant partners for scientific research work on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility.

	4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). 5 Train employees to apply new digital tools for cinemetrics research, including photography and computer games. 6 Creating an open web application related to the database in which users can explore the cinemetrics of Croatian film with the possibility of complementing their research. 7 Promotional activities of approaching the field of scientific research and professional work to all interested parties with special emphasis on the field of data science and statistics through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications).
Indicators	1 Scientific research activities are aimed at exploring the interdisciplinarity of film through seeing films in a complex, engineering system according to System Theory, and finding a sample according to the Data Sciences with the aim of drawing conclusions about the development of both Croatian film and individual authors. 2 Formation of a cinemetrics database for Croatian film. 3 Signing of contracts with selected relevant partners for scientific research work on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. 4 Conclusion of contracts with relevant partners in the public sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). 5 Establishing a team of scientists and experts who will systematically work on "filling" the database which, after a few years, should be a useful tool for researching Croatian film. 6 Promotional activities of bringing the field of scientific research and professional work closer to all interested parties with a special emphasis on the field of film through the prism of cinemetrics and data science through various activities (open

	days of the University, Science Festival, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in publications).
Number of teachers and associates involved in the work	1 – 2 (from University North) (for starters, the whole research is planned to start as a doctoral thesis, and try to apply the idea for the Call for Projects of the Croatian Film Institute, with the hope of developing a cinemetrics database of Croatian film)
Collaboration	cooperation with scientific and professional staff has been agreed: - Academy of Dramatic Arts, University of Zagreb, - Faculty of Organization and Informatics, University of Zagreb, - the Croatian Film Association, - Faculty of Contemporary Arts, Belgrade - ESRA Ecole de Cinéma, Son de Animation, Paris

BIOTECHNICAL SCIENCES:

Topic 1	ANTIMYCOTOXIC FOOD PROTECTION
Summary	Mycotoxins are toxic secondary metabolites of mould that are inevitable contaminants of food, primarily grain, fruits and vegetables. The growth of mould in the field depends on weather conditions, which makes it impossible to accurately predict contamination for individual years in advance. Other parts of the problem of mycotoxin contamination are the control of contamination during harvest and storage. In order to keep food quality and healthy in terms of mycotoxin contamination, it is possible to apply different methods of suppression: from testing the influence of new compounds on mould growth suppression and the impact on mycotoxin biosynthesis, testing naturally occurring contaminants on mycotoxin biosynthesis, through testing the cultivation methods and resistance of individual grain, fruit or vegetable varieties to mould growth and mycotoxin accumulation.
Aims	The specific aims of this topic are: 1. Determination of the incidence and co-occurrence of regulated and non-regulated mycotoxins on real samples 2. Determination of resistant grains, fruits and vegetables to mould contamination and mycotoxin accumulation 3. Influence of natural contaminants on metabolic pathways of mycotoxin biosynthesis in mould 4. Provide medically sound food using food additives or storage facilities in view of the occurrence of mycotoxins.
Activities	1. Measurement of the incidence and co-occurrence of regulated (13 mycotoxins) and unregulated (more than 300) mycotoxins on food samples, where at least 50 samples per year will be tested for total mycotoxins, and an additional 50 samples specific to individual mycotoxins. 2. The resistance of cereals to mould contamination will be determined by the control and deliberate infection of grains in test fields with mycotoxicogenic mould, while experiments to determine the resistance of grains, fruits and vegetables will also be carried out *in vitro* by infection of sterilised plant samples, or infection after sterilisation of the surface of the tested plants themselves. At least 25 trials per year are planned. 3. When examining natural contaminants on the metabolic pathways of mycotoxin biosynthesis, the effect of selected natural contaminants on the metabolic pathways will be examined in more detail, including enzymes involved in oxidative metabolism, antioxidant activity, and the generation of reactive oxygen species. All measurements will be performed by validated spectrophotometric and/or spectrofluorometric methods. 4. According to the results of activity 2, find active components for antifungal activity research, prepare extracts of functional antifungal components and apply them to other foods and/or warehouses where mycotoxin contamination is expected (in accordance with Commission Regulation No. 1881/2006 laying down maximum levels of certain contaminants in food).

Indicators	1 Key indicators that correspond to Aims 1 - 4: Scientific research projects, published scientific papers indexed in WOS (at least 2 papers per year in the highest quartiles (Q1 and Q2), professional papers and new study programmes or subject curricula based on the results of scientific research, and increasing international visibility. 2 Key indicators that correspond to Aims 1, 2, and 3: published scientific papers on mould metabolism, and participation in international conferences. 3 Key indicators that correspond to Aim 2: at least one international scientific research mobility per year during which research will be conducted in institutions with appropriate analytical equipment, and at least one participation in an international scientific conference per year with partners on Aim 2. 4 Key indicator that corresponds to Aim 4: established cooperation with relevant partners in the economy to establish cooperation on the placement of a new product on the market.
Number of teachers and associates involved in the work	6 teachers and associates from University North 15 associates from other institutions
Collaboration	University of Zagreb, Faculty of Food Technology and Biotechnology University of Zagreb, Faculty of Geotechnical Engineering Varaždin University of Zagreb, Faculty of Chemical Engineering Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Josip Juraj Strossmayer University of Osijek, Department of Chemistry Josip Juraj Strossmayer University of Osijek, Department of Biology University of Split, Faculty of Chemistry and Technology Croatian Agency for Agriculture and Food Podravka (research and development) Croatian Veterinary Institute Agricultural Institute, Osijek Ruđer Bošković Institute Dr. Rudolf Steiner Centre Institute of Bioanalytics and Agro-Metabolomics, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Life Sciences Vienna (BOKU), Tulln, Austria Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Serbia Department of Microbiology, Babcock University, Ogun State, Nigeria Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, Belfast, Northern Ireland, UK Department of Food Chemistry and Toxicology, Faculty of Chemistry, University of Vienna, Vienna, Austria Laboratory of Pharmacology and Toxicology, University of Yaounde I, Yaounde, Cameroon MIAEH, School of Public Health, University of Maryland, College Park, USA University of Chemistry and Technology, Prague, Czech Republic

Topic 2	QUALITY AND HEALTH SAFETY OF FOOD PRODUCTS IN GASTRONOMIC TRENDS
Summary	Healthcare is humanity's number one imperative. The risk of diseases caused by problems in food production and preparation (application of new technologies, preparation of inadequate raw materials, changed lifestyles and decreasing resilience of people) – is a danger. It can be said that one of the most important aspects in the production and distribution of food is its quality and health safety, which should be met by every food manufacturer. Modern technologies and globalisation provide new possibilities for food production, processing and distribution, as well as the latest gastronomic trends (e.g. food for reheating – *Convenience cooking*), which increases the list of benefits, but the risks also grow.
Aims	1 To get an insight into the activities of food manufacturers with an emphasis on the latest gastronomic trends regarding: - reducing the occurrence of food-borne diseases and ensuring the supply of safe, healthy and quality satisfactory food products to the population - compliance with the requirements of legal regulations and inspection supervision activities - laboratory controls - enabling the efficient introduction of new technologies and products in accordance with gastronomic trends. 2 To investigate the impact of gastronomic trends and consumer demands on the quality and health safety of food products outside the parameters set by the legislation.
Activities	1 Survey of the general population and producers on gastronomic trends 2 Organisation of lectures on proper nutrition and gastronomic trends for producers and consumers 3 Participation in international scientific and professional conferences related to gastronomy and dietetics
Indicators	1 Key indicators that correspond to Aims 1 - 4: Scientific research projects, published scientific papers indexed in WoS (at least 1 paper in indexed journals), professional papers and new study programmes or curricula based on the results of scientific research, and increasing international visibility. 2 Indicators that correspond to Aims 1 and 3: surveys conducted and statistical data on dietary trends in producers, consumers and processors. The surveys will be used to prepare thematic reports, lectures, scientific publications and/or final/graduate/doctoral theses (at least 1 per year). 3 Indicators corresponding to Aims 2 and 3: Lectures for food producers and processors held, as well as lectures for consumers (at least once a year) on proper nutrition and modern trends in nutrition.
Number of teachers and associates involved in the work	13 teachers and associates
Collaboration	Collaborative institutions of University North (food industry, scientific research institutions, Croatian Chamber of Economy, institutes of public health, accreditation companies...)

Topic 3	**APPLICATION OF MICRO-REACTORS FOR THE IMPLEMENTATION OF CHEMICAL AND BIOCHEMICAL REACTIONS**
Summary	Micro-reactors have been increasingly applied in various fields of chemical and pharmaceutical industry, biotechnology and medicine. Large surface-to-volume ratio, short diffusion pathway, fast and efficient transfer of matter and heat are some of the most important advantages of micro-reactor systems that have been successfully utilised in the field of organic synthesis, with higher conversion and productivity in these systems compared to reactions carried out in conventional reactor systems. The application of various micro-reactor systems in the intensification of the process of production of pharmaceutically active components is the subject of numerous studies, and the results show the justification of the application of microreactor technology taking into account the achieved conversion and productivity. Research carried out includes the application of various types of microreactors, from commercial to those that are based on the requirements of a particular process and are the result of their own development, and which are made using 3D printers or additive technologies. Reactions that are the subject of research in microsystems include chemical and biochemical processes, and part of the research is focused on the application of photomicroreactors. In the research, the chemical engineering methodology is applied, which, in addition to optimising process conditions based on conducted experiments, also includes the development of mathematical process models, with special emphasis on 2D mathematical process models.
Aims	- To optimise the processes of production of pharmaceutically active components in microreactors - To develop appropriate process models - Present research results to the wider scientific and professional community - To transfer knowledge from laboratory systems to an industrial scale (process magnification).
Activities	1 Optimisation of microreactors for the production of pharmaceutically active components 2 Development of a mathematical model for the optimal management of the process with regard to the given variables 3. Presenting the results of scientific research
Indicators	1 Key indicators that correspond to Aims 1 - 4: Scientific research projects, published scientific papers indexed in WoS, professional papers and presentation at international scientific congresses. 2. Indicators that correspond to Aims 1-2: report on the optimised process for the production of pharmaceutically active components (at least one optimisation).
Number of teachers and associates involved in the work	One (4 other teachers in scientific and teaching titles and four doctoral students employed at higher education institutions in the Republic of Croatia are involved in the work on these studies)
Collaboration	University of Zagreb, Faculty of Chemical Engineering and Technology

	University of Zagreb, Faculty of Food Technology and Biotechnology J.J. Strossmayer University of Osijek, Faculty of Food Technology Osijek University of Ljubljana, Faculty of Chemistry and Chemical Technology

Topic 4	**SPECIALISED PLANT METABOLITES AS USEFUL MOLECULES FOR THE FOOD INDUSTRY**
Summary	Plants as sessile organisms synthesise a large number of molecules that allow them to survive in adverse weather conditions. Such molecules are called specialised plant metabolites or phytochemicals, and this group includes molecules from the group of polyphenols, terpenoids, alkaloids, glucosinolates, coumarins, etc. In addition to the role in the plant itself, these molecules play an important role in the food industry where they are used as natural additives due to their antioxidant and antimicrobial properties or as natural colours, aromas, etc. Also, due to their presence in certain foods, such food is called a functional food because epidemiological studies show that the presence of these molecules can have positive effects on human health.
Aims	The specific aims of this topic are: 1. Determination of the presence of specialised metabolites in plants and food of plant origin. (1) 2. Isolation of specialised metabolites from plants and food of plant origin and determination of their antioxidant and antimicrobial activity. (2) 3. Discovering new plant sources of potentially useful specialised metabolites for the food industry. (3) 4. Monitoring the amount of specialised metabolites during plant growth, storage and processing of raw materials to determine a favourable harvesting time and optimal storage and processing conditions that would enable their desired and standardised quantity in the food product (4) 5. Monitoring environmental factors that affect their biosynthesis in the plant, but also the parameters that can cause their degradation in the food product during storage and processing. (5) 6. Conduct research that is competitive in the international scientific community. 7. Conducting competitive scientific projects. (6) 8. Dissemination of results outside the scientific community.
Activities	1. Development of metabolomic methods using instruments available within the University to achieve aim (1) 2. Development of protocols for isolation of specialised metabolites from different plant matrices with the purpose of achieving aim (2) 3. Use of methods and protocols developed during activities (1) and (2) to achieve aims (3), (4) and (5) 4. Establishment of cooperation with domestic and foreign scientific institutes and universities in order to jointly apply to competitive scientific projects in order to achieve aims (6) and (7) 5. Publication of research results in international scientific journals and their dissemination at national and international meetings in order to achieve aims (6) and (7)

	6. Participation in events for the popularisation of science in order to achieve aim (8)
Indicators	1. Key indicators of aim 1 achieved: developed laboratory protocols for the determination of specialised metabolites on instruments available at University North 2. Key indicators of aim 2 achieved: developed protocols for isolation of specialised metabolites; developed protocols for determination of biological activity 3. Key indicators of aim 3 achieved: results on the composition of specialised metabolites in less studied plant species that can be a source of functional food ingredients 4. Key indicators of aim 4 achieved: results on the composition of specialised metabolites during plant growth and raw material storage and processing 5. Key indicators of aim 5 achieved: set of data on environmental factors affecting the synthesis of specialised metabolites in plants and their potential degradation in food of plant origin 6. Key indicators of aim 6 achieved: the number of published international scientific papers, especially in Q1 journals; the number of papers in which the University scientist is the first and/or correspondent author; the number of invited lectures at domestic and international scientific conferences; established cooperation with other scientific institutes and universities in Croatia and abroad, and the number of international projects in which University North participates as a partner. 7. Key indicators of aim 7 achieved: number of accepted and managed projects of the Croatian Science Foundation; number of accepted scientific projects with international review 8. Key indicators of aim 8 achieved: number of participants in events for the popularisation of science
Number of teachers and associates involved in the work	A total of 4 North University teachers and associates and at least 10 associates from other institutions in Croatia and abroad are expected to participate in this topic
Collaboration	Planned cooperation with domestic and international scientific and professional institutions: - University of Zagreb, Faculty of Food Technology and Biotechnology - University of Zagreb, Faculty of Science - University of Zagreb, Faculty of Agriculture - University of Zagreb, Faculty of Chemical Engineering and Technology - Ruđer Bošković Institute, Zagreb - Institute for Adriatic Crops and Karst Reclamation, Split - Institute for Agriculture and Tourism, Poreč - BIOCentre - Incubation centre for biosciences, Zagreb - Washington State University, Institute for Biological Chemistry, Pullman-WA, USA - University of Sarajevo, Department of Biology, Faculty of Science, Sarajevo, Bosnia and Herzegovina

	- Centre of the Region Haná for Biotechnological and Agricultural Research, Palacky University, Olomouc, Czech Republic - University of Basilicata, Department of Science, Potenza, Italy.

Topic 5	SENSORY PROPERTIES OF FOOD
Summary	Sensory analysis is a scientific discipline that encourages, measures, analyses and interprets the reactions of those characteristics of food and substances that are perceived by the senses of vision, smell, taste, touch and hearing. Sensory properties such as external appearance, colour, taste, smell and texture are crucial in determining the acceptability of food, while sensation is the ultimate measure of the quality and success of the product. Sensory analysis of food includes a number of sensitive "tools" for measuring human reactions to food and other products. It is important to choose the appropriate test, test conditions and data analysis which must provide reproducible, strong and relevant results.
Aims	The specific aims of this topic are: 1. Development, description and characterisation of new products 2. Product improvement by changing ingredients 3. Comparison with competitive products 4. Routine quality control 5. Determining the differences between batches 6. Introducing new or redesigned products to the market and the consumers.
Activities	1 Establishment of a laboratory for sensory evaluation of food in accordance with the ISO 20613:2019(en) standard 2 Testing the sensory properties of new food products that are just coming to the market, and perfecting the recipe based on minor modifications. 3. Using sensor tests to compare the sensor quality with competitive products, or sensor comparison of multiple related products on the market. 4. Cooperation with industry and institutions in the region on the marketing of new products or recipes on the market.
Indicators	First indicator of aim 1 achieved: Establishment of a laboratory for sensory evaluation of food in accordance with the ISO 20613:2019(en) standard Second indicator of aims 2-4 achieved: cooperation with the industry in setting up a new product on the market (at least 1 product per year), within which the final/graduate thesis on this topic will be carried out
Number of teachers and associates involved in the work	A total of 4 North University teachers and associates and at least 5 associates from other institutions are expected to participate in this topic
Collaboration	Planned cooperation with domestic and international scientific and professional institutions: - University of Zagreb, Faculty of Food Technology and Biotechnology - Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology - Croatian Agency for Agriculture and Food

	- Podravka (research and development) - Dr. Rudolf Steiner Centre - Institute of Bioanalytics and Agro-Metabolomics, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Life Sciences Vienna (BOKU), Tulln, Austria.

Topic 6	**ANTIMICROBIAL PROPERTIES OF NEWLY SYNTHESISED COMPOUNDS AND EXTRACTS**
Summary	Antibiotics, fungicides and other antimicrobials are overused today, which is why microorganisms are rapidly adapting and becoming resistant to their action. In order to be ready for new classes of antimicrobials, it is important to constantly design and synthesise new functional antimicrobials with new mechanisms of action or alternatively to look for natural extracts and ingredients of plants or marine organisms with which the growth of microorganisms can be suppressed.
Aims	The specific aims of this topic are: 1. Design and synthesize potential antimicrobials based on computer simulations and predictions of antimicrobial effects 2. Identify new mechanisms of antimicrobial activity 3. Seek plants or marine organisms with natural antimicrobial activity 4. Extract, characterise and determine the functional constituents of plant extracts or marine organisms with antimicrobial action.
Activities	1 Design of new organic antimicrobial molecules using computer software (QSAR) and confirmation of actual action based on theoretical antimicrobial action by synthesis and testing of such compounds in *in vitro* systems. 2 Extraction of local plants and marine organisms to find active functional groups that exhibit antimicrobial activity 3 Determination of the composition of extracts with antimicrobial action using sovereign analytical methods.
Indicators	1 Indicator of aim 1: established workstation with predictive software on the basis of which it will be possible to predict the antimicrobial activity of newly synthesised compounds. 2 Aims 1-3 indicator: published scientific papers with antimicrobial activity of newly synthesised compounds and natural extracts (at least 3 papers) in journals indexed in WoS. Aim 2 indicator: testing the antimicrobial activity of plant or marine organism extracts in the form of an antimicrobial activity report (at least 3 organisms tested) in collaboration with other projects or private companies. 3 Aim 3 indicator: Report with the chemical composition of the extract showing antimicrobial activity, established cooperation with other scientific institutions and cooperation on projects.
Number of teachers and associates involved in the work	A total of 4 North University teachers and associates and at least 10 associates from other institutions are expected to participate in this topic
Collaboration	Planned cooperation with domestic and international scientific and professional institutions:

	- University of Zagreb, Faculty of Food Technology and Biotechnology - University of Zagreb, Faculty of Geotechnical Engineering Varaždin - University of Zagreb, Faculty of Chemical Engineering - Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology - Josip Juraj Strossmayer University of Osijek, Department of Chemistry - Josip Juraj Strossmayer University of Osijek, Department of Biology - University of Split, Faculty of Chemistry and Technology - Institute of Bioanalytics and Agro-Metabolomics, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Life Sciences Vienna (BOKU), Tulln, Austria - Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Serbia.

Topic 7	**PLANT METABOLOMICS**
Summary	Over the past few years in the natural sciences, especially biology, the emphasis has been on the development of *omnics* technologies that enable the characterisation of entire groups of biological molecules, and with the help of the collected results, they explain the structure and function of the observed biological system. Metabolomics is one of the complementary omnics technologies and is defined as the global or local profiling of a large number of metabolites in the observed system. In the last 10 years, there has been intense development of plant metabolomics, which studies various physiological processes and plant responses to genetic and ecological changes at the level of metabolites
Aims	The specific aims of this topic are: 1. Establishment of a metabolomic laboratory for the profiling of plant tissues 2. Development of metabolomic platforms for the profiling of plant tissues 3. Bioinformatic data processing to clarify biological functions in the observed systems 4. Integration of metabolomics data with data obtained using other *omnics* technologies (transcriptomics, proteomics, etc.) 5. Modelling of biosynthetic pathways based on data from *omnics* technologies.
Activities	1. Development of metabolomic methods using instruments available within the University to achieve aims (1) and (2). 2. Use of methods and protocols developed during activities (1), (2) and (3) to achieve aims (4) and (5) 3. Establishment of cooperation with domestic and foreign scientific institutes and universities in order to jointly apply to competitive scientific projects in order to achieve aims (3), (4), and (5) 4. Publication of research results in international scientific journals and their dissemination at national and international meetings in order to achieve aims (2-5)
Indicators	1. Key indicators of the achieved aims 1 and 2: developed laboratory protocols for the determination of metabolomes on instruments available at University North

	2. Key indicators of aims 1-5 achieved: the number of published international scientific papers, especially in Q1 journals; the number of papers in which the University scientist is the first and/or correspondent author; the number of invited lectures at national and international scientific conferences; established cooperation with other scientific institutes and universities in Croatia and abroad, and the number of international projects in which University North participates as a partner. 3. Key indicators of aim 5 achieved: number of accepted and managed projects of the Croatian Science Foundation; number of accepted scientific projects with international review
Number of teachers and associates involved in the work	A total of 4 North University teachers and associates and at least 10 associates from other institutions in Croatia and abroad are expected to participate in this topic
Collaboration	Planned cooperation with national and international scientific and professional institutions: - University of Zagreb, Faculty of Science - University of Zagreb, Faculty of Chemical Engineering and Technology - Ruđer Bošković Institute, Zagreb - Institute for Medical Research, Zagreb - BIOCentre - Incubation centre for biosciences, Zagreb - Washington State University, Institute for Biological Chemistry, Pullman-WA, USA - University of Sarajevo, Department of Biology, Faculty of Science, Sarajevo, Bosnia and Herzegovina - Palacky University, Olomouc, The Czech Republic - Institute of Botany, Technische Universität Dresden, Dresden, Germany.

