ISSN 2637-3298

XV INTERNATIONAL CONFERENCE ON SOCIAL AND TECHNOLOGICAL DEVELOPMENT – STED 2026

THE BOOK OF ABSTRACTS

XV MEĐUNARODNA KONFERENCIJA O DRUŠTVENOM I TEHNOLOŠKOM RAZVOJU–STED 2026

ZBORNIK IZVODA RADOVA

Trebinje, June, 04-07, 2026.
Trebinje, 04-07. juni 2026. godine

Co-organizers:

UNIVERSITY of DEBRECEN

UNIVERSITY OF ECONOMICS AND HUMAN SCIENCES IN WARSAW

TECHNICAL UNIVERSITY OF KOŠICE
Faculty of Manufacturing Technologies

ФАКУЛТЕТ ТЕХНИЧКИХ НАУКА
1975
ЧАЧАК

ÓBUDAI EGYETEM
OBUDA UNIVERSITY

АКАДЕМИЈА СТРУКОВНИХ СТУДИЈА ШАБАЦ

AUE
American University of Europe - FON
FON

УДРУЖЕЊЕ ИНЖЕЊЕРА ТЕХНОЛОГИЈЕ
УИТРС
РЕПУБЛИКЕ СРПСКЕ

НАЦИОНАЛЬНА АКАДЕМИЯ СТАТИСТИКИ, ОБЛІКУ ТА АУДИТУ

VUB
VISOKA ŠKOLA ZA USLUŽNI BIZNIS

EUMMAS

XV INTERNATIONAL CONFERENCE ON SOCIAL AND TECHNOLOGICAL DEVELOPMENT

BOOK OF ABSTRACTS

Publisher:
University PIM, Banja Luka, Republic of Srpska, B&H

For publisher
Dejan Kojić, PhD, General Manager

Editors:
Dejan Kojić, PhD
Darjana Sredić, PhD

Design and Computer processing:
Ljubica Janjetović, PhD

Print:
„Vilux“ Banja Luka

Circulation:
120 copies

WITH THE SUPPORT OF THE MINISTRY OF ECONOMY AND ENTREPRENEURSHIP OF THE REPUBLIC OF SRPSKA
UZ PODRŠKU MINISTARSTVA PRIVREDE I PREDUZETNIŠTVA REPUBLIKE SRPSKE

Trebinje, June, 04-07, 2026, Republic of Srpska, B&H

Organizing and Program Committee:
Dr Dejan Kojić, president, Dr Mladen Ivić, Dr Simonida Vilić, Dr Danijela Jokanović, Dr Darjana Sredić, Dr Jelena Jovović, MSc Nada Dursun, Ba Bojan Milićević,
Students: *Sofija Pačariz, Slaviša Marković, Ilhana Nesimović, Sergej Jokanović, Nataša Ćurko*

Scientific and Program Committee:
Dr. Mladen Ivić, president, University PIM, Banja Luka, B&H;
Dr. Milena Marinović-Cincović, University of Belgrade, Vinča Institute of nuclear Sciences, Belgrade, Serbia;
Dr. Darina Dupláková, Technical University of Kosice, Faculty of Manufacturing Technologies with a seat in Prešov, Institute of Advanced Technologies, Prešov, Slovakia;
Dr. Maja Fošner, Faculty of Logistics, University of Maribor, Celje, Slovenija;
Dr. Jelena Pavličević, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Ayse Aroguz, Istanbul University-Cerrahpasa, Engineering Faculty, Istanbul, Turkey;
Dr. Vladimir Mladenović, University of Kragujevac, Faculty of Techincal Sciences, Čačak, Serbia;
Dr. Savo Ashtalkoski, American University of Europe, Skopje, North Macedonia;
Dr. Irena Petrušić, Faculty of Management, Herceg Novi, Montenegro;
Dr. Svetlana Karić, Academy of vocational studies in Šabac, Serbia;
Dr. Tigran Petrosyan, Yerevan Haybusak University, Yerevan, Armenia;
Dr. Tibor Gonda, Faculty of Business and Economics of the University of Pécs, Hungary;
Dr. Zoltán Raffay, Faculty of Business and Economics of the University of Pécs, Hungary;
Dr. Dragan Brenjo, Food safety agency of Bosnia and Herzegovina, B&H;
Dr. Boris Dorbić, scientific- expert association "FUTURA", Šibenik, Croatia;
Dr. Zoltán Nyikes, Department of Informatics, Milton Friedman University, Budapest, Hungary;
Dr. Tünde Anna Kovács, Bánki Donát Faculty of Mechanical and Safety Engineering, Obuda University, Budapest, Hungary;
Dr. Ilija Džombić, University PIM, Faculty of Economics, Banja Luka, B&H;
Dr. Mile Vasić, European Marketing and Management Association, B&H;
Dr. Ognjen Bakmaz, The College of Service Business, Sokolac, B&H;
Dr. Osman Khan, Institute of Customer Management, United Kingdom;
Dr. Perica Bošković, University of Split, Faculty of Science, Split, Croatia;
Dr. Yajnya Dutta Nayak, P.G. Dept. of Commerce, Khallikote Auto. College, Berhampur, Odisha, India;
Dr. Martin G. Abrahamyan, Yerevan Haybusak University, Yerevan, Armenia;
Dr. Svetlana Radchenko, Technical University of Kosice, Faculty of Manufacturing Technologies with a seat in Prešov, Institute of Advanced Technologies, Prešov, Slovakia;
Dr. Lucia Knapčíková, Technical University of Kosice, Faculty of Manufacturing Technologies with a seat in Prešov, Institute of Advanced Technologies, Prešov, Slovakia;
Dr. Bojan Rosi, Faculty of Logistics, University of Maribor, Celje, Slovenija;
Dr. Isaac Lera, University of the Balearic Islands, Dept. of Mathematics and Computer Science, Balearic Islands, Spain;
Dr. Benea Marius Calin, Politehnica University Timisoara, Faculty of Engineering Hunedoara, Romania;
Dr. Milena Špírková, Institute of Macromolecular Chemistry, Prague, Czech Republic;
Dr. Yaroslav Kusyi, National University "Lviv Polytechnic", Lviv, Ukraine;
Dr. Irena Ashtalkoska, American University of Europe, Skopje, North Macedonia;