6.2.2 STRATEGIC PROGRAMME OF SCIENTIFIC RESEARCH IN THE FIELD OF NATURAL SCIENCES, BIOMEDICINE AND HEALTH

Scientific research in the field of natural sciences, biomedicine and health is strategically oriented towards natural, basic and clinical biomedical research, nursing, physiotherapy and public health (social medicine).

The aims of scientific research in the field of natural sciences, biomedicine and health from 2021 to 2027 at University North are:

(i) Research the impact of environmental and genetic factors on the production of phytochemicals in plants

(ii) Research the processes leading to the development of diseases of the digestive system and the therapeutic potential of newly prepared compounds

(iii) Develop nursing care by raising the level of knowledge among students, and by analysing the implementation of holistic nursing care

(iv) Analyse posture in the target population (preschool children, obese people) and develop models for the prevention of postural deformities

(v) Study the general state of health of the target population (school-age children, young people, students, teachers, health professionals, patients) and the interdependence with working conditions, life circumstances and health care organisation, and explore views on the possibility of applying certain measures to improve the health of the population.

The achievement of these aims will be enabled by the implementation of scientific research activities together with associates from collaborative institutions (health, social, educational, business institutions), education of students at the undergraduate and graduate level and popularisation of science. Research activities will contribute to the development of University North and the achievement of general strategic aims. It will enable scientific research contributing to natural, basic and clinical sciences, and public health, to ensure interdisciplinarity as well as research excellence. Indicators of research excellence are scientific projects funded by the Croatian Science Foundation and University North, and the inclusion of foreign experts in the research, which also achieves international recognition. Given the interdisciplinary nature of the research and the involvement of experts from collaborative institutions, it will be possible to transfer knowledge from the clinical and social environment to University North, as well as vice versa. The transfer of knowledge and skills from the clinical setting will enable the development of appropriate specialist study programmes (such as the specialist emergency medicine programme) and education on new and innovative technologies (such as the use of artificial intelligence in medicine) used in practice. In addition to the education of students, the general population will be educated about new knowledge in the field of basic and clinical biomedical research and nursing, physical and social medicine. Students will be offered new teaching content (amendments to the teaching content of individual courses), and the general population will be educated by being included in popular-scientific workshops and lectures held every year at University North (Open Days, Science Festival).

Topic 1	IMPACT OF ENVIRONMENTAL AND GENETIC FACTORS ON THE PRODUCTION OF PHYTOCHEMICALS IN PLANTS
Summary	Plants produce a large number of structurally diverse specialised metabolites or phytochemicals, which have developed in different plant lines and represent an adaptation to specific ecological conditions. Due to their specific role in the plant organism, they possess a chemical structure that allows them to act as substances with biological activity useful in the pharmaceutical, cosmetic and food industries. Because of this effect, many plants, i.e., herbal preparations, are functional ingredients of food, pharmaceutical and cosmetic preparations. Although more than 300,000 different plant metabolites are known, most of them are poorly researched and the exact mechanisms of their biosynthesis, the influence of environmental factors on their synthesis, etc., are unknown.
Aims	- To establish a competitive, internationally recognisable research group to investigate the biosynthetic pathways of phytochemicals that have the potential to be used in the food, pharmaceutical and cosmetic industries. - Develop analytical methods for the identification and quantification of specialised metabolites. - To develop a methodology for measuring *in vitro* activities of specialised metabolites that enable testing of phytochemicals as molecules with action in the prevention of skin, neurodegenerative, vascular and similar diseases - To apply to domestic and international competitive projects and establish cooperation with the private sector with the aim of developing new products.
Number of teachers and associates involved in the work	4 teachers and associates
Collaboration	Cooperation with national and international scientific and professional institutions and groups dealing with a similar topic who are internationally recognisable in this field, with which the topic leader has a long-standing cooperation planned: - University of Zagreb, Faculty of Food Technology and Biotechnology - University of Zagreb, Faculty of Science - University of Zagreb, Faculty of Agriculture - University of Zagreb, Faculty of Chemical Engineering and Technology - Ruđer Bošković Institute, Zagreb - Institute for Adriatic Crops and Karst Reclamation, Split - Institute for Agriculture and Tourism, Poreč - BIOCentre - Incubation centre for biosciences, Zagreb - Washington State University, Institute for Biological Chemistry, Pullman-WA, USA - University of Sarajevo, Department of Biology, Faculty of Science, Sarajevo, Bosnia and Herzegovina - Centre of the Region Haná for Biotechnological and Agricultural Research, Palacky University, Olomouc, The Czech Republic - University of Basilicata, Department of Science, Potenza, Italy

	- National Institute of Agrarian and Veterinary Research, Food Safety Unit, Vila do Conde, Portugal - School of Agricultural Sciences, Department of Agriculture Crop Production and Rural Environment, University of Thessaly, Volos, Greece - National Institute of Chemistry, Ljubljana, Slovenia.

Strategic direction	**BASIC AND CLINICAL BIOMEDICAL RESEARCH**
Topic 2	**RESEARCH OF THE PROCESSES OF THE DEVELOPMENT OF DISEASES OF THE DIGESTIVE SYSTEM AND THERAPEUTIC POTENTIAL OF NEWLY PREPARED COMPOUNDS**
Summary	Comorbidities such as cardiovascular, pulmonary, endocrinological, nephrological and neurological diseases are the main groups of diseases that are closely related to the emergence, development and complications of diseases of the digestive system. Furthermore, people with COVID-19, caused by the SARS-CoV-2 virus, usually have fever and respiratory symptoms, but some patients also have gastrointestinal manifestations with diarrhoea, vomiting and abdominal pain. SARS-CoV-2 RNAs were identified in anal/rectal swabs. This has important implications for disease management, transmission and suppression of infections. Therefore, it is necessary to study the gastrointestinal aspects of this disease. The prerequisite for maintaining the energy and metabolic homeostasis of the body is proper nutrition and adequate absorption of nutrients. Given that gastrointestinal homeostasis is impaired by COVID-19, it is necessary to determine the damage to the digestive system and the nutritional status of patients. Nutritional status is defined by a number of interrelated factors and is determined based on laboratory and clinical data. Within the proposed research, it is planned to determine the damage and comorbidity of the digestive system and nutritional status in patients with COVID-19, as well as to conduct detailed laboratory-biochemical analyses. Scientific research on the connection between these comorbidities and diseases of the digestive system will provide results that will contribute to the current scientific knowledge, and thus affect the quality of diagnostic and therapeutic procedures in these patients. Furthermore, the therapeutic potential of newly prepared compounds will be investigated and the processes leading to the development of diseases of the digestive system will be investigated. Inflammatory bowel diseases (IBD) are chronic diseases of the digestive system of complex pathogenesis and require an interdisciplinary approach to research. The pathogenesis of IBD includes multiple factors: genetic changes, disorders of the immune response to bacterial microflora, impaired number and diversity of intestinal microbiota, environmental impact and food. Dysbiosis, a change in the normal balance of bacterial flora, plays an important role in IBD. *Escherichia coli (E. coli*), adherently invasive *E. coli* (AIEC), is associated with IBD etiopathogenesis. AIEC binds strongly and in large quantities to intestinal epithelial cells and macrophages, leading to secretion of pro-inflammatory cytokines and chronic inflammation. One of the therapeutic strategies for treating IBD is based on blocking bacterial adhesion with antiadhesive compounds. The main advantages of the antiadhesion strategy over the antibiotic one is the low risk of bacterial

	resistance. Mannosides with aromatic aglycon have pronounced antiadhesive properties and bind with high affinity to FimH adhesives expressed on the surface of AIEC. Another important aspect of the treatment of IBD by inhibiting the production of pro-inflammatory cytokines is the cholinergic system. The proposed research plans to explore the mechanism of action of new, rationally designed glycoconjugates with antioxidant action as FimH antagonists and cholinesterase enzyme inhibitors. In the design of molecules, the multitarget strategy will be used, which represents a new and promising pathway in the design of new drugs, including anti-inflammatory drugs. Based on the multitarget approach, glycoconjugates/ligands will be designed that contain the substructures needed to bind to FimH lectin located on the surface of invasively adherent *E. coli*, but which can also inhibit cholinesterase enzymes. As part of the research, it is planned to prepare glycoconjugates inspired by natural polyphenols. Given their antioxidant effect, it is expected that prepared mannosides, in addition to FimH antagonistic and inhibitory action towards cholinesterase, will also have a pronounced antioxidant effect. Inhibition of cholinesterase allows to increase the concentration of acetylcholine, which affects the reduction of the production of inflammatory cytokines. Synthesized FimH antagonists will be structurally characterised and then biologically evaluated by *in vitro* and *in vivo* tests. The therapeutic potential will be assessed on the basis of a certain antiadhesive and antioxidant effect and inhibitory effect. At the same time, the influence of compounds on the direction of the immune response will be studied. These actions can have a synergistic beneficial effect on IBD alleviation, by regulating the AIEC bacterial population and cholinergic system activity. Laboratory data confirm that inflammatory bowel disease is the result of an impaired immune response and that NOD2/CARD15, the first identified gene responsible for Crohn's disease, is responsible for reducing NOD2 receptor function. Therefore, an interdisciplinary approach, using scientific methodology in the field of medical chemistry, chemical biology and fundamental biomedical sciences, will explore (synthesise and structurally and biologically evaluate) new synthetic compounds inspired by natural NOD2 ligands. Freund's adjuvant is one of the most potent adjuvants used in experimental immunology. In 1974, it was confirmed that the muramyl dipeptide (MDP, MurNAc-L-Ala-D-isoGln) is the smallest structural subunit of peptidoglycan that exhibits adjuvant activity and is a natural ligand for the NOD2 receptor. In order to improve the pharmacological properties of MDP, a large number of its derivatives and analogues are prepared. An increase in lipophilicity has been shown to have a positive effect on activity. Desmuramyl-peptides (MDP analogues without sugar structure) with different lipophilic groups are described in the literature. In our previous research, biologically evaluated peptides with lipophilic adamantane subunit were prepared, using a mouse model with ovalbumin as an antigen. Small structural differences were observed to affect the immunomodulatory activity, diastereomers of (adamant-1-yl) tripeptide and (adamant-2-yl) tripeptide showed different effects. The binding of mannose to adamantyl tripeptides enhanced the immunostimulatory properties of the baseline properties and resulted in a change in the direction of the immunoreaction. The immunological activity of mannose derivatives of adamantane desmuramyl-peptides *in vivo* is comparable to that of a natural peptidoglycan fragment. Mannosylated desmuramyl peptides with glycol linkage have been shown to be

	effective immunostimulants in the BALBc mouse model, and the most active series of compounds in this class of desmuramyl peptides. The effect of the described compounds can be further enhanced by incorporating mannose compounds with a lipophilic substructure into drug delivery systems, such as liposomes and cyclodextrins. Within the proposed research, new derivatives with multiple bound manose subunits will be prepared with the aim of enhanced stimulation of manose receptors important for the immune response and derivatives with built-in ferrocene. The immunomodulatory and immunostimulatory properties of desmuramyl peptide will be tested using *in vitro* and *in vivo* methods. The amount of excreted pro-inflammatory/anti-inflammatory Th1/Th2 cytokines, the level of activation of NOD2 and mannose receptors, and the effect of *in vivo* immunostimulation in a mouse model with ovalbumin as an antigen will be determined. The specificity of binding to receptors that recognise peptidoglycan structures will be determined experimentally and by computer methods.
Aims	- To investigate pathophysiological pathways and biochemical signals of comorbidity that affect the occurrence, development and complications of diseases of the digestive system - To synthesise and biologically evaluate *in vitro* and *in vivo* tests of FimH antagonists, research the antiadhesive and antioxidant effect of the prepared compounds, and research the inhibitory effect on cholinesterase enzymes, i.e., on the cholinergic system - To synthesise and structurally characterise new desmuramyl peptides - To biologically evaluate NOD2 agonists, measure the amount of excreted pro-inflammatory/anti-inflammatory Th1/Th2 cytokines, determine the level of activation of NOD2 and mannose receptors (experimental and computational methods), and analyse the effect of *in vivo* immunostimulation in a mouse model.
Activities	- Conducting interdisciplinary research in order to achieve the set aims - Preparation and publication of scientific publications - Dissemination of research results at national and international conferences - Application of scientific research projects.
Indicators	- Number of publications describing the results of the research - Number of defended final and graduate theses, and doctoral dissertations - Number of plenary lectures and congressional communications at national and international conferences - Number of scientific research projects.
Number of researchers	6 University North employees 15 external associates (collaborative institutions)
Collaboration	CH Dubrava (employees of the Internal Clinic, the Department of Psychiatry, the Department of Neurology and the Department of Medical Laboratory Diagnostics) Faculty of Food Technology and Biotechnology, University of Zagreb Faculty of Science, University of Zagreb Ruđer Bošković Institute Josip Juraj Strossmayer University of Osijek "Polyclinic Dr. Zora Profozić" University of Debrecen, Hungary

	Faculty of Health Sciences, University of Novo Mesto, Slovenia

Strategic direction	RESEARCH IN THE FIELD OF NURSING
Topic 3	DEVELOPMENT OF NURSING AND ANALYSIS OF THE IMPLEMENTATION OF HOLISTIC NURSING CARE
Summary	Nursing is a profession of a highly humane nature in which its work requires advanced specific communication and social skills that can be learned and improved through education, clinical and volunteer work, and assistance to the needy. The organisation of teaching in nursing is specific and requires teachers to be exceptional professionals in practice, but also to possess the qualities of good lecturers. Dent, Harden and Hunt (2017) believe that awareness of student focus should be developed among lecturers, as this affects the student to choose a nursing profession, enrol in nursing studies and participate in the curriculum. The lecturer has an invaluable role as a driver of learning that gives the student guidance and support, but it is the student who has a greater responsibility for their own education. In the research of the opinions of the lecturers themselves on the art of performing medical classes and the characteristics of a successful lecturer, the following aspects are considered important: knowledge of the subject, enthusiasm during the lecture, communication skills, student behaviour during the teaching and the introduction of professional innovations in teaching. The importance of developing new methods and approaches in teaching, as well as encouraging creative thinking and critical thinking, were assessed as very important research components in the final academic assessment of lecturers (Dent, Harden and Hunt, 2017). Effective teaching, as well as student orientation, has been assessed in many studies as necessary in medicine for the creation of quality health professionals, with a great emphasis on the responsibility of the students themselves for their own education. Exercise classes in a clinical setting at the undergraduate study of nursing are an indispensable part of the study, and cover half of the total teaching. Prevention of infections associated with healthcare is an integral part of the work of all health professionals, and it also applies to students as future employees, and current participants in the process of work within health institutions through mandatory exercise classes of different types. During their stay in healthcare institutions, students can be the carriers of pathogenic microorganisms to other patients, the environment, or themselves, if they are not educated and do not have basic knowledge and skills in the prevention and control of infections associated with healthcare. Some studies directly link healthcare students to the cause of cross-transfer of microorganisms because they spend a large part of their regular classes in health institutions (Ojo and Ojo, 2017). Research shows that students recognise this problem and define two essential items - lack of knowledge and lack of a positive model when staying in healthcare institution wards (Ward, 2010, pp. 1533-1542). Holistic nursing care should be an integral part of daily nursing care, i.e., healthcare, since it has a number of benefits for patients and nurses/technicians. The doctrine that man is a being consisting of multiple dimensions is widely known and applies equally to a healthy person, as well as to a sick one. Despite this, literature states that holistic nursing care in our area has not yet come to life in the daily work of nurses/technicians and that

	education on holistic nursing care is also insufficient in our country. In working with patients who have a need for palliative care, i.e., seriously ill patients with advanced and incurable diseases, the psychological, social and spiritual needs come to light even more, and nursing care should be oriented towards all needs arising from the physical, psychological, social and spiritual dimension of a person, and not only towards physical needs, as most often seen in everyday work with patients. There are numerous obstacles in the implementation of holistic nursing care that are mentioned in literature – in first place is the lack of knowledge about holistic nursing care, but certain organisational characteristics of health institutions are also indicated. In order to increase the quality of all palliative care, it is necessary to determine the current situation in the implementation of holistic nursing care within palliative care in the Republic of Croatia, and to prepare and strengthen nurses/technicians working in palliative care and students of nursing studies for the implementation of holistic care. In addition to clinical work and education of nursing students and nurses/technicians, volunteer work enables the acquisition of additional skills that are important for personal and professional growth and development. It plays an important role in the development of self-esteem and social skills, as well as strengthening existing and acquiring new competences, knowledge and experiences, which greatly contributes to the growth of competitiveness in the labour market and the competence of future nurses/technicians in the work process. Healthcare professionals face emotionally demanding situations (death of a person, pain, etc.) in their work, so they are susceptible to the occurrence of burnout syndrome that occurs after long-term exposure to stress. Accordingly, it is important to prevent and provide early detection of persons susceptible to its development, and to develop emotional intelligence in healthcare professionals, which has been shown to have a protective role in exposure to excessive stress and the development of burnout syndrome.
Aims	- To determine whether there is a connection in burnout in the workplace and the level of emotional intelligence in healthcare professionals, and to develop guidelines for the development of emotional intelligence in healthcare professionals - To determine and identify the frequency of carrying out the physical, psychological, social and spiritual dimensions of holistic care in everyday work with patients who have a need for palliative care; to identify the limitations in the implementation of holistic care and the dimensions that participants consider to be insufficiently educated in, and formulate a proposal to improve learning outcomes and competences for nursing students - To determine the level of knowledge of nursing students from the basics of prevention and control of infections related to healthcare at the undergraduate study of nursing in the Republic of Croatia, and formulate a proposal for the implementation of courses from the basics of prevention and control of infections related to healthcare in the regular curriculum of the 1st year of the undergraduate study of nursing - To identify the most important characteristics of a successful teacher/lecturer/mentor in the field of higher education in nursing in the opinion of teachers and nursing students and, according to the results obtained, develop a strategy for improving the performance of medical

	teaching and identify important factors of student participation in medical teaching - To examine the differences in attitudes on volunteering of nursing students in Croatia, Slovenia, Bosnia and Herzegovina and Serbia and, based on the results obtained, propose activities to motivate nursing students to do volunteer work.
Activities	- Conducting interdisciplinary research in order to achieve the set aims - Dissemination of research results at national and international conferences - Preparation and publication of scientific publications - Application for research projects.
Indicators	- Number of publications describing the results of the research - Number of defended final and graduate theses, and doctoral dissertations - Number of plenary lectures and congressional communications at national and international conferences - Number of research projects.
Number of researchers	7 University North employees 3 doctoral students 20 external associates (collaborative institutions involved in the project)
Collaboration	University of Rijeka, Faculty of Health Studies, Undergraduate professional programme in nursing University of Zadar, Undergraduate professional programme in nursing University of Split, Undergraduate university programme in nursing University of Dubrovnik, Undergraduate university programme in nursing Josip Juraj Strossmayer University of Osijek, Faculty of Dental Medicine and Health Osijek, dislocated undergraduate university programme in nursing, Pregrada University of Applied Health Sciences in Zagreb, undergraduate professional study programme in nursing Varaždin General Hospital Čakovec County Hospital Dubrava Clinical Hospital Zagreb University Hospital Centre Dr. 'Tomislav Bardek' General Hospital, Koprivnica Krapinske Toplice Special Hospital for Medical Rehabilitation Srebrnjak Children's Hospital Faculty of Health Sciences, Novo Mesto Faculty of Health and Social Sciences, Slovenj Gradec Faculty of Health Studies, University of Mostar College of Occupational Health Studies in Belgrade Specialist palliative services in the Republic of Croatia – 28 institutions at the secondary level of healthcare, and 13 institutions at the primary level of healthcare County coordinators for palliative care Special Hospital for Pulmonary Diseases, Zagreb

Strategic direction	RESEARCH IN THE FIELD OF PHYSIOTHERAPY
Topic 4	ANALYSIS OF POSTURE OF THE BODY AND DEVELOPMENT OF MODELS FOR THE PREVENTION OF POSTURAL DEFORMITIES
Summary	Posture is the way the body is positioned. The posture of the body is the relationship between parts of the body in a certain time and space, with the main role assigned to the feet and legs, the pelvis and spine, and the shoulders and head. The best posture is the one in which a person moves most economically and has no predisposition to the development of future postural problems, that is, when parts of the body are ideally arranged and balanced and enable maximum efficiency at the minimum energy unit invested. Flexibility and mobility of articular structures can be one of the factors of the occurrence of postural defects, because with limited movements, the body is automatically placed in an unfavourable position and there are physical compensations and errors in posture. If there is a lack of mobility in certain joints, which can be caused by a lack of flexibility and overstretched muscle fibres, then the movement will be incomplete and therefore there is a compensation for this deficiency, and then the second joint assumes this function and the harmony and posture of the body collapses. In children of younger age, there is an increasingly pronounced problem of poor posture. The collection of data on the growth and development of children, and on the effects of various endogenous and exogenous factors on their body in different periods of growth, is important for understanding growth and development, especially for the correct and timely selection of preventive measures in order to ensure the proper growth and development of the child. The ability to perform a thorough and accurate assessment of the posture in standing and walking, and the reliability of measuring instruments leads to timely recognition of the occurrence of possible major problems. With the modern way of life and the development of modern technologies, more and more children spend their time in a seated and improper position of the body. Considering that the skeleton of a child in preschool age differs from that of adults, it is very important to diagnose, as early and as accurately as possible, the irregularities in the postural segments of the spine that lead to poor posture, and later to the formation of deformities such as scoliosis, kyphosis and lordosis. It has been scientifically confirmed that most changes occur in the human body during the period from birth to adolescence. The ways that children sit on school benches, while looking at tablets or mobile phones, carrying school bags that are too heavy, non-compliance of working furniture with the anthropometric characteristics of children, insufficient physical activity, inappropriate footwear, as well as repeated viewing of TV programmes are characterised by poor posture that entails many other complications in the future. All of the above leads to loosening of muscle structures and weakening of muscle control, which leads to the disruption of body balance. In the period from 5 to 10 years, when growth and development is slower, it is necessary to diagnose problems in a timely manner, because at the beginning of puberty these problems are even more emphasised and aggravated. Therefore, it is important that children acquire a habit of proper posture through regular and active engagement in physical activity, and thus successfully direct their development.

	Most postural deformities fall into the category of developmental disorders, but if they become a habit, then they are known as postural disorders. Developmental disorders are those that occur in most children as a temporary condition and most often disappear on their own without any special treatment. It is also necessary to assess when to respond to these developmental disorders, as some of these problems may develop into postural disorders that will cause problems in the future. It is important to recognise postural deviations in children of developmental age in time, but at the same time, do not expect them to be subject to adult standards. The main reason for this is that children who are still developing are more mobile and flexible than adults. in some children, bone growth during development is not fully accompanied by the timely development of connective and muscle tissue, which is why some children may be hypermobile in certain joints. It is very important to notice such changes before puberty and adolescent growth momentum when these curves intensify even more, and where it is much more difficult to correct such a deformation. For these reasons, a longitudinal study is planned, within which a static and dynamic three-dimensional analysis of the spine in preschool children will be carried out. Furthermore, the population in which postural changes will be monitored is obese. Obesity is a very complex, multifactorial disease whose incidence in the population is increasing. Obesity is a risk factor for cardiovascular diseases, diabetes, arterial hypertension, some types of cancer and other diseases (Medanić and Pucarin-Cvjetković, 2012; Viđak et al., 2017). Obesity can significantly contribute to the symptoms associated with osteoarthritis, osteoporosis, rheumatoid arthritis, degenerative disc disease, spinal stenosis and spondylolisthesis. Obesity is also associated with several forms of chronic pain, including lower back pain. In people with a large body mass index (BMI), the load on the spine is increased, which makes the risk of "wear" of the spine even greater. There are primary, secondary and tertiary levels of obesity prevention. The primary goal of the prevention of obesity is to encourage children and young people to adopt a healthy lifestyle, which is also the most demanding part of the entire preventive programme. Secondary prevention is aimed at a risky individual or population. The values of blood pressure, lipidogram, hepatogram, blood glucose and maintenance of adequate body weight are controlled. Tertiary prevention is based on a multidisciplinary approach and requires individual consideration of the problems of obesity and obesity-related diseases with regular anthropometric and biochemical monitoring (Bralić et al., 2010). The branch of surgery that deals with the surgical treatment of obesity is called bariatric surgery. Bariatric surgery is indicated in people with a third-degree thickness or BMI greater than 40 kg/m^2. Obesity leaves a significant negative mark on the mental and social state and behaviour of the individual (body image problems, low self-esteem, social isolation and discrimination, depression, reduced quality of life) (Ručević, 2018). Research shows that in the last twenty years, the level of discrimination against obese persons has increased to 66% and exceeds the level of discrimination against other discriminated persons (Kuculo et al., 2018). In adulthood, obese people, in addition to health problems, often have serious emotional and social difficulties, such as loneliness, depression, behavioural problems and reduced life opportunities in close relationships and employment (Berk, 2005; Robinson, Sutin and Daly, 2017;

	Sutin and Terracciano, 2017). Because of this, obese people often feel lonely and socially isolated.
Aims	- To analyse the segmental positions of the subject's spine using rasterstereography with the DIERS Formetric 4D device and a pedoscan when standing and walking (initial analysis and screening of possible postural abnormalities in all subjects) - Longitudinal analysis of the posture when standing and walking of the two groups of study participants – children from 6 years of age (the first group will perform the assigned tasks of corrective exercises, and the second group will not) through 3 measurement cycles (in the preschool period (6 years of age) and during the school period (8 and 10 years of age)) - Development of a model of prevention of postural deformities related to segmental, pelvic and shoulder rotation in static and dynamic conditions in subjects - To analyse the posture of obese people using Diers Formetric 4D devices and a pedoscan segmentally, and on the principle of stereophotogrammetry and triangulation before surgery (bariatric surgery) - To analyse the posture of the body via the Diers Formetric 4D device and a pedoscan segmentally, and on the principle of stereophotogrammetry and triangulation after surgery in several cycles in correlation with % EBW via bioimpedance scale - To assess social and emotional loneliness with the help of the SELSA-S scale before and after surgery.
Activities	- Conducting interdisciplinary research in order to achieve the set aims - Dissemination of research results at national and international conferences - Preparation and publication of scientific publications - Application for research projects.
Indicators	- Number of publications describing the results of the research - Number of defended final and graduate theses, and doctoral dissertations - Number of plenary lectures and congressional communications at national and international conferences - Number of research projects.
Number of researchers	13 teachers and associates
Collaboration	"Nado" Centre for the Spine, Varaždin Cerebellum Centre, Varaždin Private and public kindergartens of the Varaždin County Varaždin County elementary schools School Medicine, Varaždin Varaždin General Hospital

Strategic direction	**PUBLIC HEALTH RESEARCH**

Topic 5	INTERDEPENDENCE OF THE HEALTH CONDITION AND WORKING CONDITIONS, LIVING CIRCUMSTANCES AND HEALTHCARE ORGANISATION
Summary	Public health and social medicine are branches in the field of biomedicine and health and are important for the health and organisation of healthcare for the entire population. Public health is a branch of medicine that deals with disease prevention and health promotion through organised efforts of society (Acheson 1988), while social medicine is a branch that investigates the interdependence of the health status of the population and the socio-economic opportunities in a particular community. The proposed research deals precisely with the topic of specific groups in the population such as adolescents, patients, pregnant women who are exposed to factors whose action can be harmful to the development, condition and health of individuals. The research will include target groups of participants/respondents such as children of primary and secondary school age and adolescents, students of health studies, pregnant women and puerperae, employees in the primary education system, and patients and health professionals. Life circumstances such as speech disorders such as stuttering, playing video games, and using social networks affect the quality of life and the social and psychological development of children and young people. Stuttering usually occurs in situations of increased excitement, so it is safe to assume that people who stutter have higher levels of cortisol and adrenaline. Although playing video games and social networks can have positive effects, today their excessive use increasingly emphasises their danger to children, especially adolescents, as they can lead to various behavioural disorders and even symptoms of addiction. These life circumstances have significant impacts on the well-being of children and young people, so it is necessary to work on the further development of them in the healthcare system aimed at early detection and assistance to video game players and users of social networks, as well as encouraging the application of stuttering therapy programmes. For younger people, it is important to stress grit, which signifies passion and perseverance in achieving long-term and important goals. For academic success, the level of grit in students is important, especially in students of health studies since it can influence their career progression. The working conditions of employees in the primary education system, as well as the working conditions of healthcare professionals, have an impact on the occurrence of stress, especially when we talk about special conditions such as working with children with disabilities, or the work of healthcare professionals during the pandemic caused by COVID-19. Classroom teachers and nurses are among the professions subject to stress in the workplace, which can be reflected in their professional and personal emotional life and physical health, so it is necessary to work on the development of a model of support for the workers, and the development of interventions to reduce stress, and stress coping techniques. Healthcare professionals may be exposed to violence from patients and those close to them, but patients may also experience violence from healthcare professionals, so it is important to recognise the risk factors for violent behaviour towards healthcare professionals and patients, and to establish measures to prevent the occurrence of violence. Adequate organisation of healthcare is extremely important in ensuring the desired outcome of the patient's treatment, but also in ensuring the safety of health professionals and patients. The SARS-CoV-2 virus

	pandemic brings numerous changes in daily functioning with it, as well as negative feelings such as the fear of infection. Such circumstances can affect the development of anxious, depressive or post-traumatic symptoms in pregnant women and puerperae, therefore through healthcare, it is necessary to provide psychological assistance for this vulnerable group in the population. The interdependence of the health status of the target population with working conditions, life circumstances and healthcare organisation will be researched using the following scientific methodologies: 1 In the research of the level of stress before and after stuttering therapy, which will include children of primary and secondary school age and adolescents, a measurement of the biomarker of stress in saliva before and at the end of stuttering therapy is planned, which will be conducted in a collaborative institution, in the VaLMod Centre. Stress analysis will be performed by laboratory measurement of the amount of cortisol and amylase, and a standardised questionnaire will be used to assess the subjective experience of tension in children. 2 The influence of social networks becomes a real danger, especially for people who spend 8 or more hours at the computer. Research on the impact of social networks on adolescent and youth behavioural disorders would be conducted by a validated survey questionnaire. The target group would be students of 3rd and 4th grade of secondary school and students of 1st and 2nd year of various study programmes. 3 The aim of the research of gaming disorders, which will be conducted among adolescents through a questionnaire, is to develop an early detection programme, help people with developed symptoms, determine the quality of life of family members and the quality of life of video game players. 4 Grit is defined as the ability to persevere when obstacles arise in order to achieve a given goal. The study of the level of students' grit in health studies, and the factors that influence the level of grit, would be carried out with a "Grit scale" of 12 questions, with the aim of gaining insight into the degree of grit and diagnosing the needs and interests of students for further education on this topic. 5 The research with the purpose of assessing and comparing the level of stress in workers in the primary education system with regular and special curricula will be conducted through the measurement of physiological indicators, levels of cortisol in saliva and self-assessment of teachers, since this occupation belongs to the more stressful ones. This research will show the differences in the use of different measuring instruments, but also their connection with other variables such as age, gender, length of work, the use of various self-help techniques, i.e., techniques of coping with stress. 6 The research on patient and healthcare professionals' safety, with an emphasis on the incidence of violence, will be conducted as a causal non-experimental study using a standardised questionnaire for violence against patients as an instrument, as well as an assessment of healthcare safety indicators using the analysis of the frequency of adverse events. The participants in the study would be nurses/technicians and doctors who have been working in the healthcare system for a minimum of one year. 7 The analysis of the patient safety culture in healthcare institutions will be carried out as a causal, non-experimental study using a questionnaire created by the Agency for Healthcare Research and Quality. Respondents will be

	nurses/technicians from general hospitals in the Republic of Croatia. The aim is to investigate the perception of nurses/technicians on patient safety, and the purpose of the research is to propose a model for educating nurses on the patient safety culture. 8 The study of the level of stress of healthcare professionals who care for and treat hospitalised patients suffering from COVID-19 will be conducted through the measurement of the level of cortisol in the saliva and self-assessment of participants and will determine the differences in the level of stress when arriving at work, entering isolation, getting out of isolation and leaving work. The self-assessment will identify the stressors that employees emphasise as the most significant. 9 Restrictive measures and the COVID-19 pandemic can have a negative impact on future mothers and the occurrence of anxious, depressive and post-traumatic symptoms. Research on the impact of the SARS-CoV-2 virus pandemic on women during pregnancy, childbirth and postpartum, as well as an assessment of the need for the development of psychological assistance to pregnant women and puerperae would be carried out through a customised questionnaire via social networks. The aim is to gain insight into the need to organise psychological support and counselling that would have a positive effect on the outcome of pregnancy, childbirth and the puerperium.
Aims	- To research the level of stress before and after stuttering, and demonstrate the importance of implementing timely stuttering therapy in school children and adolescents in order to enable them to further sociological and psychological development without difficulties - To examine the safety of patients and healthcare professionals in healthcare institutions with an emphasis on the incidence of violence - To determine the prevalence of internet gaming disorders among adolescents - To assess and compare the stress levels of workers in the primary education system with regular and special curricula through the measurement of physiological indicators, cortisol levels in saliva and self-assessment - To analyse the patient safety culture in healthcare institutions - To investigate the stress levels of healthcare professionals who care for and treat hospitalised patients with COVID-19 through the measurement of cortisol levels in saliva and self-assessment - To examine the level of grit in students of health studies and factors affecting the level of grit - To analyse the impact of social networks on adolescent and youth behavioural disorders - To assess the impact of the SARS-CoV-2 virus pandemic on women during pregnancy, childbirth and postpartum and assess the need for the development of psychological assistance to pregnant women and puerperae.
Activities	- Conducting interdisciplinary research in order to achieve the set aims - Dissemination of research results at national and international conferences - Preparation and publication of scientific publications

	- Application for research projects.
Indicators	- Number of publications describing the results of the research - Number of defended final and graduate theses, and doctoral dissertations - Number of plenary lectures and congressional communications at national and international conferences - Number of research projects.
Number of researchers	10 University North employees 20 associates (collaborative institutions)
Collaboration	"Dr. Zora Profozić" Polyclinic VaLMod Speech and Language Centre Varaždin General Hospital Čakovec County Hospital Elementary schools "Dr. Fran Mihaljević" Clinic for Infectious Diseases Pula General Hospital Zadar General Hospital Šibenik General Hospital Croatian Institute of Public Health, Zagreb Krapinske Toplice Special Hospital for Medical Rehabilitation

6.2.3 STRATEGIC PROGRAMME OF SCIENTIFIC RESEARCH IN THE FIELD OF SOCIAL SCIENCES

The European Strategy contains three complementary priorities:

1 Smart growth: developing an economy based on knowledge and innovation

2 Sustainable growth: promoting a resource-efficient, greener and more competitive economy

3 Inclusive growth: nurturing an economy with a high employment rate that brings social and territorial cohesion.

The scientific research strategic programme of University North in social sciences for the period 2021-2027 is oriented towards examining the comprehensiveness of social processes and changes caused by the speed of development of new technologies, the results of which will tentatively contribute the most to the goal of smart growth by developing an economy based on knowledge and innovation and lifelong education with a high employment rate, as well as an increased ability to conduct scientific research of superior quality by digitally competent researchers. In the broader national-research context of the social sphere, the uneven development of the Croatian society, whose causes must be sought in the geopolitical context, the technological gap and economic and demographic changes, is foreshadowed. The aforementioned problems and changes that we are witnessing today are also largely characterised by scientific research directions that form part of the specific goals of the social field of this scientific-research strategy. The research directions detect the interdisciplinary peculiarities of a series of socio-economic changes that we are witnessing, which will seek to be examined and interpreted in depth in the national and international context through elaborate topics and sub-topics. The Strategic programme of scientific research in the field of social sciences for the period 2020-2025 focuses on exploring all the processes that information and communication technologies have brought into science and education as basic social activities. Accordingly, the emphasis is on topics regarding the role of social sciences in contemporary society, but also on science, understanding and predicting changes that will be reflected in the field of science and education at University North in the future period.

Strategic direction 1	HUMAN RESOURCES TRANSFORMATION: EDUCATIONAL, COMPETENCY AND WORK DYNAMICS IN THE DIGITAL AGE
Summary	Digital transformations are a hallmark of the modern business environment and, as such, bring new work tasks and new methods of work, which also requires the adaptation of work procedures. Thus, the known concepts of human resources management are changing and creating new conditions in which this scientific area needs to be observed. Changes that occur in terms of work organisation directly affect changes in the demand for the necessary characteristics of human resources of the new age, and consequently the development of their competencies in various forms of formal education, as well as other lifelong learning programmes. The transformation of the modern working environment in all activities is rapid, and therefore the need to adapt educational programmes requires even faster interventions, all in order to successfully overcome the lack of workforce that possesses the necessary characteristics and knowledge on the labour market. The basic goal of this research direction is to determine the paradigms that are a prerequisite for the creation of human resources according to the modern requirements of business and, accordingly, the future labour market. Since the changes do not stop, the focus of the research of this scientific direction refers to the continuous determination of the requirements and characteristics of work and the workplace in the digital environment, but also to the detection of possible other factors that affect changes in the working environment and organisation of work. Any possible factor affecting the work itself is related to the change in the needs (competencies) for the implementation of such work. Such scientific research must be carried out in close cooperation with the real and public sector, and it will also contribute in terms of establishing new scientific concepts on human resources management, but also in practical terms by implementing new knowledge into business practice, which will improve the overall economic and public systems, and the quality and productivity of work in Croatia. This implies that changes in the acquisition and improvement of work competences are significantly broader than the digital competences themselves, which implies an interdisciplinary approach to research, especially from the aspect of observing the field of information, communication, economic and legal sciences. Keywords: human resources, education, competences, work, digital transformation.

Topic 1	DIGITAL EDUCATION
Aims	- To design a model of theoretical paradigms of digital literacy, digital competence and digital intelligence (1) - To nominate and engage researchers from at least three different scientific fields into the project research team (2) - To conduct at least one research at a foreign institution for the purpose of preparing a doctoral dissertation and/or postdoctoral training related to the topic of digital education (3) - To involve scientists from the real and public sectors in research projects. Implementation of research outcomes in study and digital literacy training programmes (4) - Transfer of the developed theoretical model of digital literacy, competences and intelligence into study programmes with the aim of their digital transformation (5) - University North - accredited institution for programme implementation and EDSC certification (*European Digital Skills Certificate*) (6) - The scientific and professional reputation of University North in the field of studying and perfecting digital literacy of citizens. (7)
Activities	- Explore the theoretical framework, knowledge corpus and the empirical-epistemological aspect of digital competences, digital intelligence and their significance for digital education and management (1) - Design and apply for an interdisciplinary research project funded by the Croatian Science Foundation whose head is an employee of University North (2) - Explore the alignment of University North education programmes with the EU Digital Education Action Plan (2021-2027). (3) - Explore the alignment of educational programmes and teaching practices with existing and future needs of employers (4) - Explore labour market needs related to the research problem and digital transformation of education (5) - Involve students in the development and implementation of lifelong digital literacy training programmes (6) - Promote and encourage the development of an ecosystem of education for digital literacy coordinated by University North. (7)
Indicators	- Number of defended doctoral dissertations and scientific papers of doctoral students and/or mentors related to the topic of research, and number of citations of these papers. Published university textbook (1) - Approved research project of the Croatian Science Foundation led by University North, and the project of career development of young researchers (2) - Number of guest lectures, number of plenary lectures at international conferences and number of organised *Special Issue* sections in indexed journals (3) - Number of study programmes in which the subject or module "Digital Literacy and Competences" is studied. Number of adopted and certified lifelong digital literacy training programmes (4)

	- Number of innovative methods of learning and teaching in a digital environment approved by the competent professional body of the higher education institution (5) - Proportion of EDSC certified employees more than 50% and students more than 25% (6) - Number of panels, forums and public appearances related to the topic "Digital Literacy and Digital Intelligence" organised in cooperation with city departments for social activities. (7)
Number of researchers	This will be specified when preparing projects depending on the requirements of the tender and the type of project.
Collaborative institutions	This will be specified when preparing projects depending on the requirements of the tender and the type of project.