Dr. Bojana Ikonić, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Mirjana Jovičić, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Nikša Grgurević, Faculty of Management, Herceg Novi, Montenegro;
Dr. Oskar Bera, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Nataša Lukić, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Vesna Teofilović, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Azemina Mašović, American University of Europe, North Macedonia;
Dr. Hafiz Imtiaz Ahmad, Faculty of Business, Higher Colleges of Technology, Ali Alin, Abu Dhabi, UAE;
Dr. Nada Damljanović, University of Kragujevac, Faculty of Techincal Sciences, Čačak, Serbia;
Dr. Marija Blagojević, University of Kragujevac, Faculty of Techincal Sciences, Čačak, Serbia;
Dr. Milenko Košutić, Institute of Food Technology, Novi Sad, Serbia;
Dr. Jovana Kojić, Institute BioSense, Novi Sad, Serbia;
Dr. Jelena Miljanić, Institute of food Technology in Novi Sad, Serbia;
Dr. Nevena Vukić, University of Kragujevac, Faculty of Techincal Sciences, Čačak, Serbia;
Dr. Tamara Erceg, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Predrag Kojić, University of Novi Sad, Faculty of Technology, Novi Sad, Serbia;
Dr. Snežana Papović, University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia;
Dr. Jovana Selak, University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia;
Dr. Milan Vesković, University of Kragujevac, Faculty of Techincal Sciences, Čačak, Serbia;
Dr. Enes Sukić, Faculty of Information technology and engineering, Belgrade, Serbia;
Dr. Ljiljana Tanasić, Academy of vocational studies in Šabac, Serbia;
Dr. Bojan Damnjanović, Academy of vocational studies in Šabac, Serbia;
Dr. Božana Odžaković, University of Banja Luka, Faculty of technology, Banja Luka, B&H;
Dr. Željko Grublješić, University PIM, Banja Luka, B&H;
Dr. Saša Salapura, University PIM, Banja Luka, B&H;
Dr. Marijana Žiravac-Mladenović, University PIM, Banja Luka, B&H;
Dr. Emir Sinan, University PIM, Banja Luka, B&H;
Dr. Predrag Raosavljević, University PIM, Banja Luka, B&H;
Dr. Snežana Samardžić, University PIM, Banja Luka, B&H;
Dr. Velimir Dedić, University PIM, Banja Luka, B&H;
Dr. Svetlana Anđelić, University PIM, Banja Luka, B&H;
Dr. Ljubica Janjetović, University PIM, Banja Luka, B&H;
Dr. Danijela Jokanović, University PIM, Banja Luka, B&H;
Dr. Darjana Sredić, University PIM, Banja Luka, B&H;
Dr. Dejan Kojić, University PIM, Banja Luka, B&H.

NOTE:
The authors have full responsibility for the originality and content of their own papers.

CONTENT
SADRŽAJ

PLENARY LECTURERS 17
PLENARNA PREDAVANJA

BRIDGING EDUCATIONAL RESEARCH AND PUBLIC POLICY: ANTI-RACIST TRANSFORMATIONS AND COMMUNITY EMPOWERMENT IN EUROPE 2
Fernando Macias-Aranda

ENVIRONMENTAL CRIME AS A BARRIER TO SUSTAINABILITY TRANSITIONS 3
Jelena Dimovski, Darko Dimovski

INVITED LECTURE 4
POZIVNO PREDAVANJE

SUSTAINABLE MOBILITY: THE CASE OF COPENHAGEN 5
Aleksandar Šobot

ECOLOGY, ENERGY EFFICIENCY 6
EKOLOGIJA, ENERGETSKA EFIKASNOST

VERMICOMPOSTING OF RABBIT MANURE FOR SUSTAINABLE ORGANIC WASTE MANAGEMENT AND ENVIRONMENTAL QUALITY IMPROVEMENT 7
Milena Milojević, Suzana Knežević, Maja Došenović Marinković, Aleksandra Milošević

ECOCIDE AS A NEW CHALLENGE TO INTERNATIONAL CRIMINAL LAW IN RELATION TO DIRECTIVE (EU) 2024/1203 8
Aleksandra Milošević, Milena Milojević, Suzana Knežević, Maja Došenović Marinković

CIRCULAR ECONOMY IN BOSNIA AND HERZEGOVINA: FIRST STEPS IN DEVELOPING WASTE-TO-RESOURCE VALUE CHAINS 9
Draženko Bjelić, Scott E. Crosset