Topic 2	**COMPETENCES FOR WORK IN THE DIGITAL ENVIRONMENT**
Aims	- To create innovative metrics to determine the interdisciplinary evaluation of competences in the selected field of activity (1) - To nominate and hire a renowned researcher as a mentor-advisor to project research teams (2) - To determine the cultural impact on interspectional competitions of the investigated competence framework for work in the digital environment (3) - Involvement of real and public sector representatives in research projects and implementation of research outcomes in study and educational programmes (4) - Transfer of the developed competence model to study programmes and job systematisations with the aim of their digital transformation (5) - Recognisable and generally accepted academic and organisational culture of self-initiative approach to lifelong improvement of competences of employees and students (6) - The scientific and professional reputation of University North in the field of studying and perfecting competence for working in a digital environment. (7)
Activities	- Exploring theoretical competency models and identifying constructs for their expansion in the domain of digital skills (1) - Design and application of an interdisciplinary project financed from the funds "Support to scientific research and artistic work of University North" (2) - In cooperation with the Office of Science, on the basis of signed cooperation agreements with University North, the detection of institutions dealing with related topics (3) - Considering competence needs and identifying research problems in cooperation with the real and public sector (4) - Monitoring and adoption of competency needs of the labour market related to the research problem and transformation of job systematisation (5) - Designing, adopting and affirming the programme of lifelong improvement of competences of teachers and students for work in the digital environment (6) - Designing the concepts of promotion and their permanent implementation in cooperation with the services for the management and development of human resources. (7)

Indicators	- Number of defended doctoral dissertations and scientific papers of doctoral students and/or mentors related to the topic of research, and number of citations of these papers. Published university textbook (1) - Number of grants granted for interdisciplinary projects, number of scientific fields represented, and number of researchers involved (2) - Number of cooperation agreements signed, number of publications co-authored with international researchers, number of mobilities and duration (3) - Number of revised study programmes, number of approved new study programmes, and number of adopted training programmes (4) - Number of revised/new study programmes introduced, and number of workshops/training courses held (5) - Share of employees of participants in the programme of training competences for work in the digital environment more than 50%, and students more than 25% (6) - Number of external associates involved in research projects and lifelong programmes for the development of competences of University North. (7)
Number of researchers	This will be specified when preparing projects depending on the requirements of the tender and the type of project.
Collaborative institutions	This will be specified when preparing projects depending on the requirements of the tender and the type of project.

Topic 3	**DIGITAL WORK AND INNOVATION**
Aims	- To develop and publish a scientific methodology for monitoring digital education trajectories and labour markets in the digital environment (1) - To provide space and equip the University North Digital Innovation Centre (2) - Participation in the programme "Horizon Europe: 2021-2024" , Cluster 2: Culture, Creativity and Inclusive Society (3) - Approved curriculum for specialist education in the field of e-management (4) - Transfer of developed knowledge and innovative solutions to real environments. (5) - To develop and integrate opportunities for preparing students for a career in a digital environment (6) - To develop and promote best practices at the University that provide cooperation with the local community and participate in their promotional activities. (7)
Activities	- Explore the theoretical framework and recent research related to digital work and innovation in the scientific and artistic fields of University North (1) - Design the DCI-SS Centre establishment project and apply it with funds from the "National Recovery and Resilience Plan 2021-2026" of the Government of the Republic of Croatia (2) - Explore the alignment of University North education programmes with the EU Digital Education Action Plan (2021-2027). (3) - Research the compliance of existing education programmes and management practices in the real and public sector with the needs of e-managers (4) - Explore the information, communication, economic and legal aspects of the digital transformation of non-informatics professions (5)

	- Establish an association of University North innovators, launch a competition and establish a UNIN-DI award (6) - Promote innovative solutions, new forms of work and new professions studied at University North. (7)
Indicators	- DCI-SS Centre (University North Digital Innovation Centre) formed (1) - Number of scientific research cooperation contracts with the non-profit and for-profit sector including small and medium-sized enterprises (2) - Number of scientific research projects, number of project managers, number of researchers, and number of contracts for scientific cooperation with scientists from the diaspora (3) - Established postgraduate specialist study programme in e-management (4) - Participation in the creation of the national "Charter of Digital Jobs" (5) - Digital transformation of University North - share of digital work in certain areas of business, teaching and learning more than 50% (6) - Number of public appearances organised in cooperation with professional associations. (7)
Number of researchers	This will be specified when preparing projects depending on the requirements of the tender and the type of project.
Collaborative institutions	This will be specified when preparing projects depending on the requirements of the tender and the type of project.

Strategic direction 2	SCIENCE AND TRANSFORMATIONS: THE IMPORTANCE OF INFORMATION AND COMMUNICATION SCIENCES FOR SCIENCE, MEDIA, CULTURE AND SOCIETY IN TIMES OF PARADIGM CHANGE
Summary of the direction	The starting point is based on the information and communication sciences — an area that has undergone intensive changes over the last two decades, especially under the influence of new technologies. The fact is that the development of new technologies directly affects the development of science in general, and research methods primarily formed in the context of modern information and communication sciences become the framework for the development of specific research procedures inherent in other areas of science. In a time characterised by a paradigm shift, epistemological shifts and the development of new theoretical concepts and methodological procedures, information and communication sciences become the basic area around which they gather, but which, at the same time, spread to other scientific fields (humanities, technical sciences), the artistic field, and the real sector. In this process, communication, identity and characteristics of individual engagement in the community are transformed in the context of democratic processes and active citizenship. Bearing in mind all of the above, and starting from the strategic goals of University North's Scientific-Research Strategy, the specifics of the study programmes currently being carried out, as well as those planned (from the undergraduate to the doctoral level of study), the Scientific-Research Strategy of the Doctoral Study Programme in Media and Communication 2019-2023, as well as the work programme of the Centre for the Development of Digital Competences and E-Learning Technologies of University North, this direction of research is developed through 4 fundamental courses: a) Communication in science - the direction examines the impact of new technologies on modern science and points to the fact that the influence of technologies opens the space for inter/multi and transdisciplinary cooperation of researchers from different fields of science and art. The course includes research aimed at the application of digital technologies in the research process, as well as research related to the implementation of digital technologies in research processes. b) The digital transformation of education demonstrates the range related to the creation and storage of digital content in repositories, the ability to use information and communication technology safely and critically for work, and to develop the knowledge, skills and attitudes necessary to be functional in a digital environment. c) Information technologies and new media - a course aimed at exploring the relationship between traditional and new media; changes that occur under the influence of new technologies in the creation of media and media content, as well as exploring the consequences that technologies have on the perception of media

	and media content both in the communication and in the broader social, political and cultural sense. d) Communication and inclusion - a course aimed at considering the complex interrelationships of transformational effects of education, communication and media discourse as a transdisciplinary theoretical framework for the establishment of new supplementary education programmes for media workers. The idea of inclusive pedagogy as social justice is explored in order to develop intercultural competences for lifelong learning as well as experiential models of socially useful learning in order to create an inclusive platform in support of the third mission of the university and social inclusion. Keywords: information and communication technologies, inclusion, communication, media, education

Topic 4	**COMMUNICATION IN SCIENCE**
Aims	- To provide support to the strategic programme of scientific research in the field of humanities entitled *Meeting points between humanities and information-communication technologies* (1, 2) - To determine the status of information and communication sciences in the context of science in general and explore and point out the importance of communication between different scientific fields and areas in the modern research community (1, 2, 3, 4, 5, 6, 7) - To involve colleagues with foreign universities (3) - To establish cooperation with the real sector. (4)
Activities	- Investigate and determine the theoretical framework of understanding contemporary developments in science (interdisciplinarity, transdisciplinarity, multidisciplinarity) and determine the importance and status of information and communication in relation to other areas of science, but also in the field of art (1, 2, 3, 4, 5, 6, 7) - Plan and develop a lifelong programme in the field of digital humanities (4) - Investigate and determine the level of use of digital technologies in the research process. (5)

Indicators	- Analysis of papers relevant to the topic of research (digital humanities); proposal of models and approaches in the study of the aforementioned issues, and established cooperation with professors and scientists in other fields of science and art (1) - Presentation of research results at the international scientific conference and/or relevant scientific journal and/or other scientific literature (book, chapter in the book, etc.); defended doctoral dissertations; approved grants for scientific research of University North, and application for tenders of the Croatian Science Foundation (headed by an employee of University North) (2) - Established status of digital humanities in the framework of the national system of classification of sciences (2, 6, 7) - Established cooperation with international partners and achieved international mobility (3) - Launching lifelong learning programmes in the field of digital humanities and organising workshops to increase the level of digital research competences (at least once a year for teachers of the University, but also for other interested public, and once a year for doctoral students of the study of Media and Communication, all organised by the Centre for the Development of Digital Competences and E-Learning Technologies of University North), and established cooperation with the real sector (4) - Determined status of the level of use of digital technologies in the research process in national frameworks (5) - Presentation of research results at an international scientific conference and/or relevant international scientific journal; activities (workshops and discussion groups) at the Science Festival, and organisation of public forums. (7)
Number of researchers	8
Collaborative institutions	Departments of University North in the social and technical field of science Faculty of Humanities and Social Sciences - University of Zagreb, Faculty of Humanities and Social Sciences – University of Rijeka Ruđer Bošković Institute University Computer Centre of the University of Zagreb Faculty of Medicine in Zagreb Faculty of Organisation and Informatics – University of Zagreb University of Ljubljana, Slovenia, University of Maribor, Slovenia

Topic 5	**DIGITAL TRANSFORMATION OF EDUCATION**
Aims	- To explore topics that will enable a better understanding of the digital literacy process and the need to develop digital competences that affect the quality in the educational process and the quality of students' knowledge and skills (1, 2, 3)

	- To explore topics that will enable a better understanding of the digital literacy process and the need to develop digital competences that affect the quality in the educational process and the quality of students' knowledge and skills (1, 2, 3, 4) - To explore topics that will enable a better understanding of the digital literacy process and the need to develop digital competences that affect the quality in the educational process and the quality of students' knowledge and skills (1, 2, 3, 4, 5) - To align the educational process with the real situation in the labour market. (4, 6)
Activities	- Investigate and determine possible ways of aligning the educational process with realistic requirements in the labour market, given the specifics of each profession (1, 2, 3) - Analyse the involvement of digital skills and competences in existing study programmes (at the general level and at the level of the programme description of each individual course) at the University level (1, 2) - Plan and develop a lifelong programme in the field of digital competences with regard to the specifics of the profession, and plan and develop workshops in the field of digital transformation of education and digital competences for doctoral students in Media and Communication (4, 6, 7) - Explore and determine the level of digital literacy among teachers and students of the University; hold a minimum of two workshops per year, organised by the Centre for the Development of Digital Competences and E-Learning Technologies of University North, for doctoral students in Media and Communication. (5, 6)
Indicators	- Analysis of the real situation between the educational process and the real sector (1, 2, 3) - Analysis of the involvement of digital skills and competences in existing study programmes (at the general and individual level) and cooperation with professors and scientists in other fields of science and art (1, 2, 3, 6) - Analysis of papers relevant to the topic of research and proposal of models and approaches in the study of the aforementioned issues; presentation of research results at the international scientific conference and/or relevant scientific journal and/or other scientific literature (book, chapter in the book, etc.); defended doctoral dissertations; approved grants for scientific research of University North, and applications to tenders of the Croatian Science Foundation (2) - Mobility; cooperation with colleagues from foreign universities (3) - Analysis of the real situation between the educational process and the real sector; initiation of at least 3 lifelong learning programmes organised by the Centre for the Development of Digital Competences and E-Learning Technologies of University North, and activities carried out in cooperation with the Croatian Chamber of Economy (4, 6, 7) (4, 6, 7) - An analysis of the level of digital literacy among teachers and students at the University; developed model of raising the level of digital skills and competences for teachers and students; amendments to study

	programmes made in accordance with the requirements of the digital transformation of education and the implementation of the necessary digital skills and competences in individual study programmes with regard to the specifics of a particular profession. (5, 6, 7)
Number of researchers	12
Collaborative institutions	Faculty of Humanities and Social Sciences, University of Zagreb Faculty of Humanities and Social Sciences, University of Rijeka Ruđer Bošković Institute University Computer Centre of the University of Zagreb Croatian Chamber of Economy Zadar University Juraj Dobrila University of Pula Dubrovnik University Mostar University Faculty of Education, University of Ljubljana Ministry of Science and Education

Topic 6	**INFORMATION TECHNOLOGIES AND NEW MEDIA**
Aims	- To explore the position and changes experienced by today's media under the influence of technologies (1, 2, 5, 7) - To examine the status of culture and art that are under the influence of new technologies (artificial intelligence, augmented reality, etc.) approaching the "status of the media" and explore the effects of new media on political and economic reality and vice versa (1, 2, 5, 7) - To establish a dialogue with other fields of science and support a strategic programme of scientific research in the field of humanities entitled *Humanistic aspects of media questioning* (1, 3) - To present new theoretical concepts in the reflection of new media, as well as new methodological procedures in their research. (2, 6, 7)
Activities	- Explore the position and changes experienced by today's media under the influence of technologies (1, 2, 5, 6, 7) - Examine (1, the status of culture and art that are under the influence of new technologies (artificial intelligence, augmented reality, etc.) approaching the "status of the media" and explore the effects of new media on political and economic reality and vice versa 2, 5, 6, 7) - Establish a dialogue with other fields of science and support a strategic programme of scientific research in the field of humanities entitled *Humanistic aspects of media questioning* (1, 2, 3, 5, 6, 7)
Indicators	- Analysis of papers relevant to the topic of research and cooperation with professors and scientists in other fields of science and art (1)

	- Proposal of models and approaches in the study of the problem of new media; defended doctoral dissertations; approved grants for scientific research at University North, and applications to tenders of the Croatian Science Foundation (2) - Established cooperation with international partners and achieved mobility (3) - A minimum of one workshop per year held for the development and/or application of tools for the analysis of digital/cultural artifacts, all organised by the Centre for the Development of Digital Competences and E-Learning Technologies of University North, and establishing cooperation with the real sector (4) - Developed applications and software for the analysis of cultural artifacts (5) - A minimum of one workshop per year held for the development and/or application of tools for the analysis of digital/cultural artifacts, all organised by the Centre for the Development of Digital Competences and E-Learning Technologies of University North (6) - Presentation of research results at the international scientific conference and/or relevant scientific journal and/or other scientific literature (book, chapter in the book, etc.). (7)
Number of researchers	14
Collaborative institutions	Faculty of Humanities and Social Sciences - University of Zagreb, Faculty of Humanities and Social Sciences – University of Rijeka University Computer Centre, Zagreb Geneva University of Art and Design (HEAD – Genève) (Institut de recherche en art et design (Irad) University of Alicante (Department of Language and Information Systems) Technical University of Cluj-Napoca (Design Engineering and Robotics) Museum of Contemporary Art, Zagreb; Museum of Applied Arts in Osijek; National Museum of Modern Art, Zagreb, and the National Museum of Zadar Agency for Electronic Media Croatian Chamber of Economy

Topic 7	**COMMUNICATION AND INCLUSION**
Aims	- To critically consider the plausibility of creating social/public spaces and discourses for members of different vulnerable groups in order to increase their visibility and build their own identities within the community (1, 2) - To explore the effects of inclusive media content on positive social change (3, 4) - To explore and establish acceptable models of academic socially useful learning in order to strengthen the mechanisms for integrating universities into society in the field of communication inclusion. (6, 7)

Activities	- Analysis of the interests and the potential of potential stakeholders of national and international higher education cooperation in the context of the introduction of social learning programmes (1, 3) - Identifying a sustainable integrative model of the experience-based communication learning curriculum in the community in the context of communication inclusion and social justice, and evaluating the implementation of academic social learning programmes (2, 5) - Designing models of academic, socially useful learning in order to strengthen intercultural and communication skills, and establishing a model of community media that can equally effectively perform inclusive, as well as recreational and educational tasks (3, 4) - Implementation of individual programmes of academic, socially useful learning. (6, 7)
Indicators	- Stakeholder analysis and PEST analysis, and established cooperation with professors and scientists in other fields of science and art (1, 3) - Analysis of domestic and international good practice; held focus groups; developed catalogue of topics of integrative model; defended final and graduate theses; approved support to scientific research of University North; number of applications for tenders of the Croatian Science Foundation, and accepted projects co-financed by the European Union funds (2) - Drafted proposal of forms and stakeholders of interinstitutional cooperation; established cooperation with international partners, and achieved international mobility (3) - At least one workshop for the education of teaching staff held; the number of newly produced media content published (spoken, written) in support of social inclusion (increased visibility and other aspects of integration), and cooperation with the real sector was established. (4) - Curricula developed in accordance with the National Qualifications Framework; extension and adaptation of University North performance plans; creation and realisation of student inclusive projects in the community; analysis of observation/work logs; self-evaluation of students, and completed and analysed evaluation forms/surveys at the end of the semester. Publication of student project results. Defended graduate theses (6) - Presentation of results at a international scientific conference and/or number of articles published in the relevant scientific journal, and number of panels with businessmen held. (1, 2, 7)
Number of researchers	8
Collaborative institutions	Faculty of Education and Rehabilitation Sciences - University of Zagreb Media and Communication Studies - University of Iceland, Iceland Institute of Journalism and Social Communication - University of Warmia and Mazury (UWM), Poland Monmouth University, New Jersey, US Ministry of Culture and Media of the Republic of Croatia Ministry of Justice and Administration of the Republic of Croatia National Foundation for Civil Society Development

Strategic direction 3	TOURISM AND PUBLIC RELATIONS
Summary of the direction	Tourism is taking on new forms that emphasise care for the environment, human health and increasing the quality of service. From the aspect of tourism development, there is a need for an innovative tourism offer within special forms of tourism - rural, eco, sports, cyclo, nautical, congress, health, cultural tourism, etc. The subject of the research are trends in the development of tourism and determining the directions of tourism development for the Republic of Croatia. Trend analysis should contribute to the modernisation of the tourist offer, the creation of competitive products based on sustainable development, socially responsible business and modern digital technologies in the promotion of special tourism products. Market research will be conducted, examples of good practice will be compared, attitudes and perceptions of target demand groups will be examined, and modern tourism products that are in accordance with the conditions in which the world and Croatia found themselves due to the consequences of the COVID-19 pandemic will be proposed. The strategic direction includes tourism management, development trends in all segments of tourism activity with an emphasis on the development of innovative tourism products and compliance with the principles of sustainable marketing strategies. The aim is to increase the competitiveness of tourism in the Republic of Croatia by raising the quality of destination management. The strategic direction will also explore the use of virtual and augmented reality that contribute to the creation of modern tourist products and the promotion of sustainable tourist destinations and tourist attractions. Research also includes public relations through contemporary virtual and visual media, as they are responsible for greater visibility and perception in media reporting. Using press clipping, an analysis can be obtained on the types of reports (positive, negative, neutral). The results of the research will be used as a basis for public relations and increasing the visibility of University North in the media through topics that will be published in scientific and professional papers in the field of tourism, media, public relations and promotion. At the same time, participation in scientific meetings will promote Croatia as a tourist destination. Keywords: tourism development trends, marketing and management of sustainable destinations, public relations, media, virtual and augmented reality

Topic 8	FUTURE TRENDS IN TOURISM
Aims	- Analysis of trends as well as anticipation of new special forms of tourism, their specific content and concept of service provision (1) - To explore the national, international and global market (2) - Implementation of a successful and innovative tourism practice (3) - Dissemination of research results, new knowledge and scientific insights (4) - To explore trends in development and the possibility of applying virtual and augmented reality in each specific form of tourism (5)

	- Introduction of new educational content based on research and scientific activities, related to all levels of study through the development of joint research teams (6) - Organisation at scientific and general meetings with the aim of promoting and popularising tourism. (7)
Activities	- Research on the state of tourism supply, special forms of tourism and tourism demand (1) - Comparison of examples of good practice, examination of attitudes and perceptions of target groups and creation of new contemporary tourism products (2) - Comparative analysis of current trends in the world (3) - Cooperation with the economy, public and civil sector in the organisation and implementation of workshops, scientific projects and research (4) - Examination of the perception of tourists and visitors, and their readiness to use various forms of digital applications and tools (5) - Use of innovative learning and teaching methods in the field of tourism, PR and new technologies (6) - Participation in scientific conferences in order to increase the global visibility of University North and promote tourism capacities. (7)
Indicators	- Number of published scientific and professional papers in scientific journals (WoS, Scopus, other relevant databases) (1) - Number of signed cooperation agreements with higher education institutions, and the number of projects (2) - Mobility of teachers and students involved in international scientific research projects, conferences and research (3) - Number of workshops held in the field of tourism (4) - Number of scientific conferences held by virtual means involving scientists and students (5) - Number of new courses in the field of tourism in Croatian and foreign languages (6) - Number of public appearances organised in cooperation with professional associations and institutions (Ministry of Tourism and Sports, Croatian National Tourist Board, Croatian Chamber of Commerce, Croatian Employers' Association, Croatian Chamber of Trades and Crafts, Association of Croatian Travel Agencies, Croatian Meeting Professionals Association, etc.) (7)
Number of researchers	7
Collaborative institutions	Faculty of Tourism and Hospitality Management, Ika, Opatija Plekhanov Russian University of Economics, Moscow, Russia Virovitica Polytechnic