TYRES WEAR, HARMFUL EFFECT ON HUMAN AND MEASUREMENTS FOR IT REDUCTION: A REVIEW 10
Nadica Stojanović, Ivan Grujić, Milan Ivković, Danijela Miloradović, Suzana Petrović Savić

BEES AS BIOINDICATORS OF THE ENVIRONMENTAL QUALITY: ASSESSMENT OF POLLUTION AND ECOLOGICAL RISK 11
Maja Došenović Marinković, Suzana Knežević, Milena Milojević, Aleksandra Milošević

BIOCHAR APPLICATION IN MANURE MANAGEMENT: ENVIRONMENTAL IMPACTS, GAS EMISSIONS, AND NUTRIENT RETENTION 12
Suzana Knežević, Milena Milojević, Maja Došenović Marinković, Aleksandra Milošević

SAFETY ASPECTS OF OPERATING MARINE SCRUBBER SYSTEMS ON PASSENGER SHIPS 13
Miroslav Vukičević, Marija Čukić

ECONOMY AND MANAGEMENT 14
EKONOMIJA I MENADŽMENT

DEVELOPMENT OF INCLUSIVE INSTITUTIONS: A COMPARATIVE ANALYSIS OF THE WESTERN BALKAN COUNTRIES AND THE EU-27 15
Danijela Despotović, Miroljub Nikolić, Andrea Andrejević Panić, Slobodan Cvetanović

INVESTMENT IN HUMAN CAPITAL AND ECONOMIC GROWTH: A COMPARATIVE ANALYSIS OF WESTERN BALKAN COUNTRIES AND NEIGHBORING EU MEMBER STATES 16
Miroljub Nikolić, Andrea Andrejević Panić, Danijela Despotović, Slobodan Cvetanović

THE CONCEPT OF CLINICAL MARKETING: BACKROUND AND THEORY 17
Iuliia Zuenkova

IMPACT OF DIGITAL TRANSFORMATION ON MARKETING COMMUNICATION IN THE BANKING SECTOR 18
Jelena Vukićević, Ljiljana Jović

APPLICATION OF DIGITAL TECHNOLOGIES IN INTERNAL CONTROLS IN THE PUBLIC SECTOR OF REPUBLIKA SRPSKA 19
Ljiljana Jović, Jelena Vukićević

INTEGRATION OF DIGITAL MANAGERIAL ACCOUNTING IN OPTIMIZING BUSINESS PERFORMANCE OF SMALL AND MEDIUM-SIZED TOURISM ENTERPRISES IN THE POST-PANDEMIC ERA 20
Denis Stojkanović, Zdravka Petković, Aleksandar Lukić, Aleksandar Mrđen

LEADERSHIP AND COMMUNICATION AS DRIVERS OF ORGANIZATIONAL RESILIENCE IN TOURISM CRISIS MANAGEMENT 21
Zdravka Petković, Denis Stojkanović, Aleksandar Mrđen, Aleksandar Lukić

SUBSIDIES AND STRUCTURAL TRANSFORMATION IN SERBIA: IS A PARADIGM SHIFT IN INDUSTRIAL POLICY WARRANTED? 22
Marija Marčetić, Bojan Kocić, Jovana Andjelković

LEGAL ASPECTS OF THE CUSTOM SYSTEM 23
Jovana Anđelković, Marija Marčetić, Bojan Kocić

INFLUENCE OF LOYALTY CARDS ON CONSUMER BEHAVIOR 24
Mladen Milić, Marko Milić

CLIMATE SHOCKS AND REAL ESTATE INVESTMENT RISK IN DEVELOPING COUNTRIES: CASE STUDY OF NIGERIA 25
Muhammad Umar Faruk

DIGITAL FASHION COMMUNICATION: CONSUMER PERCEPTIONS OF ONLINE CAMPAIGNS AND INFLUENCER IMPACT 26
Neda Srnić, Milica Slijepčević, Jelena Krstić

EDUCATION FOR SUSTAINABLE DEVELOPMENT IN CENTRAL & EASTERN EUROPE: CHALLENGES AND BEST PRACTICES 27
Sirine Haj Taieb

CHALLENGES & BEST PERSPECTIVES ON SUSTAINABILITY OPERATIONS IN CENTRAL & EASTERN EUROPEAN UNIVERSITIES: BARRIERS AND ENABLERS 28
Sirine Haj Taieb

FOOD WASTE IN THE HOSPITALITY SECTOR OF MONTENEGRO: CONTEMPORARY CHALLENGES AND LIMITATIONS 29
Vesna Vujačić, Kristina Davidović, Marko Kukanja

EXAMINATION OF THE STRATEGY OF HUNGARIAN YOUTH FOOTBALL ORGANISATIONS 30
Zoltán Szalánczi, Éva Judit Bartha

ECONOMIC BENEFITS AND ECOLOGICAL CHALLENGES OF SUSTAINABLE REAL ESTATE DEVELOPMENT 31
Dragan Dukić, Nataša Papić Blagojević, Dragan Đuranović, Milica Ničić, Milica Obadović

THE IMPACT OF INDUSTRIAL ROBOTICS ON PRODUCTIVITY AND THE LABOR MARKET 32
Biljana Bjelica, Stefan Tomanić, Bahta Halilović