Topic 9	MANAGEMENT AND A MARKETING SUSTAINABLE STRATEGY IN TOURISM
Aims	- To define and describe the key features of sustainable marketing application in each segment of the marketing function in tourism with regard to destination tourism planning (1) - To identify the exchange of application of the sustainable development strategy in different dimensions of action, and management of the tourist destination in the delivery of the integrated tourism product (2) - To determine the frequency of applying a sustainable approach to marketing in the business of tourist destinations and integrated tourism product manufacturers on the international tourism market (exchange of experience) (3) - Increasing the competitiveness of Croatian tourism (4) - To determine the degree of development of smart tourist destinations in the Republic of Croatia with regard to the established set of indicators, and identify the potentials of interdependence between factors that affect the development of smart tourist destinations (5) - Strategic inclusion of elements of consumer orientation in tourism and competition, interdepartmental coordination and orientation to social benefits through the development of tourism products and services, as well as fostering innovation competence in tourism marketing strategies (6) - Impact on public opinion, behaviour and political preferences when scientific evidence suggests that certain choices may have implications for tourism development, the implementation of sustainable marketing strategies and the development of smart destinations. (7)
Activities	- Define and describe the key features of the application of sustainable marketing strategy in each segment of the marketing function in tourism with regard to destination tourism planning (1) - Explore and analyse the development of the concept of sustainable marketing at the level of tourist destinations of the tourist market of the Republic of Croatia (2) - Examine the impacts of attitudes, norms and behavioural control of sustainable tourism destination management, in the context of theories of planned behaviour, on the level of implementation of the sustainable development strategy in tourism (3) - Improve the processes and procedures encountered by entrepreneurship in tourism in working with public authorities and the real sector (other industries), and support the development of competitive, technologically advanced and sustainable tourism based on knowledge, innovation and the application of advanced technology (4) - Describe the system of activities in the context of the development and management of smart tourist destinations and identify potential contradictions and tensions that are present in the tourism system (5)

	- Identify, select and present key factors that condition the creation of preconditions for sustainability as a strategic marketing orientation to tourism. In this respect, a significant impact arises from the development of elements of environmental, social and economic sustainability, and the market competitiveness of tourism (6). - Participate in the open days of the University with the presentation of scientific research infrastructure and scientific research achievements. (7)
Indicators	- Indexation of scientific papers, number of scientific projects and cooperation on the topic among different tourist destinations, and examples of good practice (1) - Hierarchical level of creation and organisation of the offer in the tourist destination (2) - Number of international cooperation contracts with partner institutions involved in scientific research, professional and educational institutions, and the realisation of activities under contracts (3) - Number of workshops held, and number of projects and cooperation fulfilled with the public sector and civil society (4) - Monitoring of the digital maturity index by year (5) - Number of own and external scientists involved in the research of the said topic, and total scientific output of the research topic (6) - Number of collaborations with different scientists of different research approach. (7)
Number of researchers	9
Collaborative institutions	Institute for Tourism, Zagreb Faculty of Tourism and Hospitality Management, Ika, Opatija Faculty of Tourism & Hospitality - Ohrid Plekhanov Russian University of Economics, Moscow, Russia Ministry of Tourism and Sports Dubrovnik University Juraj Dobrila University of Pula Zadar University FH Burgenland University of Economics in Bratislava Mostar University Ministry of Culture and Media

Topic 10	**PUBLIC RELATIONS IN THE AGE OF DIGITAL MEDIA**
Aims	- To increase public and targeted public information on the scientific and other achievements of University North (1) - To continuously work on a good image of University North (2) - To increase the number of scientific articles in reference databases (3)

	- To increase the visibility of University North on the national and international scientific scene (4) - To educate and train the personnel required by the real sector in tourism. To explore trends in the use of digital media at University North (5) - To attract as many students as possible from the country and the EU and attract as many Erasmus students as possible. To attract distinguished scientists to University North (6) - Organisation of scientific and professional conferences with the aim of promoting and popularising tourism and University North. (7)
Activities	- - Conduct qualitative research to define a basis grounded on the model of the impact of the level of application of the sustainable development strategy on the business performance of the destination (1) - Produce scientific papers, and participate in national and international projects (2) - Organise lectures by renowned scientists and experts, and hold lectures at other universities (3) - Organise important courses and trainings for employees in tourism (4) - Transfer developed knowledge and innovative solutions to real environments. - Develop opportunities for students to develop careers in the digital environment (6) - Participate in scientific meetings in order to increase the global visibility of University North, and promote Croatia as a tourist destination by means of scientific papers on tourism. (7)
Indicators	- Appearance of University North as a subject in digital media (using press clipping to obtain an analysis on types of announcements; positive, negative, neutral (1) - Number of published articles and citation of authors (2) - Number of international cooperation agreements with partner institutions (3) - Organised lifelong e-learning and studies at all levels (4) - Participation in the creation of the national *Charter of Digital Jobs* (5) - Digital transformation of University North - share of digital work in certain areas of business, teaching and learning more than 50% (6) - The appearance (number and quality of reports) of University North as a subject in the media, and its visibility and recognition. (7)
Number of researchers	5
Collaborative institutions	VTV Press Cut

Strategic direction 4	POLITICAL, ECONOMIC AND SOCIAL ASPECTS OF EUROPEAN INTEGRATIONS
Summary of the direction	Political and general social rifts in the EU between liberal and conservative forces and a wave of populism, fuelled by cultural shocks and economic inequalities, pose major challenges to EU institutions and in particular to individual Member States. The differences between the core and the post-socialist periphery, affected by the emigration of a younger, more productive and more educated population at the core of the EU, seem to be growing. It is evident that the post-socialist periphery of the EU is mostly dying out demographically, and similar trends are present in the Western Balkan countries. Possible enlargement to the Western Balkans does not seem to be a real priority for the EU. The impact of the European integration process on legal and illegal migration will be investigated in the context of the possible future enlargement of the European Union to the Western Balkan countries, as well as the impact of the European integration process on migratory movements from post-socialist EU Member States. The research will cover aspects such as flows of illegal migration across the Western Balkans, legal migration from the Western Balkan countries to the EU Member States, as well as intra-EU labour movements from post-socialist Member States. When it comes to Croatia, negative demographic trends, unbalanced regional development, population reduction and ageing indirectly become a limiting factor for the sustainability of economic and social development, which is mainly a feature of most post-socialist EU member states, and even more so of the Western Balkan countries. It is expected that new knowledge on migration will be gained, in addition to the reasons for emigration, specifics of the labour market and the effects of European policies to stimulate economic development and recovery. It is planned, among other things, to explore demographic trends and, accordingly, new economic opportunities and social demands, trends in further migratory movements from the Western Balkans and from the most emigrant post-socialist EU Member States, the effects of the migration crisis on Europe and the unity of the European Union, and the impact on the EU's determination to integrate the Western Balkan countries within a reasonable period of time. These areas of investment would create the most jobs in the countries from which the population emigrates most in the area of Southeast Europe. Keywords: migration, demand, personal consumption, Western Balkans, European Union

Topic 11	POLITICAL ASPECTS OF EUROPEAN INTEGRATIONS
Aims	- To define whether European integration processes have a positive or negative impact on the demographic picture of the post-socialist countries of the European Union (1-2) - To analyse the possibility of returning a part of the population that has legally emigrated from the territory of post-socialist EU Member States and Western Balkan countries (1-2) - To investigate wage policy as one of the key problems in lagging behind the developed world and the general decline in standards and reasons for the economic migration of the Croatian population, the state of the rule of law, citizens' mistrust in the judiciary and administration, inefficiency of a large number of local self-government units, corruption, distrust in the political system and institutions, and other relevant factors (1-2) - To develop partnerships and international cooperation with researchers dealing with related topics and their institutions. (3, 6)
Activities	- Using quantitative and qualitative research methods in order to gain new insights into the impact of external and internal migration in the EU on the economic and social picture of the countries of the post-socialist periphery of the EU, and particularly in the Western Balkans (1-2) - To explore demographic trends and, accordingly, new economic opportunities and social requirements (among other things, to explore what demographic ageing brings to society and whether it can trigger some economic niches, and to explore the source of a high share of remittances from abroad present in the Croatian economy) (1-2) - To predict the trends of further migration movements from the Western Balkans and from post-socialist EU Member States most affected by emigration (1-2) - To anticipate the effects of the migration crisis on Europe, the unity of the European Union and the impact on the EU's determination to integrate the Western Balkan countries within a reasonable time, over the next 10 years or so, which will have a key impact on the region's development prospects (1-2) - To define the areas of investment that would create the most jobs in the countries from which the population emigrates the most in the area of Southeast Europe. (1-2, 6-7)
Indicators	- Number of published scientific and professional papers in indexed scientific publications (1-2) - Number of quotes from all scientists involved in the research (Google Scholar) over time, and visibility on scientific services (Research Gate, Academia.edu, ORCID, Kudos, etc.) (1-2) - Number of visiting professors who are international scientists (3, 6, 7)

	- Number of students involved in scientific research (4-5) - Number of scientific conferences held by virtual means involving scientists and students (1-2, 4-5) - Cooperation with national and international faculties, teachers and the economy in creating new electoral courses (3, 4, 7) - Participation in the Science Festival with the aim of promoting the content of the topic to different groups of the public. (7)
Number of researchers	6
Collaborative institutions	RMIT University, Melbourne Sankt Gallen Universität , Sankt Gallen University of Liechtenstein, Vaduz Canterbury University, Christchurch Hong Kong Baptist University, Hong Kong

Topic 12	**ECONOMIC ASPECTS OF EUROPEAN INTEGRATION**
Aims	- To explore the relationship between the migration rate and household consumption in a country from a macroeconomic perspective, since both (migration phenomenon and household consumption) represent the pillars of a country's macroeconomic stability (1-3) - To analyse the impact of labour migration on changes in household consumption patterns, and household welfare in the home country (1-3) - To compare the Croatian demand for goods with the demand of countries with a similar socio-economic, historical or cultural framework, i.e., transition and post-transition countries (3-4) - To investigate the effects and simulate the effects of changes in economic and social policies on household consumption (3-4) - To investigate wage policy as one of the key problems in lagging behind the developed world and the general decline in standards and reasons for the economic migration of the Croatian population, the state of the rule of law, citizens' mistrust in the judiciary and administration, inefficiency of a large number of local self-government units, corruption, distrust in the political system and institutions, and other relevant factors (1-4) - To provide institutional and financial support to scientists and experts from the institution and funding for external collaborators (6) - To raise the attractiveness of University North as a scientific research institution. (6 and 7)
Activities	- Continuous improvement and raising the level of scientific excellence in researching the economic aspects of European integration, with a special focus on post-socialist EU Member States and Western Balkan countries (1) - Publishing papers in indexed journals and proceedings of international conferences (2)

	- Joint work with colleagues from abroad, cooperation on projects and submissions at conferences (3) - Cooperation with the economy and the public sector and civil society in organising workshops, conducting scientific projects and research (4) - Examination of the motives of different groups of legal and illegal migrants for the use of different forms of digital applications and tools in everyday life (5) - Providing institutional and financial support to scientists and experts from the institution and funding for external collaborators (6) - Science Festivals - organisation, European Researchers' Night and other science popularisation projects. (7)
Indicators	- Number of published scientific and professional papers in indexed scientific publications (1-2) - Number of quotes from all scientists involved in the research (Google Scholar) over time, and visibility on scientific services (Research Gate, Academia.edu, ORCID, Kudos, etc.) (1-2) - Number of visiting professors who are international scientists (3, 6, 7) - Number of students involved in scientific research (4-5) - Number of scientific conferences held by virtual means involving scientists and students (1-2, 4-5) - Cooperation with national and international faculties, teachers and the economy in creating new electoral courses (3, 4, 7) - Participation in the Science Festival with the aim of promoting the content of the topic to different groups of the public. (7)
Number of researchers	3
Collaborative institutions	Faculty of Economics in Rijeka

Topic 13	SOCIAL ASPECTS OF EUROPEAN INTEGRATION
Aims	- To gain new insights into the social aspects of European integration (1-3) - To explore the topics and factors that influence the creation of a stimulating and attractive social and economic environment for the stay, return and arrival of young people and families who will find their place to work and raise children in Croatia (1-3) - To investigate the impact of the Enforcement Act and its impact on Croatian society in practice, given that it leads one part of the population to "debt slavery" (1-3) - To explore trends in the use of digital tools related to European integration by state authorities, the economy and civil society (5) - Dissemination of research results and new scientific knowledge related to the investigated topics (4) - To raise the attractiveness of University North as a scientific research institution (6) - To promote awareness of the existence, activities and continuous growth of the quality of University North. (7)
Activities	- Analyse demographic trends that Croatia has been affected by in recent decades such as the reduction and ageing of the population, possible participation and activation of the potential of the Croatian diaspora and measures and policies aimed at improving the position of families, children and young people, easier realisation of the balance between family and work life, and the right of women and mothers to job security and employment (1-3) - Explore the topics and factors that influence the creation of a stimulating and attractive social and economic environment for the stay, return and arrival of young people and families who will find their place to work and raise children in Croatia (1-3) - Investigate the impact of the Enforcement Act and its impact on Croatian society in practice, given that it leads one part of the population to debt slavery (1-3) - Cooperation with the economy and the public sector and civil society in organising workshops, conducting scientific projects and research (4) - Examine the motives of different groups of legal and illegal migrants for the use of different forms of digital applications and tools in everyday life (5) - Providing institutional and financial support to scientists and experts from the institution and funding for external collaborators (6) - Popularisation of science through organisation or participation in various science festivals (e.g., European Researchers' Night and other science popularisation projects). (7)

Indicators	- Number of published scientific and professional papers in indexed scientific publications (1-2) - Number of quotes from all scientists involved in the research (Google Scholar) over time, and visibility on scientific services (Research Gate, Academia.edu, ORCID, Kudos, etc.) (1-2) - Number of visiting professors who are international scientists (3, 6, 7) - Number of students involved in scientific research (4-5) - Number of scientific conferences held by virtual means involving scientists and students (1-2, 4-5) - Cooperation with national and international faculties, teachers and the economy in creating new electoral courses (3, 4, 7) - Participation in the Science Festival with the aim of promoting the content of the topic to different groups of the public. (7)
Number of researchers	
Collaborative institutions	

Strategic direction 5	MANAGEMENT AND ORGANISATION OF SUSTAINABLE SYSTEMS
Summary of the direction	Successful business operations of companies (organisations) in today's business conditions are becoming an increasing challenge for all those who manage them. Businesses face numerous market challenges and operate in an unsafe environment, which requires them to be managed proactively. This means that the resources given or acquired are managed and used in an effective and efficient way. The ultimate goal of proactive management is to evaluate whether the company manages the business system effectively and efficiently through simple measurements of the business process, in order to achieve added value and ensure competitiveness. New needs arise every day, demand is expanding and changing, markets are becoming more demanding and volatile, and new industries are emerging. Over the past months, the idea of designing a new term and management concept called SMART Management (a new management concept - Sustainability, Measurable, Agile, Risk oriented, Technologically adaptable) has emerged. As a result of this trend, there is an increasing transition to a virtual environment with the need to create new business models and ways of doing business and management, with the digital transformation of business that ensures sustainable success. Sustainable development involves a comprehensive approach in which economic, social and environmental aspects are brought together and mutually reinforced. Sustainable business comprises, among other things, just and resilient societies, and prosperous economies. Therefore, sustainability and sustainable business should be an imperative of any economy that will manage to preserve the resources of future generations and show the way towards building a successful and resilient economy. The pursuit of sustainable business requires, above all, harmonisation of both economic and socially ecological aspects of business in order to be able to manage the company in a quality manner, and to achieve added value. With the advancement of technology, the conditions of company management are changing, which requires the use of new methods and new management tools for the purpose of winning and retaining a high position in the market and creating and retaining the concept of sustainable business. Keywords: organisational competence, organisational competitiveness, SMART management, sustainable business, sustainable success

Topic 14	ORGANISATIONAL COMPETENCE AND COMPETITIVENESS
Aims	1 In accordance with the concept of “new economy,” and in relation to new problems, as well as new models of competitiveness, it is necessary to develop a new methodology and define a model for solving problems, i.e., achieving sustainable development of a businesses (1) 2 To ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2)

	3 To select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 To select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic-scientific-research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 To plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department and ensure the realisation of scientific research and professional activities taking into account the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 To actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotion and popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation, and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications) (7)
Activities	1 Launch and implementation of scientific research activities related to the research and development of a new competitiveness model and a new methodology based on the theory of organisational competence with the aim of achieving sustainable success of the company (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2)

	3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility,and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department; the number of newly employed competent staff for scientific research; laboratory for strategic management and competitiveness; the availability of relevant sources of global scientific research literature; the secured funds through the budget of the University for the procurement; installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders; the

	number of accepted and applied national and international scientific research projects, and the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research; number of concluded contracts with selected institutions on mutual cooperation through defined; common thematic scientific research areas; number of international scientific research projects, number of mobilities carried out by scientists; scientific and professional conferences and events, and international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation; number of concluded contracts with selected partners in the public and real sector; number of joint thematic scientific research and professional areas; number of realised scientific research and professional projects; formed professional-scientific working groups; number of joint scientific and professional laboratories and/or plants; number of scientific research and professional projects carried out; realisation of scientific and professional conferences and events, and the number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0; implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0; procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities conducted in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University; the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN; the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure; the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University; the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements; the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories) as well as scientific research achievements; conferences organised or co-organised in the scientific research field and the field

	of scientific expertise; popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research work. (7)
Number of researchers	9
Collaborative institutions	Croatian Chamber of Economy Podravka Fortenova Group Dm Croatian Post L'Oreal Schrack

Topic 15	**SMART MANAGEMENT AND DIGITAL TRANSFORMATION**
Aims	1 To explore and develop the concept of management – SMART management, and position it in the context of digital transformation and management of sustainable success of business and other systems (1) 2 To ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2) 3 To select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 To select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 To plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 To actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic

	documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 To promote and popularise the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Activities	1 Launch and implementation of scientific research activities with the aim of developing the concept, theory and methodology of SMART management with the aim of managing the sustainable success of business and other sustainable systems in the context of business excellence and quality 4.0, with the development of new study programmes, curricula and courses (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds

	for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility,and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department; the number of newly employed competent staff for scientific research; laboratory for industry 4.0 and digital transformation and the laboratory for SMART management and business decisions; the availability of relevant sources of global scientific research literature; the secured funds through the budget of the University for the procurement; installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders; the number of accepted and applied national and international scientific research projects, and the number of advancements of scientific research staff (2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research; number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas; number of international scientific research projects; number of mobilities carried out by scientists, scientific and professional conferences and events, and international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation; number of concluded contracts with selected partners in the public and real sector; number of joint thematic scientific research and professional areas; number of realised scientific research and professional projects; formed professional-scientific working groups; number of joint scientific and professional laboratories and/or plants; number of scientific research and professional projects carried out; realisation of scientific and professional conferences and events, and the number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0; implemented laboratory infrastructure for appropriate digital transformation and technology of

	industry 4.0; procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities conducted in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University, the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN; the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure; the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific research infrastructure (laboratories) and scientific research achievements at the Open Days of the University; the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements; the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories) as well as scientific research achievements; conferences organised or co-organised in the scientific research field and the field of scientific expertise; popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research work. (7)
Number of researchers	10
Collaborative institutions	Koprivnica-Križevci County City of Koprivnica City of Varaždin Croatian Chamber of Economy Belupo Carlsberg

Topic 16	**SUSTAINABILITY AND SUSTAINABLE BUSINESS**
Aims	1 To explore and design models and methodologies that will improve operations and result in successful business results, with the function of sustainable operations with financial and non-financial elements of sustainability reporting, and with the aim of achieving cohesion of financial and non-financial reporting in the context of sustainable success management of business and other systems (1) 2 To ensure the employment of competent staff and monitor their training for scientific research in the formed scientific-research infrastructure of the department (laboratories, scientific practicums, etc.). (2)

	3 To select relevant partners for scientific research and conclude contracts with selected institutions on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 To select possible relevant partners in the public and real sector for professional and scientific research cooperation and concluding contracts with selected partners (forming joint thematic scientific research and professional areas, define the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 To plan and implement training of employees for the application of new digital tools and technology of industry 4.0 and of the acquired and established laboratory infrastructure of the department, and ensure the realisation of scientific research and professional activities taking into account the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 To actively participate in the development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 To promote and popularise the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications).
Activities	1 Launch and implementation of scientific research activities with the aim of developing a concept, theory and methodology of sustainable development aimed at managing the sustainable success of business and other sustainable systems in the context of sustainability reporting (financial and non-financial reporting) (1) 2 Recruitment of competent staff and their training for scientific research in the formed scientific and research infrastructure of the department (laboratories, scientific laboratories, etc.). (2) 3 Signing of contracts with selected relevant partners for scientific research on mutual cooperation through defined common thematic scientific research areas (application to available international scientific research projects, mutual mobility of scientists, organisations of possible scientific and professional conferences and events) with the aim of increasing international visibility. (3) 4 Conclusion of contracts with relevant partners in the public and real sector for professional and scientific research cooperation (forming joint thematic scientific

	research and professional areas, defining the field of cooperation on scientific research and professional projects, forming expert scientific working groups and joint scientific-professional infrastructure, joint scientific research professional projects, realisation of scientific and professional conferences and events). (4) 5 Training of employees for the application of new digital tools and technology of industry 4.0, the acquired and established laboratory infrastructure of the department, and the realisation of scientific research and professional activities taking into account the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacije/novi-izazov-globalni-ciljevi-odrvivog-razvoja-do-2030/). (5) 6 Development of a quality and applied scientific research strategy of the University in accordance with the relevant strategic documents of the University, the Ministry of the Interior and other ministries and the Government of the Republic of Croatia, the EU and the UN, with special emphasis on securing funds for the implementation of scientific and professional research activities, and the procurement of the necessary infrastructure by the University, with the need to amend the necessary institutional documents of the University and the regulations on the organisation of jobs. (6) 7 Promotional activities for the popularisation of the field of scientific research and professional work of the department to all interested parties with special emphasis on the field of logistics, sustainable mobility,and organisation and management of sustainable systems through various activities (open days of the University, Science Festival, motivational lectures in secondary schools, organisation of conferences, continuous publication of articles aimed at popularisation of science and profession in various publications). (7)
Indicators	1 Key indicators that correspond to aim one (1): scientific research projects, published scientific and professional papers in indexed publications, doctoral dissertations, new study programmes and curricula based on the results of scientific research (1) 2 Key indicators that correspond to aim two (2): the implementation of the training plan of all employees in the department; the number of newly employed competent staff for scientific research; laboratory for sustainability and sustainable business and the laboratory for smart cities; the availability of relevant sources of global scientific research literature; the secured funds through the budget of the University for the procurement, installation and use of relevant laboratory equipment for the needs of research and transfer of knowledge to students and other stakeholders; the number of accepted and applied national and international scientific research projects, and the number of advancements of scientific research staff (aim 2) 3 Key indicators corresponding to aim three (3): number of relevant partners for scientific research; number of concluded contracts with selected institutions on mutual cooperation through defined, common thematic scientific research areas; number of international scientific research projects; number of mobilities carried out by scientists, scientific and professional conferences and events, and international visibility (3) 4 Key indicators that correspond to aim four (4): number of relevant partners in the public and real sector for professional and scientific research cooperation; number of concluded contracts with selected partners in the public and real sector;

	number of joint thematic scientific research and professional areas; number of realised scientific research and professional projects; formed professional-scientific working groups; number of joint scientific and professional laboratories and/or plants, number of scientific research and professional projects carried out; realisation of scientific and professional conferences and events, and the number of new entrepreneurial ventures (start-up companies) (4) 5 Key indicators that correspond to aim five (5): trained employees for the application of new digital tools and technology of industry 4.0; implemented laboratory infrastructure for appropriate digital transformation and technology of industry 4.0; procurement of planned digital equipment for the purpose of scientific research and professional work of scientific teaching staff and students, and scientific research and professional activities in line with the UN-defined Sustainable Development Goals (https://www.odraz.hr/publikacije/publikacija/novi-izazov-globalni-ciljevi-odrzivog-razvoja-do-2030/) (5) 6 Key indicators that correspond to aim six (6): the adopted scientific research strategy of the University aligned with the relevant strategic documents of the University; the Ministry of Health and other ministries, and the Government of the Republic of Croatia, the EU and the UN; the planned and reserved funds by the University for conducting scientific and professional research activities and the procurement of the necessary infrastructure; the adopted amendments to the necessary institutional documents of the University, and the Ordinance on the organisation of jobs in laboratories (6) 7 Key indicators that correspond to aim seven (7): the number of presentations of scientific-research infrastructure (laboratories) and scientific research achievements at the Open Days of the University; the number of workshops and topics for the Science Festival with a presentation of scientific research infrastructure (laboratories) and scientific research achievements; the number of promotions in secondary schools through motivational lectures by students of departments and teachers promoting the scientific field and scientific research infrastructure (laboratories) as well as scientific research achievements; conferences organised or co-organised in the scientific research field and the field of scientific expertise; popular articles published on professional and scientific portals and journals, as well as popular publications in the field of science related to scientific research work. (7)
Number of researchers	7
Collaborative institutions	Croatian Chamber of Economy Podravka Fortenova Group Dm Croatian Post L'Oreal Schrack

6.2.4 STRATEGIC PROGRAMME OF SCIENTIFIC RESEARCH IN THE FIELD OF HUMANITIES

Over the last twenty years, digital technologies have entered all spheres of human activity. During the same period, digital transformation and digitisation become central topics of numerous strategic documents and policies of the European Union, and in such circumstances, the importance of technology for the processes of modernisation and progress of education and science becomes unquestionable. Humanities are by their nature interpretative sciences, always focused on the study of man, his status in relation and with regard to culture, art, history, language, philosophy, etc. In the period of transition from industrial to post-industrial, technological society, these sciences are experiencing a kind of degradation in the broader scientific, i.e., academic milieu, and the thought of their inferiority to science in general is beginning to spread. Significant changes have been taking place in the world during the last twenty years when, under the influence of new media and information and communication technologies, the status and perception began to change, and their importance was revitalised. Equally, under the influence of technologies and humanities within its fields, it is experiencing significant changes, both in methodological and theoretical terms. Turning to computer and information and communication sciences, from the previously dominantly interpretative, these sciences are becoming increasingly analytical, which significantly changes the current research patterns and methods.

The Strategic Programme of Scientific Research in the Field of Humanities for the 2021-2027 period was also established on the basis of the above. The research programme is divided into two major directions. One group of research is moving in the direction of digital humanities, and the other in the direction of cultural questioning of contemporary journalism, that is, the media as a whole. Through interdisciplinary cooperation with other fields of science, primarily with social and technical sciences, while at the same time realising the importance for human understanding of art, culture and history, i.e., the world and society in general, new technologies and new media, we aim to contribute to the modernisation of humanities in national frameworks, but also to contribute to the modernisation of study programmes at the University. Likewise, we aim to show how humanistic disciplines become an extremely important component for a holistic, science-based understanding of contemporary social developments.

Topic 1	INTERSECTIONS OF HUMANITIES, INFORMATION AND COMMUNICATION TECHNOLOGIES
Summary	Modern national humanities are largely focused on research approaches characterised by still dominant traditional methodological procedures. Scientists are primarily oriented towards printed text, and the still dominant hermeneutic interpretation is based on the problematisation of narratives from the perspective of classical and now obsolete methods of qualitative analysis. Therefore, it is necessary to raise awareness in the field of the general idea according to which science is not a purpose in itself, but is also about the experience of the world we perceive and think about, primarily through advanced and widespread information models and digital technologies. This is an extremely important moment for the humanities, in which they must overcome the limitations set by tradition and focus on practically based research with developed technical skills. For this reason, all scientific fields within the field simply must detect, signal and activate cooperation with other fields of science. Approaches, methods and tools in the context of humanistic research should be redefined and brought closer to the opinion that content is no longer the focus of research, but rather a research problem. Therefore, it is necessary to miss the methods of information and communication and other social sciences, as well as the methods and tools of other areas of science, emphasising the use of digital technologies in conducting research. If all sciences will soon carry some of the characteristics of the digital world, and this will surely happen, we consider it strategically important to develop and support the principles and contributions of the humanities in this area.
Aims	Within this topic, the aim is to develop several directions of research that will emphasise the need for digital transformation of education, the establishment of theoretical and methodological frameworks for the development of modern humanities, as well as the research of broader cultural, social, legal, linguistic, historical, but also bioethical issues arising from the increasingly present synergy of man and machine. The aims for the next five years are: - To achieve a direct connection with the strategic research programme in the social field of science (Course: *Science and Transformations: The importance of information and communication sciences for science, media, culture and society in a time of paradigm change*, Topic: *Communication in science*) - To determine the status of the humanities in the world of modern scientific and technological developments - Involvement of colleagues from foreign universities - To establish cooperation with the real sector.
Activities	- Establishing a theoretical and methodological framework that will enable the connection of traditional humanities with digital technology and artificial intelligence - Developing software for the purpose of media text research (in the broadest sense of this term)

	- Investigate and determine the extent to which and how the application of ICT in the field of humanities can contribute to the development of education, but also certain economic branches (culture, tourism, etc.) - Gather a team of experts and scientists from different fields who will use a collaborative approach to contribute to the realisation of the basic goals and achieve a direct connection with the strategic research programme in social sciences (Course: *Science and Transformations: The importance of information and communication sciences for science, media, culture and society in a time of paradigm change*, Topic: *Communication in science*) - Develop a model study programme in the field of application of digital tools and artificial intelligence in the field of humanities and contribute to the improvement of study programmes of University North, especially those in the social field of science focused on media studies, communication and journalism.
Indicators	- Analysis of papers relevant to the topic of research; proposal of models and approaches in the study of the aforementioned issues, and established cooperation with professors and scientists in other fields of science and arts - Analysis of the involvement of digital skills and competences in existing study programmes (at the general and individual level), and cooperation with professors and scientists in other fields of science and arts - Established status of digital humanities in the framework of the national system of classification of sciences - Established cooperation with international partners and achieved international mobility - Developed model of the study programme in the field of application of digital tools and artificial intelligence in the field of humanities and the organisation of workshops to increase the level of digital teaching and research competences (at least once a year) for teachers of the University, but also for other interested public, and once a year for doctoral students of the study Media and Communication, all organised by the Centre for the Development of Digital Competences and E-Learning Technologies of University North - Presentation of research results at an international scientific conference and/or relevant international scientific journal; activities (workshops and discussion groups) at the Science Festival; organisation of public forums and defended doctoral dissertations.
Number of teachers and associates involved in the work	15
Collaboration	Departments of University North in the social and technical field of science and in arts Faculty of Humanities and Social Sciences - University of Zagreb Faculty of Humanities and Social Sciences - University of Rijeka Ruđer Bošković Institute University Computer Centre of the University of Zagreb

	Faculty of Organisation and Informatics – University of Zagreb Geneva University of Art and Design (HEAD – Genève) (Institut de recherche en art et design (Irad) University of Alicante (Department of Language and Information Systems) Technical University of Cluj-Napoca (Design Engineering and Robotics)

Topic 2	**HUMANISTIC ASPECTS OF MEDIA QUESTIONING**
Summary	Humanistic aspects of media questioning is the second key direction of research in the field of humanities at University North, which will be implemented through several topics. Certain aspects of the previously stated direction of research can directly fall into this area, as is possible and vice versa. Part of the research continues on the projects from the previous five-year period that are underway, *Croatian North – Language, Culture, Media and Border – History, Poetics and Cultural Heritage*. Research within the scope of the offered topics shows a focus on recent interdisciplinary scientific interests in order to raise awareness and/or define the role of certain humanistic disciplines (philology, philosophy, history, art history) in the context of media studies, communication and journalism. This highly interdisciplinary approach that considers media, communication and journalism from the perspective of the humanities is unique in our region and points to theoretical and methodological peculiarities, but also opportunities for the development of the humanities in a different perspective.
Aims	As part of this research direction, the aim is to explore several key sub-topics in the next five years (e.g., Interculturalism and Intermediacy of Croatian North; Gender Strategies in the Media; History of Journalism; History and Collective Memory, and Presentation of Heritage) aimed primarily at illuminating the problems of media studies, communication and journalism from a cultural and humanistic point of view in general. The aims for the next five years are: - To critically consider theoretical and methodological approaches to the study of media, communication and journalism from the perspective of the humanities (gender studies, history, linguistics, philosophy, art history) - To establish a dialogue with other fields of science and arts and support a strategic programme of scientific research in the field of social sciences (Course: *Science and Transformations: The importance of information and communication sciences for science, media, culture and society in a time of paradigm change*, Topic: *Information technologies and new media*) - To establish cooperation with the real sector - To examine the status of culture and art which, under the influence of new technologies (artificial intelligence, augmented reality, etc.), are approaching the "status of the media" and determine the role and importance of man in shaping and reflecting on this "new reality" - To present new theoretical concepts in the reflection of media, communication and journalism, as well as new methodological procedures in their research.
Activities	- Exploring the changes that the media is experiencing under the influence of technology

	- Establishment of cooperation with the real sector - Involvement of colleagues from foreign universities - Determining the status and potential importance of the humanities in the context of media, communication and journalism research - Establishing a theoretical and methodological framework for media, communication and journalism research from the perspective of the humanities - Research of models for improving study programmes in the field of media, communication and journalism.
Indicators	- Analysis of papers relevant to the topic of research and cooperation with professors and scientists in other fields of science, and in the artistic field - Established cooperation with international partners and achieved mobility - International symposium, workshops and focus groups held, a theoretical and methodological framework for media, communication and journalism research from the perspective of the humanities established - A model for improving study programmes in the field of media, communication and journalism developed - Presentation of research results at an international scientific conference and/or relevant international scientific journal; activities (workshops and discussion groups) at the Science Festival; organisation of public forums, defended final and graduate theses, and defended doctoral dissertations.
Number of teachers and associates involved in the work	15
Collaboration	Centre for Women's Studies, Zagreb Department of Comparative Literature, Faculty of Humanities and Social Sciences, University of Zagreb Agency for Electronic Media Ombudsman for Gender Equality Centre for Historical and Cultural Research of Socialism, University of Pula University of Rijeka, Department of Cultural Studies City Institute for the Protection of Monuments of Culture and Nature, Zagreb Institute of Art History Conservation Department in Zagreb Croatian Conservation Institute Academy of Fine Arts in Sarajevo, Bosnia and Herzegovina Federal Institute for Protection of Cultural and Historical Heritage of Bosnia and Herzegovina Sarajevo, Bosnia and Herzegovina Commission for the Preservation of National Monuments, Sarajevo, Bosnia and Herzegovina Centre for Balkan Research, Academy of Sciences and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina The National Museum in Sarajevo, Bosnia and Herzegovina Faculty of Arts, University of Ljubljana. Faculty of Philosophy, University of Belgrade

	Geneva University of Art and Design (HEAD – Genève) (Institut de recherche en art et design (Irad)

6.2.5 STRATEGIC RESEARCH PROGRAMME IN ARTS

Artistic research of teachers and students at University North can be presented using the following keywords and expressions:

- creative art process, illustration, promotional design, information design, UX design, user interface design, original graphics, scenography, 3D animation, multimedia and intermediate, graphic tools, art history, visual culture, digital image, sound design, typography, text and letter, animated graphics, web design, web production, media system design, digital space communication, creative industries, post-digital publishing, hybrid media practices, interdisciplinary art practices, graphic design, art book, conceptual art, conceptual photography, hybrid art forms, internet-art, sound art, experimental music, electroacoustic composition, sound objects, sonification and amplification, spatial adaptation sound, independent music publishing, digital and analogue media, electronic and computer music, multimedia image perception, multimedia performance, consecrated works, memorisation processes, phenomenological scientific and artistic research, extended film, space dramaturgy, staged photography, performance video, sound design, subjective and objective in sound, sound archives, sound and tactile sensations, musicology, virgins-art, conceptual art, sound installations, multimedia installations, generative art, programming in art, inclusive and participatory practices, innovative practices, sustainable design, environmental design, design and renewable energy sources, design and social responsibility, artistic heritage, photographic contests, cultural activities, photographic image perception, photographic documentation, media literacy, photographic image, e-learning in the artistic field, design of contactless interactions in the digital environment, artificial intelligence in the artistic field, virtual and augmented reality in the artistic field, presentation of artworks in the digital environment, artistically shaped models.

The strategic aims of artistic research from 2021 to 2027 at University North are:

1 To collect and analyse the material created on the topic of innovative, inclusive and participatory practices in design, and on the topic of sustainable and ecological design
2 To increase the quality of artistic activity through experience in exhibiting and developing interdisciplinary art projects
3 To research and critically reflect in the sphere of media and mass media communication, primarily through the concepts of media and visual literacy
4 To improve the quality and visibility of artistic practices in the media
5 To raise awareness of the importance and representation of cultural content in public space
6 To increase the visibility of artistic activities in the field of sound art and experimental music
7 To increase the visibility of artistic activities at University North through gallery exhibitions and promotion of publications
8 To explore and improve all types of e-learning in the art field
9 To increase the quality of University North's artistic activity through cooperation with various associations, and the creation of a series of authored art publications

10 To increase the quality of research and teaching at University North through the improvement of artistic knowledge and skills in the field of graphic editing and production
11 To increase the use of artificial intelligence, virtual and augmented reality in the art field
12 To improve the presentation of all types of artworks in the digital environment
13 To explore and find the key to returning individual artists to focus by discovering survival mechanisms, methods of emancipation and continuation of existence
14 To single out sound as a means of expression and a medium that opens inexhaustible possibilities of artistic research, expression and action through a series of experiments that intertwine with research in the humanities
15 To bring the local community closer to sound as a concept and sound as a natural phenomenon, introduce them to ideas of more than a hundred years old about connecting sound and light, as well as about the visual experience of sound sensation
16 To present, preserve and document tangible and intangible heritage
17 To explore heritage and reinterpret and revalue earlier discoveries in the field of heritage
18 To organise study, exhibition and media presentation of heritage, as well as artistic interpretation, popularisation and promotion of heritage
19 To explore the perceptions of multimedia imagery in remote areas of caves
20 To design scenographic elements and models in the permanent exhibitions of museums and in occasional exhibitions, thus pointing out the importance of such forms of content presentation.

Within the area of arts, the following artistic themes/projects will be explored:

1 Scientific and artistic research of innovative, inclusive and participatory practices in the context of reflection, education and creation of sustainable design
2 Art research project "Independent Art Publishing"
3 Art research project "Sound in Contemporary Art"
4 Artwork – site specific spatial-sound installation "Meditation Circle – OZ"
5 Artistic work – device art/site specific installation "Wind/noise/music"
6 Interdisciplinary artistic work in the field of sound design, musicology, ethnology and composition "Sound design of traditional instruments in contemporary music genres"
7 Artistic work in the field of applied arts "The use of artistically shaped models in permanent museum exhibitions and temporary exhibitions"
8 Artistic work in the field of applied arts "Elements of exhibition exhibitions in the form of artistically shaped interactive models or ideal reconstructions of buildings and landscapes on a reduced scale"
9 Art project "Culture in focus"
10 Art project "More than a Habit"
11 Multimedia art project "The Beginning"
12 Sound arts, performance and publishing
13 Artistic work and phenomenological research "Tomislav Gotovac, Life After Death"
14 Artistic research and the book "Scenography, Space of Dramaturgy"
15 Artistic work and phenomenological research – artistic group "Daklelososi"

16 Independent artistic research “This is Normal for Me” within the project “Dissimulation of Masks”
17 Art project “Design and Environment – Lake in the Yard”
18 Presentation of heritage.