CRISIS MANAGEMENT AND BUSINESS CONTINUITY IN CONDITIONS OF GLOBAL INSTABILITY 33
Ognjen Bakmaz, Predrag Obrenović

CIRCULAR ECONOMY IN MARITIME INDUSTRY: LITERATURE INSIGHTS AND EMERGING PRACTICES 34
Senka Šekularac-Ivošević, Špiro Ivošević, Selma Medunjanin, Dragana Milošević

ANALYSIS OF THE APPLICATION OF SUSTAINABLE AND CIRCULAR PRACTICES IN THE MARITIME SECTOR OF MONTENEGRO 35
Ivana Bacović, Dragana Milošević

DIGITAL PLATFORMS AS ENABLERS OF CIRCULAR ECONOMY TRANSITION: A FRAMEWORK FOR ORGANIZATIONAL RESILIENCE 36
Andrea Ivanišević, Marijana Dukić Mijatović, Otilija Sedlak, Aleksandra Marcikić Horvat, Biljana Pajin

THE PRODUCTIVITY-ENERGY NEXUS IN NIGERIA: ASYMMETRIC IMPACTS OF EFFICIENCY AND FACTOR SUBSTITUTION 37
Fatai Asimi, Atoyebi Kehinde

ENERGY TRANSITION, ENVIRONMENTAL QUALITY, AND FINANCIAL DEVELOPMENT IN NIGERIA: AN EMPIRICAL ANALYSIS 38
Olatokunbo D. Salami, Olajide S. Gbemisola, Hassan T. Bello, Arogundade S. Lawal

DETERMINING THE IMPORTANCE OF PERFORMANCE INDICATORS FOR THE ANALYSIS OF PRODUCTION SECTOR EFFICIENCY USING DATA ENVELOPMENT ANALYSIS (DEA): A CASE STUDY OF THE COMPANY VENDOM 39
Sandra Đukanović

ARTIFICIAL INTELLIGENCE IN THE FUNCTION OF OPTIMIZING INTERNATIONAL BUSINESS PROCESSES 40
Nikša Grgurević

STRATEGIC MANAGEMENT FOR THE LONG-TERM SUSTAINABILITY OF SMALL AND MEDIUM-SIZED ENTERPRISES - CHALLENGES AND OPPORTUNITIES 41
Filip Markovć, Goran Babić

LAW AND SECURITY SECTION 42
PRAVO I BEZBJEDNOST

ENVIRONMENTAL CRIME 43
Darko Dimovski, Jelena Dimovski

WOMEN'S RIGHTS AS HUMAN RIGHTS: ANALYSIS OF THE IMPLEMENTATION OF WOMEN'S RIGHTS IN DEVELOPING COUNTRIES 44
Merjema Pašović, Predrag Raosavljević

THE IMPACT OF DIGITAL TRANSFORMATION ON LEGAL PRACTICE IN BOSNIA AND HERZEGOVINA-CHALLENGES, ADVANTAGES AND DIRECTIONS FOR DEVELOPMENT. 45
Snježana Radošević

GESTALT PSYCHOLOGY AND THE VISUALIZATION OF LAW IN THE ERA OF ARTIFICIAL INTELLIGENCE 46
Živorad Rašević, Darjana Sredić, Mladen Nikolić

CRIMINAL LAW ASPECTS OF THE JUSTICE AGAINST SPONSORS OF TERRORISM ACT (JASTA) IN U.S. LEGISLATION 47
Boriša Lečić, Nikola Trajković

CHRONOLOGY OF TRIAD HISTORY: SECURITY AND POLITICAL ASPECTS OF THE EXISTENCE OF CHINESE SECRET SOCIETIES 48
Boriša Lečić, Nikola Tadić

TECHNOLOGICAL EXCLUSION AND THE REALIZATION OF HUMAN RIGHTS IN DIGITALIZED SOCIAL PROTECTION 49
Draško Gajić

INFORMATION TECHNOLOGY 50
INFORMACIONE TEHNOLOGIJE

THE ROLE OF ARTIFICIAL INTELLIGENCE IN RESTRUCTURING IT JOBS: DESKILLING AND REDUCING THE NEED FOR ROUTINE TASKS IN THE FINANCIAL SECTOR 51
Alen Kamiš, Jelena Ruzic, Stevan Stankovski, Aleksandra Markovic

PERFORMANCE OF SIMPLE NEURAL NETWORKS IN THE DETECTION OF RECTAL TUMORS 52
Edib Dobardžić, Ivana Mišković, Bećko Kasalica, Mladen Marinković, Aleksandra Bibić

PROBABILITY ASSESSMENT OF RECTAL TUMOR PRESENCE USING CLASSICAL MACHINE LEARNING ALGORITHMS 53
Aleksandra Bibić, Ivana Mišković, Mira Sarvan, Mladen Marinković, Edib Dobardžić

SYNTHETIC MEDIA AS A THREAT TO CRISIS COMMUNICATION: AI-GENERATED VIDEOS, DISINFORMATION, AND ALGORITHMIC AMPLIFICATION IN EMERGENCY SITUATIONS 54
Ljilja Šikman, Isidora Kojić, Biljana Vranješ, Đorđe Stojisavljević, Aleksandar Gaćina

RFID-BASED IOT SYSTEM FOR WIRELESS IDENTIFICATION 55
Milan Vesković, Veljko Ćorić, Srđan Nogo