Topic 1	**SCIENTIFIC AND ARTISTIC RESEARCH OF INNOVATIVE, INCLUSIVE AND PARTICIPATORY PRACTICES IN THE CONTEXT OF REFLECTION, EDUCATION AND CREATION OF SUSTAINABLE DESIGN**
Summary	Research of the topic through the work and activities of the late Prof. Tomislav Lerotić — full professor at the Department of Visual Communications Design at the Academy of Arts in Split, and winner of the 2012 Croatian Designers' Association Award for Lifetime Achievement. The interest in his work stems from his professional work, approach and thinking that design is a highly socially visible and responsible activity, and it is interesting that he approached it from an artistic and scientific position. When it comes to the topic of sustainable design in Croatia, the work of Tomislav Lerotić is indispensable. In addition to his oeuvre, he also explores other "good practices" of organisations such as "Radiona.org", the work of Deborah Hustić and Damir Prizmić, educational programmes such as "Interakcije.net" by Professor Ivica Mitrović, and similar projects. "Lerotić often implemented self-initiated projects that connected design, art, social topics, environmental protection and the use of renewable energy sources in different ways. An important part of his activities was cooperation with NGOs dealing with social and environmental issues – among others, he was the co-founder of the Citizens' Initiative for Energy Efficiency and Systematic Use of Renewable Sources, a member of the Association for Environmental Protection SUN, Split, Association for Democratic Society, and associate of Green Action Zagreb, etc. As a long-time activist, he was also a member of the Council for Ecology of the City of Split and the editorial course of the Solar Technology journal, for the Croatian Solar Energy Association. In addition to his pedagogical and design work and activist engagement, he has published a large number of professional papers in the field of ecology and sustainable development. The role of design is not only to meet the material, cognitive or practical needs of individuals, but also broader social, emotional and cultural needs that then enable a better and more satisfying life of the individual and the community. It is precisely this better, healthier and more satisfied life that has always been the primary goal of his activities. Since 1997, when he came to the newly established department of the Academy of Arts in Split, where he also served as the head of the department for many years, he has promoted such an understanding of the social role and responsibility of design among colleagues and students. He encourages them to think about all kinds of social problems and personal engagement in which they will use their expertise in the broadly understood field of design (from visual communication through new media to interaction design) in spotting, analysing and initiating problem solving or at least raising awareness among the general public about the existence of problems and the possibilities of solutions. In teaching, as in his works, he asked the question to what extent designers are responsible for overflowing landfills, discarded secondary raw materials, etc., or how their engagement can contribute to solving these problems, including by encouraging the client to take responsibility for their product after the end of its life. In this way, he also continuously advocated for the appropriate labelling of newspapers and other printed materials and packaging, in order to facilitate separate collection of waste by citizens and thus encourage its recycling" - *source: Croatian Designs Society, Profile: Tomislav Lerotić*

Aims	- The material would be used for educational purposes of getting to know a wider audience, from students to citizens, about the topics of sustainable and environmentally conscious design, and will be manifested through exhibitions, workshops and conference platform.
Activities	- Collect and analyse the material created through the work and actions of Prof. Tomislav Lerotić - Collect and analyse the material created on the topic of innovative, inclusive and participatory design practices from the archives of educational institutions, associations and civil society organisations in the Republic of Croatia - Conduct research into design education programmes on EU territory whose programmes are concerned with sustainable design, environmental protection, ecology and rely on innovative, inclusive and participatory practices - Compare the educational programme of Art Studies at University North with the programmes on the territory of the EU in the context of innovative practices, participatory practices, sustainable design, new technologies and environmental protection - Include students, professors and design practitioners in the working group on designing a conference platform on innovative design practices, participatory design practices, sustainable design, new technologies and environmental protection - Creation of programmes, organisation and realisation of the conference at University North on the topic of reflection, education and creation of better practice in design, with a focus on innovative practices, sustainable design, environmental protection, ecology, etc. - Implementation of workshops on sustainable and environmentally conscious design - Implementation of exhibitions on sustainable and environmentally conscious design
Indicators	- Increasing the number of final and graduate theses on sustainable and environmentally conscious design at University North - Recognizing inclusive and participatory research practices when it comes to student work at University North - Increasing the number of guest lectures, workshops and exhibitions on sustainable and environmentally conscious design at University North - Interest of students and the audience in conference content on the topic of thinking, educating and creating better practice in design, with a focus on innovative practices, sustainable design, environmental protection, ecology, etc.
Number of associates	The number will be specified when preparing the projects.
Associates	Deborah Hustić, Damir Prizmić, Ivica Mitrović, Marko Golub, Andrea Stanić and Dora Bilandžić

Topic 2	ART RESEARCH PROJECT "INDEPENDENT ART PUBLISHING"
Summary	The research project "Independent Art Publishing" studies hybrid media practices, the coexistence of old and new technologies, the role of graphic design for different models of information distribution and contemporary publishing practices in the context of independent individuals and art associations. This category is a specific combination of editorial, design and graphic-technology work; often all these processes are contained within a single subject. The aim is, in cooperation with different entities, to investigate: different types of production and printing processes; synergy of editing, graphic design and content; non-standard distribution method, etc. The results of the research will be visible as a practical material segment of the project, in the form of an autonomously produced series of smaller independently published publications in the field of contemporary art and contemporary art theory.
Aims	- To create innovative and authentic artworks in the field of hybrid media publishing practices - To contribute to the improvement of the quality of the University's artistic activity through cooperation with various associations and the creation of a series of authored art publications - To contribute to the improvement of the quality of teaching at University through the improvement of knowledge and skills in the field of graphic editing and production - To contribute to the visibility of the University's artistic activities through gallery exhibitions.
Activities	- Collect and analyse the material created on the topic of publishing in hybrid media practices (different types of production and printing processes; synergy of editing, graphic design and content; non-standard distribution method, etc.) - Conceptualisation and realisation of individual works of art - Presentation of works in national and foreign institutions - As part of the "Post-digital Publishing" course, encourage students of University North to autonomous theoretical and practical work - Mentoring student papers on the topic - Dissemination of student papers at exhibitions.
Indicators	- Number of realised works of art - Number of public appearances organised in cooperation with professional associations - Number of final and graduate works on graphic design in the context of hybrid art publishing - Increasing the number of guest lectures, workshops and exhibitions on hybrid art publishing at University North - Number of student works on graphic design exhibitions.
Number of teachers and associates	3

involved in the work	
Collaboration	AŽ Atelieri Žitnjak Gallery, Zagreb, Croatia Publication Studio Rotterdam, The Netherlands

Topic 3	**ART RESEARCH PROJECT "SOUND IN CONTEMPORARY ART"**
Summary	The broader art project "Sound in Contemporary Art" studies various aspects of dealing with sound in the context of contemporary art with a powerful conceptual component, through the use of modern digital technologies and media. Since 2020, several separate works of art have been developed under the aforementioned umbrella theme: "on Water Smoke the", a generative web sound composition lasting 130 years (www.onwatersmokethe.com) and a sound installation that was presented in 2020 at the Institute of Contemporary Art in Zagreb and Salon Galić, and this year it will be presented at the art biennale in Dresden, Germany. The sound performance "Need Your Love So Bad" was performed in 2021 at the Flora Gallery in Dubrovnik. The plans for 2022 include cooperation with the Museum of Contemporary Art on an interdisciplinary artwork that puts the artefacts from the archaeological collection in the context of a sound installation that combines modernist *cut-up* poetry with digital modulation of sound voice recordings. In the coming years, it is planned to continue working in this area in a similar way, by designing and realising individual artworks and presenting the results to the interested public and students.
Aims	- To create innovative and authentic artworks in the field of sound and contemporary art - To explore artistic methodologies through the use of digital media (internet) and digital software - To explore hybrid forms of sound practice in the context of contemporary conceptual art - To contribute to the improvement of the quality of the University's artistic activity through cooperation with various institutions - Contribution to improving the quality of teaching at the University by gaining experience in presenting and developing interdisciplinary art projects - To contribute to the visibility of the University's artistic activities through gallery exhibitions.
Activities	- Collect and analyse the material created on the topic of sound art, contemporary fine arts and digital technologies - Conceptualisation and realisation of individual works of art - Realisation of national and foreign exhibitions on the topic of dealing with sound in the context of contemporary art with a conceptual component - Increasing the interest of students at University North to engage in interdisciplinary artistic work through the use of modern technologies and media.

Indicators	- Number of public appearances and accomplished cooperations with professional associations and institutions - Number of realised works of art - Increase in the number of final and graduate theses at University North on the topic of sound in contemporary visual and conceptual art through the use of modern technologies and media.
Number of teachers and associates involved in the work	6
Collaboration	Institute of Contemporary Art, Zagreb Salon Galić, Croatian Association of Fine Artists, Split Flora Gallery, Croatian Association of Fine Artists, Dubrovnik Ostrale Biennale, Dresden, Germany Museum of Contemporary Art, Zagreb

Topic 4	**ARTWORK – SITE SPECIFIC SPATIAL-SOUND INSTALLATION "MEDITATION CIRCLE – OZ"**
Summary	For the duration of the project (a period of one year), VR sound materials (Drava, Mura, Koprivnica, Jegeniš, Šoderica, Gabajeva Greda, Čingi-Lingi) are recorded in the wider vicinity of Koprivnica on flowing and stagnant waters. Answers from the past ten years are excluded from the archives of written exams of the Sound Design course (UMAS, VERN, University North). Featured anonymous responses are interpreted by members of the Croatian National Theatre in Varaždin and radio broadcasters of Croatian Radio. Within the project, a prefabricated facility is raised, acoustic and visually neutral – a polyhedron (adapted form of icosahedron), which is located on a platform located on the Campus in Koprivnica, and its purpose is to serve as a "concert" space. Upon completion of field recordings, sound material is formed from the total sound material (field recordings and text interpretations) in post-production, which is reproduced within the polyhedron using a multi-channel surrounding technique.
Aims	The aim of the project is to bring the teaching activities that take place within the Sound Design course closer to the local community and students of the University. Through the project, students of Art Studies will be introduced to those methods of sound manipulation and multi-channel surrounding reproduction that, due to the limited hourly rate of limited technical resources of the study programme, are not processed within the course of classes, and will be used here. Ultimately, as a result of the project, during a certain period, there will be space available at the Campus, which will be able to be used for other performative activities in addition to the needs of sound installation. Target groups of consumers of the installation are the local population, students of the University and travellers.
Activities	- Planning the schedule for field surveys by locations and seasons (summer 2021) - Autumn recording times (autumn 2021)

	- Design of the performance/meditation dome (autumn 2021) - Text material selection (autumn 2021) - Casting and arrangement with actors (autumn 2021) - Winter recording times (winter 2021/2022) - Actors shooting (winter 2021/2022) - Sound material design – actors (winter 2021/2022) - Mixing by recording autumn locations (winter 2022) - Mixing by recording winter locations (winter 2022) - Spring recording times (spring 2022) - Mixing by recording spring locations (spring 2022) - Summer recording times (summer 2022) - Mixing by recording summer locations (summer 2022) - Sonication of the creative process (spring + summer 2022) - Construction of the performance/meditation dome (summer 2022) - Opening of the exhibition and commissioning of the performance/meditation dome (autumn equinox 2022) - Placement of audio materials on the web (autumn 2022) - Entry to the jury exhibition of Drava Art Biennale (spring 2023) - Possible presentation in autumn 2023 in Koprivnica, and in spring 2024 in Osijek - Publishing of records from the visitor's book to the web (continuous) - During the entire recording process, the results of using the Ambisonic – FUMA recording method and the XY ORTF method are compared, and the more interesting recordings are selected for final production (information on this will be available on the web).
Indicators	- Created site specific art installation "Meditation Circle - OZ" and installed in a public space (University courtyard) - Auditory, textual and graphic content related to the installation on the web - Planned participation at the Drava Art Biennale in 2023 (exhibition in Koprivnica in 2023, and Osijek in 2024).
Number of teachers and associates involved in the work	4
Collaboration	Miodrag Gladović (Audio-visual Centre) Hrvoje Pelicarić Lucija Petrović

Topic 5	**ARTWORK – DEVICE ART/SITE SPECIFIC INSTALLATION "WIND/NOISE/MUSIC"**
Summary	The organ, the queen of instruments, has always been attractive to composers. Nature is the best composer, so the Sea Organ was built in Zadar, and the wind organ is being built near Metković. In 1910, the Russian composer Alexander Skryabin wrote a symphony song for piano, orchestra, choir and light organ "Prometheus: The Poem of Fire". Dubravko Kuhta produced the video "Garden

	Entertainment" shown at the Festival of New Film and Video in Split in 1998, which referred to Skryabin's symphony song. These two works are the starting point of the project – an artwork that would set a series of 12 groups of instruments tuned to the six tones of the "Prometheus chord" along the access road to the University in the backyard of the Campus. With its current, the wind would excite the instruments and, at the same time, drive the wind generators in each instrument that would then emit light according to the pitch of the instrument and the intensity of the wind. Generated sounds as an audio stream would be continuously available on the internet.
Aims	The aim of the project, i.e., artwork is to bring the local community, visitors and students of the University closer to SOUND as a concept, as a natural phenomenon, and introduce them to ideas of over a hundred years old on connecting sound and light, and about the visual experience of sound sensation. It will also enable the wider community – internet users – to access real-time, naturally generated music. Target groups of consumers of the installation are the local population, students of the University and travellers.
Activities	- The elaboration of project elements in cooperation with Prof. Igor Peteh (hydraulic organ researcher in Croatia), Miodrag Gladović (multimedia artist) and Bojan Gagić (light designer) (summer/autumn 2023) - Production of installation elements (autumn/winter 2023) - Installation and tuning of audio and visual segments (spring 2024) - Opening of the exhibition and commissioning of the installation (summer solstice 2024) - Broadcasting of the audio stream on the internet.
Indicators	- Created artwork – device art/site specific installation "Wind/noise/music" and installed in a public space (University courtyard) - Auditory, textual and graphic content related to the installation uploaded to the Internet. - Audio streaming on the internet.
Number of teachers and associates involved in the work	4
Collaboration	Bojan Gagić Miodrag Gladović (Audio-visual Centre) Igor Peteh (Faculty of Teacher Education, University of Zagreb)

Topic 6	**INTERDISCIPLINARY ARTISTIC WORK IN THE FIELD OF SOUND DESIGN, MUSICOLOGY, ETHNOLOGY AND COMPOSITION "SOUND DESIGN OF TRADITIONAL INSTRUMENTS IN CONTEMPORARY MUSIC GENRES"**
Summary	During the project, musical works in contemporary music genres will be composed using traditional instruments as solo instruments. The compositions also use adapted elements of the original chants of the area of Međimurje, Podravina and Hrvatsko Zagorje. When designing an audio track, special attention is paid to the sound of traditional instruments in order to preserve the authenticity of sound in a foreign music genre for this type of instrument.
Aims	The aim of the project is to document and preserve the sounds of indigenous traditional instruments, as well as the songs from the area of Međimurje, Podravina and Croatian Zagorje, and to incorporate them into contemporary musical genres (techno, house...). The main reason is that foreign "folk" music of questionable musical value is increasingly penetrating our territory and suppressing our traditional music. Ultimately, an audio CD that would be one of the products of the project would contribute to the development of awareness of our rich musical heritage, and the importance of preserving tangible and intangible heritage. This way, children and young people would develop an interest in our rich musical heritage.
Activities	- Agreement with tourist boards of cities and counties for the purpose of possible cooperation - Scheduling - Selection of instruments and chants - Probing the terrain for the purpose of finding ensembles and musicians - Agreement with cultural artistic societies for the purpose of possible cooperation - Appointing a composer - Adapting compositions for orchestral performances - Recording in the studio - Post-production - Mastering - Distribution of recorded materials on sound carriers and on other music distribution platforms.
Indicators	- Release of the album in the form of an audio CD - Placing links to compositions on University pages - Distribution of compositions on music distribution platforms - Distribution of compositions and broadcasting on local and national radio stations - Concerts at county, national and international level.
Number of teachers and associates	6

involved in the work	
Collaboration	Miodrag Gladović (Audio-visual Centre) Nikša Gligo Lucija Petrović Davor Rocco Tomislav Uhlik (University of Zagreb Academy of Music)

Topic 7	**ARTWORK IN THE FIELD OF APPLIED ARTS "THE USE OF ARTISTICALLY SHAPED MODELS IN PERMANENT MUSEUM EXHIBITIONS AND TEMPORARY EXHIBITIONS"**
Summary	Before the advent of multimedia, most of the presentation of content in museums, as well as at temporary exhibitions, was through graphic materials (texts, photographs, sketches...) and models. With the advent of multimedia, a large part of the material is presented by various multimedia methods, especially digital VR methods. The problem arises for the proportion of visitors who do not find virtual presentation as an acceptable way of presentation (children and the elderly), who can even suffer adverse health consequences due to VR. Therefore, it is interesting that even distinguished museum institutions (national and foreign) largely use artificially shaped models enriched with certain elements of multimedia for the presentation of content.
Aims	The aim of the project is to show the trends in the presentation of contents in permanent museum exhibitions and temporary exhibitions, as well as to explain to younger curators and museum pedagogues the purposefulness of the presentation with artistically shaped models. By interviewing visitors, the experience of visitors would be explored during the presentation of the contents of the exhibition exclusively by digital and VR methods, according to the contents presented by artificially shaped models. The assumption is that, according to the previous informal research (Museums of Croatian Zagorje – Museum of Peasant Rebellions and the DB Museum Frankfurt), in order to prove the attractiveness and importance of such a form of presentation of content according to content presented exclusively by digital and VR methods, the publication of the results at the annual AKM congress would show the leaders of similar institutions the importance of investing in such forms of presentation of content, which would indirectly lead to greater engagement of artists who have completed education in the field of fine arts studies.
Activities	- Choosing an institution (museum or similar) and an exhibition for the implementation of the project - In cooperation with the staff of the institution, planning the schedule - Arrangement with the exhibition content author and curators on the parts of the exhibition that will be presented by VR methods, and on the parts of the exhibition that will be presented by an artistically shaped model - Research of archival material for the creation of the model - Design of the model

	- Multimedia/VR design - Design of the exhibition's overall fine art exhibition - Surveying visitors during the exhibition - Survey processing and analysis - Publication of the research results on the pages of MDC, the selected institution in which the project took place and the University website.
Indicators	- Art exhibition in the selected institution at the selected exhibition - Exhibition of the model carried out within the project in the selected institution at the selected exhibition - Publication of research results on the University's website - Publication of research results on the website of the selected institution - Publication of research results on the MDC website - Participation in the ACM annual conference.
Number of teachers and associates involved in the work	6
Collaboration	Markita Franulić (TMNZ) Nadica Jagarčec (MHZ) Ivan Marušić Klif Tamara Štefanac (NSK)

Topic 8	**ARTISTIC WORK IN THE FIELD OF APPLIED ARTS "ELEMENTS OF EXHIBITIONS IN THE FORM OF ARTISTICALLY SHAPED INTERACTIVE MODELS OR IDEAL RECONSTRUCTIONS OF BUILDINGS AND LANDSCAPES ON A REDUCED SCALE"**
Summary	It is a common occurrence that some contents of the museum want to be presented in the form of a model in order to conjure up the contents more plastically. Often these models are in the form of architectural and urban models. The problem with architectural and urban models is that they are in an exact scale, without much detail and, as a rule, not in multiple colours. If it is a landscape and the vertical dimension is in exact scale, everything seems flat and does not look convincing. Artistic representation allows deviations in scale, the use of colours and allows the design of active and interactive models, which is not appropriate for an architectural or urban model. The artist breathes life into artistically shaped interactive models so that they communicate better with visitors and provide far more information than classic static models, or architectural and urban models.
Aims	The aim of the project is to compare the reactions of visitors to the contents of the exhibition presented by an interactive artistically designed model, according to models that are not interactive, architectural, nor urban. By interviewing visitors, the attractiveness and importance of such a form of content presentation would be proven, and the publication of the results of the research of the perception of such a form of content presentation would indicate to the leaders of similar institutions the importance of investing in such forms of content presentation, which would indirectly lead to greater engagement of artists who have completed education in the field of art studies.
Activities	- Choosing an institution (museum or similar) and an exhibition for the implementation of the project - In cooperation with the staff of the institution, planning the schedule - Arrangement with the exhibition content author and curators on the part of the exhibition that will be presented with a classical architectural or urbanistic model, and the part of the exhibition that will be presented with an artistically shaped interactive model - Research of archival material for the creation of the artistically interactive model - Arrangement with the curators on the manner and content of the interaction of the model - Planning of interactive elements (Device Art) - Design of the artistic interactive model - Design and implementation of interactive content - Research of archival material for the creation of the zoning model - Design of the zoning model - Placing the artistic interactive model in space - Placing the zoning model in space - Surveying visitors during the exhibition - Survey processing and analysis

	- Publication of the results on the pages of MDC, the selected institution, and the University website.
Indicators	- Exhibition of models carried out within the project in the selected institution at the selected exhibition - Publication of research results on the University's website - Publication of research results on the website of the selected institution - Publication of research results on the MDC website - Participation in the ACM annual conference.
Number of teachers and associates involved in the work	6
Collaboration	Vlatka Filipčić Maligec (MHZ) Markita Franulić (TMNZ) Lucija Petrović Borislav Rajčević (GDi) Ivana Škiljan (MHZ)

Topic 9	**ART PROJECT "CULTURE IN FOCUS"**
Summary	The project is based on the research of the perception of cultural practices through the medium of photographic imagery, i.e., the research of the medium of photography, which explores the possibility of communicating cultural content and the possibility of documenting, archiving and promoting cultural activities and artistic practices. The photography competition selects works in six categories: covering immovable cultural heritage/monuments and architecture; musical arts and concerts; theatre and film arts, gallery exhibitions and artistic concepts. The papers are scientifically and professionally processed and presented to students at University North and the wider community through exhibitions or scientific-professional papers...
Aims	- To raise awareness on the importance and representation of cultural content in public areas To raise visual and media literacy as essential factors for contemporary man in a new convergent multimedia practice - Creation of active and topical resources for scientific and professional elaborations - To improve the quality and visibility of artistic practices in the media, presentation and preservation of cultural tangible and intangible heritage, as well as creation of documentation - Exhibitions and art presentations.