REGULATORY FRAGMENTATION AND CYBER RISK MANAGEMENT IN BOSNIA AND HERZEGOVINA: BETWEEN FORMAL HARMONIZATION AND OPERATIONAL RESILIENCE 56
Muhamed Ćosić, Edin Alić

DEEP NEURAL NETWORKS FOR SCOLIOSIS DETECTION AND ANALYSIS: A LITERATURE REVIEW 57
Dijana Stojić, Vanja Luković, Dejan Vujičić

AUTOMATA AS COALGEBRAS IN CATEGORY OF MATRICES 58
Nada Damljanović, Vučelja Lekić, Katarina Pavlović, Ljubica Đurović

DESIGN METHODOLOGY FOR FUZZY LOGIC CONTROLLERS 59
Nada Damljanović, Vučelja Lekić, Katarina Pavlović, Mladen Janjić

ENGINEERING, TECHNOLOGY AND MATERIALS 60
INŽENJERSTVO, TEHNOLOGIJE I MATERIJALI

PHYSICOCHEMICAL AND SENSORY CHARACTERIZATION OF HONEY AND ITS ADULTERANTS 61
Ana Velemir, Snježana Mandić, Danica Savanović, Aleksandar Savić, Predrag Janković

POSTMORTEM PH AND TEMPERATURE DYNAMICS IN PORK HAM UNDER CONVENTIONAL CHILLING 62
Ana Velemir, Snježana Mandić, Danica Savanović, Aleksandar Savić, Sanja Resanović

EFFECT OF TURMERIC (*CURCUMA LONGA* L.) ON SENSORY PROPERTIES OF FRESH CHEESE 63
Danica Savanović, Ana Velemir, Aleksandar Savić, Jovo Savanović, Milana Kecman

INFLUENCE OF SELECTED PLANT ADDITIVES ON THE FATTY ACID PROFILE OF TRADITIONAL JANJ CHEESE 64
Danica Savanović, Ana Velemir, Aleksandar Savić, Jovo Savanović, Branislav Šojić, Vesna Muždeka

ANTIFUNGAL EFFECTS OF ROSEMARY ESSENTIAL OIL IN PHYLLO PASTRY PROTECTION 65
Dragana Plavšić, Dragan Psodorov, Ljubiša Šarić, Ana Varga, Ivana Čabarkapa, Olja Todorić, Zorica Tomičić

SOXHLET DEFATTING AND ITS EFFECT ON THE ANTIOXIDANT CAPACITY OF COLD-PRESSED OILSEED CAKES 66
Tanja Krunić

EFFECT OF FLAXSEED–BASED HYDROGEL COMPOSITION ON MECHANICAL PROPERTIES OF EXTRUDED MICROSPHERS 67
Tanja Krunić, Nataša Obradović

ULTRASOUND-ASSISTED EXTRACTION OF AMYGDALIN FROM WASTE PLUM KERNELS 68
Anita Jović, Milan Đorić, Viktorija Petković, Biljana Đorđević, Milan Kostić, Marija Miladinović, Olivera Stamenković

DEEP EUTECTIC SOLVENT-ASSISTED BIODIESEL PRODUCTION FROM PLUM KERNEL OIL: IMPACT ON REACTION RATE AND FUEL QUALITY 69
Anita Jović, Viktorija Petković, Biljana Đorđević, Milan Kostić, Marija Miladinović, Olivera Stamenković

DOES PECTIN METHYLATION MODULATE ITS ANTIMICROBIAL POTENTIAL? INSIGHTS FROM MOLECULAR DOCKING 70
Marija M. Petković Benazzouz, Jelena B. Martinov Nestorov, Goran V. Janjić, Sara V. Ristić, Katarina M. Miletić

ADVANCED IONIC-LIQUID-BASED HYDRAULIC FLUIDS: FROM MOLECULAR DESIGN TO SUSTAINABLE HIGH-PERFORMANCE SYSTEMS 71
Milan Vraneš, Andrija Vukov, Teona Teodora Borović, Jovana Selak, Snežana Papović, Sara Klimenta

EFFECT OF CATIONIZATION ON THE FUNCTIONAL PROPERTIES OF STARCH 72
Sanda Pilipović, Tatjana Botić, Borislav N. Malinović, Tijana Đuričić, Aleksandra Borković, Dajana Dragić

TREATMENT OF TEXTILE DYE WASTEWATER BY SOLAR-POWERED ELECTROOXIDATION 73
Tijana Đuričić, Borislav N. Malinović, Draženko Bjelić, Aleksandra Borković, Dajana Dragić, Sanda Pilipović, Tatjana Vulić

EVALUATION OF THE PERFORMANCE OF COMMERCIAL BAKING PAPERS ON THE BIH MARKET 74
Aleksandra Borković, Tatjana Botić, Sanja Vovčuk, Draženko Bjelić, Dijana Drljača

RESEARCH OF PROCEDURAL MODALITIES OF INVESTIGATING SAFETY INCIDENTS IN THE BUSINESS SYSTEM 75
Biljana Vranješ, Ljilja Šikman, Mile Vajkić, Đorđe Stojisavljević, Bojana Zoraja

SEISMIC EFFECTS OF BLASTING AND THEIR INFLUENCE ON THE STABILITY OF SLOPES IN SURFACE MINES 76
Radmila Karanakova Stefanovska, Zoran Panov, Risto Popovski, Blagica Doneva

UNDERGROUND COAL GASIFICATION: FROM CONCEPT TO COMMERCIAL APPLICATION 77
Radmila Karanakova Stefanovska, Zoran Panov, Risto Popovski, Blagica Doneva

A COMPUTATIONALLY EFFICIENT ALGORITHM FOR ACCURATE PHASOR ESTIMATION IN THE PRESENCE OF DECAYING DC COMPONENT IN FAULT CURRENT SIGNALS 78
Dimitrije Rozgić, Predrag Petrović

INTEGRATED THERMAL KINETICS AND MOLECULAR DOCKING ANALYSIS OF *ARBUTUS UNEDO* POLYPHENOLS FOR ANTIDIABETIC APPLICATIONS 79
Luka Golubović, Đurica Katnić, Ognjen Todorović, Marija Milenković, Aleksandra A. Rakić, Milena Marinović Cincović, Slavica Porobić Katnić

THERMAL PROPERTIES OF IRRADIATED POLYOLEFIN BLENDS FOR WASTE RECYCLING..... 80
Đurica Katnić, Ognjen Todorović, Luka Golubović, Snezana Brkovic, Slavica Porobić-Katnić, Marija Milenković[1], Milena Marinović-Cincović

INNOVATIVE APPROACH TO SAMPLING OF MICROPLASTICS IN THE MARINE ENVIRONMENT..... 81
Filip Radunović, Špiro Ivošević, Neven Cukrov

OPTIMIZATION OF INDUSTRIAL DESIGN PROCESSES AND MATERIAL COMPOSITION FOR SUSTAINABLE DESIGN 82
Nevena Vukić, Jovana Krstović, Darina Dupláková, Nemanja Dopsaj

NATURAL SCIENCES 83
PRIRODNE NAUKE

GREEN APPROACH TO VALORIZATION OF TANGERINE PEEL WASTE: NADES-ASSISTED EXTRACTION AND PROCESS INTENSIFICATION FOR RECOVERY OF BIOACTIVE COMPOUNDS..... 84
Aleksandra Cvetanović Kljakić, Biljana Lončar, Mirjana Petronijević, Jelena Arsenijević, Sanja Panić, Slavica Ražić

FROM WASTE TO BIOACTIVITY: UNLOCKING THE POTENTIAL OF SWEET CHERRY PIT EXTRACTS VIA MICROWAVE AND ULTRASOUND-ASSISTED EXTRACTION..... 85
Aleksandra Cvetanović Kljakić, Pavle Mašković, Jelena Mašković

FROM LABORATORY TO PUBLIC: HOW BIOLOGISTS TRANSLATE COMPLEX SCIENCE RESEARCH FOR PUBLIC UNDERSTANING 86
Ajla Vejzović

EFFECT OF IONIZATION ON NICOTINE'S HYDRATION BEHAVIOUR 87
Andrija Vukov, Bojan Šarac, Domen Goste, Teona Teodora Borović, Jovana Selak, Snežana Papović, Milan Vraneš

EFFECT OF SELECTED BIOLOGICALLY ACTIVE CO-SOLUTES ON THE HYDRATION BEHAVIOR OF METFORMIN 88
Jelena Macanović, Andrija Vukov, Teona Teodora Borović, Jovana Selak, Snežana Papović, Milan Vraneš

ANION-DRIVEN DESIGN OF IMIDAZOLIUM-BASED IONIC LIQUIDS: INTEGRATING PHYSICOCHEMICAL PROFILING, IONICITY ANALYSIS, DFT/ADMET MODELING AND ANTIMICROBIAL PERFORMANCE 89
Sara Klimenta, Andrija Vukov, Teona Teodora Borović, Jovana Selak, Snežana Papović, Milan Vraneš

COMPARATIVE STUDY OF NUMERICAL MODELS OF IONIZATION DYNAMICS IN LASER-INDUCED BREAKDOWN OF SOLIDS AND GASES 90
Jasna Stevanović, Violeta Petrović, Hristina Delibašić-Marković, Ivan Petrović

ENHANCEMENT OF IONIZATION RATES FORMULAS IN TUNNELING AND BARRIER-SUPPRESSION REGIMES 91
Jasna Stevanović, Violeta Petrović, Hristina Delibašić-Marković, Ivan Petrović

WHEN MACHINE LEARNING DOES NOT HELP: CLASSIFICATION OF RADIATION COUNTING DATA 92
Jelena Delibašić, Danilo Delibašić

CIRCADIAN RHYTHM DYNAMICS UNDER HEAVY METAL-INDUCED ABIOTIC STRESS IN PLANTS 93
Marija M. Petković Benazzouz, Sara V. Ristić, Mošić S. Miloš, Jelena P. Bogosavljević Lipovac, Katarina M. Miletić

A NOVEL INAR(1) MODEL WITH TWO LATENT MARKOV PROCESSES FOR REGIME AND DISTRIBUTION PARAMETER CONTROL 94
Milena S. Stojanović, Teodora D. Čamagić, Aleksandar S. Nastić

ELECTRON-IMPACT INDUCED MOLECULAR DYNAMICS WITHIN THE ATMOLCOL FRAMEWORK 95
Sanja Tošić, Vladimir A. Srećković, Veljko Vujčić