Activities	- Analysis of past achievements - Analysis of market competitiveness and related projects - Opening of photo competitions - Collection of documentation with artistic value for scientific and artistic research - Realisation of exhibitions in cultural institutions - International cooperation - Scientific expertise.
Indicators	- Number of entries to competitions - Number of exhibitions held - Number of published catalogues, abstracts and publications - Number of photo workshops, lectures, etc. held on the topic - Number of final and scientific papers on a given topic.
Collaboration and institutions	Koprivnica City Museum Croatian Journalists' Association Theatres music scene Croatian Association of Fine Artists Croatian Association of Artists of the Applied Arts

Topic 10	**ART PROJECT "MORE THAN A HABIT"**
Summary	The #višeodnavike (more than a habit) is an artistic-scientific initiative aimed at achieving critical-analytical thinking on the daily routines and practices of the individual and the social community, in all spheres of human activity, in order to increase the overall quality of life. The authors explore different life situations, document them or co-create them with staged photography or video, questioning their authenticity, established perception and paradigms through which we observe the world. In addition to artists, the intention is to engage students of University North, who will use photography or video to detect situations that go beyond the routines, paradigms and prejudices we are surrounded by on a daily basis.
Aims	- To achieve critical thinking in the sphere of media and mass media communication - Presentation and popularisation of the concept of media literacy and visual literacy for the purpose of education - Original artworks, exhibitions and practices.
Activities	- Connecting with similar platforms in the sphere of scientific, professional and artistic activity

	- Cooperation with cultural, anthropological, ethnographic, psycho-social offices and other institutions that study human activities within the given topic - Implementation of photography competitions and similar projects - Holding workshops and lectures - Art exhibitions - Holding exhibitions - Publishing: catalogues, proceedings, periodicals.
Number of teachers and associates involved in the work	This will be specified when preparing projects depending on the requirements of the competitions and the type of project.
Indicators	- Number of workshops, gatherings, symposia held - Number of exhibitions held - Number of contests held - Number of publications - Number of participants in competitions - Qualitative improvements in image perception and interpretation of contemporary art movements.
Collaboration	Scientific institutions Museums School institutions Institutes of history, art, psychology, sociology, ethnology

Topic 11	**MULTIMEDIA ART PROJECT "THE BEGINNING"**
Summary	"The Beginning" project starts from the achieved, technologically sophisticated, symbolically emphasised and artistically dominant photography that Mario Periša took in Livno Field by shooting the famous "wild horses" — animals that live freely in an environment similar to that in prehistoric times, and act as if civilisation has never tamed them. Such aesthetised, highly cultivated, but also veristic scenes that emphasise beauty, strength, naturalness and elementality, and which belong to the top of the mimetic-representational image of the world, are deconstructed in two directions: according to the image that is released into the internet and circuits as an information in the unlimited spaces, but also as a substitution, and according to the image that Robert Geček uses as a complex procedure of computer manipulation from an image to a vector record and reduces, thickens and simplifies it. This second procedure produces a sfumato photograph, almost a silhouette of the motif of the horse, an unusually twisted shadow with a position, attitude and simplicity similar to the cave drawings of horses. Since there is a possibility that the process of "transferring" the scenes with horses to the cave walls (this assumption is supported by – just as if it were an *obscura camera* – reverse projection of animals), the author's decision to bring the

	transformed photos of horses into the cave is not a hasty, bizarre act, but a somewhat ingenious, and meaningful procedure. Here, another of the logical, transformative processes occurs: such as a photo, already transformed, devoid of its mimetic properties and printed on an adequate substrate is used as a "template" for graphics, as a motif that, decomposed by chemical procedures, is covered with a dense, tar mass and printed on paper by primary manual pressure. The result is a rough, uneven, elementary, almost "archaeological" print, a relief surface that, although in principle serial, has the character of uniqueness, and not only multi-originality. Finally, "The Beginning" project is a dialogue between two concepts, in the extremely simplified sense reduced to the polarity of the original – reproduction, photography – graphics, analogue – digital, homogeneous – dispersed, intensive – extensive... Or, even simpler, to the relationship between photography as a unique result of photographing a real scene and its deconstruction, decomposition, migration, rearrangement and multifunctionalisation. One could even say that it is questioning the status and possibilities of photographic imagery in the digital era, were it not for the fact that this project raises a number of other, significant, but also incidental, issues from the artistic and media field and beyond. Conceptual flair and spectacular form are thus reconciled in a project that has the features of an exhibition, an artistic action, an experimental game and of an ambience.
Aims	- To connect people with forgotten sites, evoking the awareness of the individual - To make students reflect on art projects.
Activities	- Maintaining multimedia performance in all available caves in Croatia and abroad, for which there is a letter of support from the Ministry of Culture, and after two very successful multimedia performances held in the Vindija Cave and the Vela Cave on Korčula. - After all the available caves have been exhausted, two final performances are planned in the Vindija Cave where it all began, and they will be called "THE BEGINNING OF THE END" and "THE END OF THE BEGINNING". - Collaboration on each performance with at least one guest artist - Involvement of Multimedia and Media Design students in the whole project.
Indicators	- Increasing the attractiveness of cave tourist sites throughout Croatia - New student projects, inspired reflecting on this project.
Number of associates	1, with the possibility of additional collaboration with different types of artists
Associates	

Topic 12	SOUND ARTS, PERFORMANCE AND PUBLISHING
Summary	Sound art is an art discipline in which sound is the primary medium of expression and can be considered historically related to experimental music. Artist and composer John Cage himself redefined music as an "organisation of sound" rather than a composition of melody and harmony. His assertion implies the inclusion of a whole spectrum of sound phenomena in the field of music, by integrating noise (and silence) into the compositional framework. All types of recorded, generated or manipulated sounds are used in sound art: field recording, recording of electrical and acoustic instruments, generated synthesised sound, manipulation of prepared soundtracks, sonication and amplification of various acoustic sound sources. The research strategy is based on the relationship between personal and public space, the way it is shaped and determined by sound, and the specifics of sound phenomena and relationships with experimental music as a tool for exploring the perception of time and memory. During the production and realisation of the work, the research will deal with hybrid forms of publishing in analogue and digital media, various techniques of design and printing, and sound performance as a synergistic ambient situation. The research process is focused interdisciplinary, in cooperation with scientists in the field of acoustics, electrical engineering, musicology and artists in the field of performing arts, multimedia and new media art, music and design.
Aims	- To contribute to increasing the visibility of artistic activity in the field of sound art and experimental music at University North - Contribution to independent publishing of produced works of art in the field of sound art on analogue and digital media: electroacoustic compositions, field recordings, sound objects, electronic and computer-generated experimental music - To contribute to the quality of teaching and course content of University North through the improvement of knowledge and skills in expanding the field of interest from design practice to new media and sound art.

Activities	- Sound performance, performances of a composite work from the field of sound art live in front of the audience - Concept and realisation of an independent work of art in the field of sound art - Research of hybrid forms of music publishing on analogue and digital media for reproduction - Presentation of projects and works in national and foreign institutions - Mentoring student papers on the topic - Initiating interdisciplinary art projects with collaborators in the fields of performing arts, multimedia and new media art, music and design - Initiating interdisciplinary research projects in the field of sound art, electroacoustic composition, new media art and design.
Indicators	- Increasing the number of produced and published works of art in the field of sound art - Increasing the number of collaborative interdisciplinary projects - Increasing the number of public appearances in cooperation with professional associations - Increasing the number of guest lectures and workshops in the field of sound and new media contemporary art at the University - Increasing the number of student papers on the topic.
Number of teachers and associates involved in the work	8
Collaboration	Davorka Begović, Miodrag Gladović, Tin Dožić, Sonja Pregrad, Branimir Norac, Lana Hosni, Hrvoje Spudić and Sven Sorić

Topic 13	**ARTISTIC WORK AND PHENOMENOLOGICAL RESEARCH "TOMISLAV GOTOVAC, LIFE AFTER DEATH"**
Summary	The multidisciplinary project explores the phenomenon of the "life of an artist" and his artwork after physical death. It explores what processes are necessary for the work and its artist to retain vitality even after the death of the artist, what conditions and preconditions are necessary, and what is the decisive factor so that one's work and the "person" continue to be present in the culture of one society by continuing and renewing one's strength and influence.
Aims	By discovering the mechanism of survival, the method of emancipation and continuation of existence, the goal is to find the key by which individual artists

	would return to the field of interest and thus continue their deserved life on our stage. There are numerous examples of artists who were forgotten and discovered after their death, and this research offers many research areas, challenges and opportunities.
Activities	- Design a research project and apply for a public presentation at scientific conferences on the topic of artistic phenomena of the nature of interest for dedicated work - Submit an interdisciplinary project to tenders for exhibitions in the Republic of Croatia and abroad - Familiarise the curators with the research - Promote the topic of research through public media - Explore the theoretical framework within which artistic research in contemporary scientific developments can be placed.
Indicators	- Number of appearances at public conferences and scientific conferences where the research is presented - Number of public appearances through which the topic of research is promoted - Establishment of cooperation with partners at home and abroad - Established a satisfactory level of utilisation of digital technologies in artistic research work, procedures and process.
Number of teachers and associates involved in the work	4 teachers 4 associates
Collaboration	

Topic 14	**ARTISTIC RESEARCH AND THE BOOK "SCENOGRAPHY, SPACE OF DRAMATURGY"**
Summary	Scenography in the dramaturgical space has always captured the interest of theorists and stage design artists. The space of dedication in the context of the new fictional imaginary world has its mystical, but also concrete level.
Aims	Through the case study of theatrical, film, exhibition and virtual scenography, multiple levels of author's creation in the construction of new imaginary worlds will be discovered, which affect the formation of subconscious levels in the viewers of the entire dramaturgical structure of an individual built visual scenographic complex.

Activities	- Design a research project and apply for a public presentation at scientific conferences with the topic of versatility of practical and theoretical dramaturgy. - Submit an interdisciplinary project of an art-scientific book essay to tenders for encouraging publication in the Republic of Croatia. - Familiarise theatrologists with the research. - Promoting the topic of research through public media, professional journals and cultural magazines. - Explore the theoretical framework within which artistic research in contemporary scientific theatre research can be placed. - Search for a publisher in the field of theatre theory and criticism.
Indicators	- Number of appearances at public conferences and scientific conferences where the research is presented. - Number of public appearances through which the topic of research is promoted. - Establishment of cooperation with partners at home and abroad. - Established a satisfactory level of utilisation of digital technologies in artistic research work, procedures and process.
Number of teachers and associates involved in the work	7 teachers 7 associates

Topic 15	**ARTISTIC WORK AND PHENOMENOLOGICAL RESEARCH – ARTISTIC GROUP "DAKLELOSOSI"**
Summary	The multidisciplinary project explores the phenomenon of group work of artists within the art collective "Daklelososi" in the context of society and art circles in the mid-1990s.
Aims	To discover the mechanisms of interest and motivation that drive the work of the group in the context of goals for self-realisation, recognition and emancipation through group work on the art scene. The research will be published in the journals "Kazalište" and "Kulturpunkt," and at scientific conferences; and an exhibition is planned that is dedicated to the group and its activities in the mid-1990s.

Activities	- Design a research project and apply for a public presentation at scientific conferences on the topic of artistic phenomena of student performative groups. - Submit an interdisciplinary project to tenders for exhibitions in the Republic of Croatia and abroad. - Familiarise the curators with the research on the topic of the 1990s. - Promote the topic of research through public media. - Explore the theoretical framework within which artistic research in contemporary scientific developments can be placed. - Gather the members of the group and the entire team to work on the project.
Indicators	- Number of performances at exhibitions in Croatia and abroad. - Number of appearances at public conferences and scientific conferences where the research is presented. - Number of public appearances through which the topic of the exhibition and of the research is promoted - Established a satisfactory level of utilisation of digital technologies in artistic research work, procedures and process. - Presentation of materials through performances at universities in front of students. - Establishment of cooperation with partners at home and abroad.
Number of teachers and associates involved in the work	5 teachers 5 associates
Collaboration	

Topic 16	**INDEPENDENT ARTISTIC RESEARCH "THIS IS NORMAL FOR ME" WITHIN THE PROJECT "DISSIMULATION OF MASKS"**
Summary	Within the project "Dissimulation of Masks", a microtheme by the author named "Lupus" is developed. The primary impetus is the recognition of the theme of the mask through the personal theme of the disease and the interpretation of the "mask" through the theme of the disease and its inversion. The mask of the normal hides the disease. Independent artistic research has the title "This is normal for me" and deals with the analysis of the relationship of society to a sick person, stigmatisation and destigmatisation of diseases and mimicry in order to survive.
Aims	To develop a series of works of different approaches: animated film, sound, painting, sculpture created by 3D technologies, art book, series of photographs,

	performative photographs... The aim of the exhibition is to present the segments of the cycle "This is normal for me".
Activities	- Design a research project and apply for public presentation at exhibitions and scientific conferences. - Submit an interdisciplinary project to tenders for exhibitions in the Republic of Croatia and abroad. - Familiarise the curators with the research. - Promote the topic of research through public media. - Explore the theoretical framework within which artistic research in contemporary scientific developments can be placed. - Performance in front of students with the aim of presenting the performative and social aspects of the mask.
Indicators	- Number of appearances at public conferences and scientific conferences where the research is presented. - Number of public appearances through which the topic of research is promoted. - Establishment of cooperation with partners at home and abroad. - Established a satisfactory level of utilisation of digital technologies in artistic research work, procedures and process. - Number of presentations through exhibitions held - Number of articles and the citation of the topic in the scientific-artistic community.
Number of teachers and associates involved in the work	15
Collaboration	The project cooperates with institutions such as exhibition spaces: AK Gallery, VN Library, Virovitica City Museum, Croatian Association of Fine Artists Zagreb and others. In addition, there is collaboration with theorists and curators such as Suzana Marjanić, Darko Šimičić, Ljubica Anđelković and actors in staged performances and memorial reconstructions.

Topic 17	**ART AND EDUCATION PROJECT "DESIGN AND ENVIRONMENT – LAKE IN THE YARD"**
Summary	The project is based on the previous experiences of the authors in the research of the discipline of permaculture, which designs and develops systems and the application of ethical guidelines and principles for the planning, design and maintenance of sustainable living spaces of people in harmony with nature. In this sense, the study of Media Design, as well as other study programmes, opens the

	possibility of interactive maintenance of the environment and teaching processes that promote ecologically sustainable design. The main activity on the project is the construction and horticultural profile: excavation of the lake about 50 metres long, and arrangement of the hiking trail and other paths along the orchard. The space allows different art colonies, as well as lectures in nature and different forms of practical and theoretical teaching.
Aims	The intention is to provide students and professors at the University with the conditions of field teaching with practical activities that take place through various courses at the University. Target groups of consumers of the installation are the local population, students at the University and travellers. Transformation of the orchard area in the immediate environment of the existing buildings of the University into a stimulating environment, with the purpose of inclusion in the university everyday life of this now unused large resource at the disposal of University North. Establishment of new and sustainable artistic, cultural, scientific and professional content on the Campus, which would be an additional space for synergy between the University and the city of Koprivnica, and the naturally gravitating environment.
Activities	- Designing and shaping the project and articulating and elaborating the execution from both spatial and temporal aspects. Articulation activities continue in a sustainable rhythm and measure during all phases of the project *in situ*, in which the specificity of the project in terms of its vitalisation/sustainability is in accordance with the social/environmental starting point. - The activity already carried out in the last three years is the one in the field of researching — the need and the reason for the implementation of such a project — students, teachers, staff, neighbouring institutions on the Campus and citizens' associations are involved in supporting such a project, which is important in assessing the relevance of the project in the current time and in the given environment. - Construction projects in the orchard area make up the vast majority of activities on the project in the initial phase: excavation of approximately 300 cubic metres of soil at a certain position in the orchard where there are no fruit trees nor their roots. - Construction of a wooden bridge, gazebos and pavilions made of wood, wicker and reed. Then the arrangement of footpaths and pathways that would connect the entrance to the Campus with the university buildings: gravel-covered brick paths, depending on the part and function. - Installation, planting of benches and canopies made of live willows and wood. - Horticultural rounding of the entire area, with an emphasis on self-sustainability: the elimination of mowing, pruning, digging, weeding and other maintenance – the entire area should also serve as an educational training ground on self-sustainability.
Indicators	- Growing student motivation to study and reside on the Campus.

	- Number of teaching, cultural, educational, social contents encouraged by the project and the establishment of facilitating circumstances on the Campus. - Number of student and teaching activities initiated or promoted by the project, e.g., number and quality of educational content, papers and programmes: exhibitions, concerts, teaching workshops, final papers, seminars and graduate theses, doctoral dissertations. - Indicators of a non-teaching nature, especially those relevant for synergy with the city and the environment are: guest appearances, lectures, meetings of an educational and workshop nature, screenings, book presentations, public readings, etc. - Indicators of the success and efficiency of activities on the project are relevant in logically different time cycles and their duration: vegetation year/solar year, academic year, duration of studies, etc.
Number of teachers and associates involved in the work	Variable, due to the specific flexibility and inclusiveness of the project.
Collaboration	Dr. Rudolf Steiner Centre City of Koprivnica students and volunteers

Topic 18	**PRESENTATION OF HERITAGE**
Summary	The topic, "Presentation of Heritage," encompasses scientific heritage research and its media presentation, as a unifying strategy of scientific and artistic research at the Department of Art Studies of University North. The topic covers a wide range of artistic periods, from prehistoric to contemporary art, and relies on earlier research and projects by teachers and associates involved in the research, as already formed starting points and a solid base that enables reliable quality of further research and projects, while at the same time allowing teachers to develop and improve their interests; from the art project "The Beginning" by Antun Franović, Mario Periša and Robert Geček in the Vindija Cave, through the research of medieval wall painting by Rosana Ratkovčić, the annual photographic exhibition "Culture in Focus" with the category of immovable art heritage organised by Mario Periša, to the interpretation of the modernist and contemporary monumental heritage of Antonija Grgić. Artistic heritage is the fundamental starting point of every culture, and heritage research is a long and continuous process that brings to light unknown and forgotten monuments as shown by Rosana Ratkovčić's research on medieval wall painting in continental Croatia. New discoveries show a constant need to supplement earlier research, as is the case with the fragment of a fresco which was recently found in the church of St. Mihovil in Gornji Vugrovec. The research of medieval wall painting in continental Croatia will be expanded by the research of

	related wall painting material in Catholic churches in Bosnia and Herzegovina, a little known and almost unexplored material that requires new interpretation and valorisation. The presentation of heritage shows multiple requirements, documentation of the current situation due to the preservation of permanent information about decaying monuments, credibility, popularisation, and tourist and promotional role. It also includes studio and artistic interpretations, such as the exhibition "The Master of Zadobarje", in which Rosana Ratkovčić collaborated, which was organised by the Karlovac City Museum and presented in several exhibition spaces in Croatia (Dubovac, Zagreb, Dragući), or the exhibition interpretation of the prehistoric art of Anton Franović and Marija Periša presented in the Vindija cave. The strategy includes cooperation with a number of relevant domestic and foreign institutions with which successful cooperation has already been initiated or established.
Aims	- Research of new heritage discoveries, and reinterpretation and revaluation of earlier discoveries - Photographic documentation of the research - Study, exhibition and media presentation of heritage - Artistic interpretation of heritage - Popularisation and promotion of heritage.
Activities	- Work on the book "Medieval Wall Painting in Bosnia and Herzegovina" on an insufficiently researched topic which is very important for knowledge of Medieval art in Croatia. The book was conceived as a series of texts that would have been previously presented at scientific conferences and/or published in scientific journals. - Field research, documentation and photographing of monuments as a basis for scientific research - Study of books, journals and archival material for the purpose of scientific research - Exploration of fine artworks in museums and galleries - Study of public spaces, architecture and urbanism - Selection, editing and final correction of texts for the Proceedings - Writing abstracts and applications to scientific conferences - Preparation of presentations for scientific conferences and creation of PowerPoint presentations - Historical and artistic research of wall paintings in the chapel of St. Martin in Dubrava near Vrbovac, and participation in the preparation of restoration works - Preliminary research of newly discovered wall paintings in the chapel of St. Juliana in Trema near Križevci, documenting and photographing - Linking scientific interests for heritage research, especially medieval wall painting, but also contemporary heritage and culture, movable and immovable, tangible and intangible, with the interests and special knowledge of colleagues in artistic professions, photography, media presentation and artistic interpretation

	- Participation in scientific and exhibition projects involving various aspects of the above research interests - Mentoring graduate and final theses - Cooperation with associations and civic initiatives dealing with contemplation of contemporary urban problems such as the Grad na drugi pogled, 1postozagrad, Mapiranje Trešnjevke, Trešnjevka Cultural Centre and involving students in these projects.
Indicators	- Participation is planned in the following scientific conferences: ISFNR conference, Zagreb, *online* and Ljubo Karaman – fifty years later, Split, 23 and 24 September - Publication of scientific papers - Publication of scientific books and journals - The cultural-animalistic journal is being prepared: Suzana Marjanić, Rosana Ratkovčić (ed.), *Mačkozbornik, Od Basted do Catwoman,* publisher Jesenski i Turk, - promotion of the Journal and expected media attention and interest - restoration, conservation and presentation of wall paintings in the chapel of St. Martin in Dubrava near Vrbovec as a contribution to the knowledge and recognisability of the medieval artistic heritage of Podravina - The realisation of exhibition projects; and the "Forrest of Horror" project is being prepared for the Dotrščina Virtual Museum.
Number of teachers and associates involved in the work	4
Collaboration	City Institute for the Protection of Monuments of Culture and Nature, Zagreb Institute of Art History Conservation Department in Zagreb Croatian Conservation Institute Academy of Fine Arts in Sarajevo, Bosnia and Herzegovina Federal Institute for Protection of Cultural and Historical Heritage of Bosnia and Herzegovina Sarajevo, Bosnia and Herzegovina Commission for the Preservation of National Monuments, Sarajevo, Bosnia and Herzegovina Centre for Balkan Research, Academy of Sciences and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina The National Museum in Sarajevo, Bosnia and Herzegovina

"The most beautiful thing that we can experience is the mysterious. It is the source of all true art and all science.

Look deep into nature, and then you will understand everything better.

Strive not to be a success, but rather to be of value."

Albert Einstein