ENERGY THRESHOLDS AND DYNAMICAL REGIMES IN ELECTRON-IMPACT IONIZED MOLECULAR CATIONS 96
Sanja Tošić, Vladimir A. Srećković, Veljko Vujčić

EFFECT OF *B*-DIKETONATE ON GERMINATION AND EARLY SEEDLING GROWTH OF *TRIFOLIUM PRATENSE* L. IN INLET AND OUTLET WASTEWATER FROM THE CVETOJEVAC TREATMENT SYSTEM 97
Snežana Branković, Radmila Glišić, Rastko Ajtić, Glorija Ćirković, Nenad Joksimović, Jelena Bogosavljević Lipovac, Filip Grbović

INFLUENCE OF PB AND CD ON GERMINATION AND ROOT GROWTH OF *TRIFOLIUM PRATENSE* L. IN TREATMENTS WITH *B*-DIKETONATE 98
Filip Grbović, Radmila Glišić, Slađan Adžić, Kristina Luković, Aleksandra Rakonjac, Marija Marin[6], Snežana Branković

EJECTED ELECTRON SPECTRA FROM INHALATION ANESTHETIC MOLECULE N_2O 99
Jelena Maljković, Bratislav Marinković, Jozo Jureta

A COMPARATIVE STUDY OF DIFFERENTIAL CROSS SECTIONS FOR ELASTIC ELECTRON SCATTERING FROM INHALATION HALOGENATED ANESTHETICS AT 150 EV 100
Jelena B. Maljković, Jelena Vukalović, Francisco Blanco, Gustavo García, Bratislav P. Marinković

IT MIGHT BE A PRECURSOR TO SOME RANDOM ENVIRONMENT INAR MODELS 101
Miodrag Đorđević

PSYHOLOGY..... 102
PSIHOLOGIJA

THE INFLUENCE OF LIFE SCRIPTS ON ATTITUDE FORMATION 103
Ivana Jovčić

EMOTIONS IN WHITE COATS: A PILOT STUDY ON ATTITUDES TOWARD EMOTIONS AND EMOTIONAL LITERACY AMONG PHYSICIANS AND NURSES 104
Ivana Jovčić

INDICATORS OF AGGRESSIVENESS ON PSYCHOLOGICAL PERSONALITY INVENTORIES 105
Snežana Samardzić

ATTITUDE TOWARDS DREAMS AS AN EXPRESSION OF THE SUBJECTIVE RELATION TO THE UNCONSCIOUS 106
Branka Blagojević Janković, Darjana Sredić

PHENOMENOLOGY AND PATTERNS OF BULLYING IN SECONDARY SCHOOLS..... 107
Jelena Milić, Danijela Jokanović, Darjana Sredić

WORK MOTIVATION OF HEALTHCARE WORKERS FROM THE PERSPECTIVE OF SELF-DETERMINATION THEORY 108
Jelena Milić, Danijela Jokanović

EDUCATION..... 109
OBRAZOVANJE

PRACTICAL APPLICATION OF 3D SCANNING TECHNOLOGY IN THE VIRTUAL EDUCATION AND MAINTENANCE TRAINING OF MARINE EQUIPMENT 110
Miroslav Vukičević, Robert Janković, Darijan Hadžisalihović

PRIMARY SCHOOL STUDENTS' PERCEPTIONS OF USING CAD IN TECHNICAL DRAWING INSTRUCTION 111
Darko Suman, Stjepan Kovačević, Damir Purković

MATHEMATICS FOR ROBOTICS AND ARTIFICIAL INTELLIGENCE 112
Tatjana Stanivuk, Goran Kovačević

DIGITALIZATION OF EDUCATION: ADVANTAGES AND CHALLENGES 113
Isidora Milošević, Mirjana Bakmaz, Milica Grbić

XSTUDIO: TRANSFORMING STUDIO PEDAGOGY THROUGH POP-UP LIVE LEARNING ENVIRONMENTS..... 114
Igor Kuvač, Malina Čvoro, Zoran Uljarević

MEDICAL AND BIOMEDICAL SCIENCES 115
MEDICINSKE I BIOMEDICINSKE NAUKE

APPLYING THE BEHAVIOR CHANGE TECHNIQUES FOR MODERNIZING HEALTHCARE AT THE NATIONAL LEVEL 116
Iuliia Zuenkova

OTHER TOPICS 117
OSTALE TEME

DIGITAL TOURISM AND TOURISM 4.0 AS A CONCEPT OF THE FUTURE 118
Branka Stipanović

VIRTUAL REALITY IN TOURISM: AN INCENTIVE OR OBSTACLE TO GAINING A REAL TOURIST EXPERIENCE 119
Branka Stipanović

ARTIFICIAL INTELLIGENCE ADOPTION, WELL BEING, AND PROFESSIONAL TRANSFORMATION IN SLOVENIA (2022–2026) 120
Anton Vorina, Tina Vorina, Svit Vorina, Vid Vorina, Ivanka Oberman

THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE NEW PUBLIC MANAGEMENT: STATUS, CHALLENGES AND PERSPECTIVES IN THE REPUBLIC OF NORTH MACEDONIA 121
Jadranka Denkova, Jovan Ananiev, Strasko Stojanovski

ELECTIONS AND OPPORTUISM: EXPLORING THE DYNAMICS OF PARTY-HOPPING IN INDIA 122
Yajnya Dutta Nayak

COGNITIVE MECHANISM OF CONCEPTUAL METAPHOR IN POLITICAL COMMUNICATION DURING THE LAST PRESIDENTIAL CAMPAIGN IN THE USA 123
Mladena Krajišnik

NEW MODELS OF MAINTENANCE OF ROTATING MACHINE 123
Stevan Petrović, Živoslav Adamović, Veljko Vuković, Branislav Gavrilović, Svetozar Bugarin, Goran Topić

APPLICATION OF BENCHMARKING AS PART OF THE RE-ENGINEERING PROCESS IN A THERMAL POWER PLANT UGLJEVIK 123
Stevan Petrović, Živoslav Adamović, Veljko Vuković, Zoran Stjepanović, Goran Topić

EU MONETARY POLICY – CURRENT STATE AND PERSPECTIVES 123
Dijana Grahovac, Radmila Čičković

PLENARY LECTURERS
PLENARNA PREDAVANJA

BRIDGING EDUCATIONAL RESEARCH AND PUBLIC POLICY: ANTI-RACIST TRANSFORMATIONS AND COMMUNITY EMPOWERMENT IN EUROPE

Fernando Macias-Aranda

University of Barcelona, Faculty of Education, Passeig de la Vall d'Hebron 171,
08035 Barcelona, Spain, fernandomacias@ub.edu

ABSTRACT

Sustainable social development cannot exist without dismantling structural discrimination. This keynote bridges the gap between high-impact educational research and the implementation of anti-racist public policies, offering a transformative perspective on social inclusion. Grounded in a profound academic and institutional career—including roles at the University of Barcelona and leadership in governmental non-discrimination initiatives in Catalonia—the presentation focuses on the educational and social success of historically excluded demographics, primarily the Roma community and other racialized populations. By analyzing over a decade of international evidence-based research, the session highlights the role of transformative social interventions that reject deficit models. Attendees will explore community-driven paradigms—from raising university access for underrepresented groups to redefining community health and overcoming anti-Gypsyism. Aligning with STED's multidisciplinary mission, this speech will challenge scholars in education, law, sociology, and health sciences to collaboratively develop evidence-based tools that transform political strategies and institutional frameworks. Through the translation of scientific excellence into public action, academia can lead the global effort toward genuine equality and social justice.

Keywords: educational research, public policy, anti-racist transformations, community empowerment, social inclusion.

ENVIRONMENTAL CRIME AS A BARRIER TO SUSTAINABILITY TRANSITIONS

Jelena Dimovski[1], Darko Dimovski[2]

[1]Innovation Center, University of Niš, Univerzitetski trg 2, Niš, Serbia, jelena.dimovski@icun.ni.ac.rs
[2]Faculty of Law, University of Niš, Trg kralja Aleksandra 11, Niš, Serbia, darko@prafak.ni.ac.rs

ABSTRACT

Environmental crime represents a significant barrier to the global sustainability transition by compromising environmental integrity, economic stability, and social well-being. The study assesses the multifaceted impacts of illegal activities, including wildlife trafficking, illegal logging, pollution, and illicit waste disposal, on sustainable development pathways. Utilizing interdisciplinary perspectives from environmental economics, criminology, and sustainability science, the analysis explores how environmental crime disrupts resource efficiency, weakens institutional frameworks, and erodes public trust in governance systems. Drawing on case studies from the European Union, particular emphasis is placed on regulatory gaps, corruption, and transnational networks that enable these activities, thereby complicating enforcement and policy implementation. The study highlights the economic consequences of environmental degradation, such as biodiversity loss, reduced ecosystem services, and long-term financial burdens on governments and communities. The research findings indicate that addressing environmental crime is essential for effective and equitable sustainable development, necessitating coordinated action among policymakers, businesses, and civil society to mitigate risks and strengthen resilience. Strengthening institutional capacity, enhancing cross-border cooperation, and leveraging technological innovations such as environmental monitoring systems are essential for effective prevention and enforcement. Furthermore, integrating anti-crime measures into sustainability strategies can enhance policy coherence and reinforce economic and environmental resilience in the long term.

Keywords: Environmental crime, sustainability, transition, EU countries, prevention.

INVITED LECTURE
POZIVNO PREDAVANJE

SUSTAINABLE MOBILITY: THE CASE OF COPENHAGEN

Aleksandar Šobot

Environmental governance – Faculty of Economics and Informatics, Na Loko 2, 8000 Novo mesto, Slovenia, ecosobot@gmail.com

ABSTRACT

Climate change is a significant global challenge, and the transport sector is a major source of greenhouse gas emissions. In response, sustainable mobility has become a central strategy for mitigating environmental impacts and improving urban quality of life. This study investigates Copenhagen as a prominent example of cycling-oriented urban mobility. The research utilises the Copenhagenize Masterclass methodology, which is organised around three principal dimensions: space, culture, and ambition. Data were collected through field observations and empirical measurements during the Masterclass in Copenhagen (June 2024), including cyclist counts, behavioural patterns, and infrastructure assessments. The findings demonstrate that elevated cycling rates result from integrated, long-term planning that combines safe and efficient infrastructure, a robust cycling culture, and sustained political commitment. These factors collectively facilitate the widespread adoption of cycling in daily urban mobility. The study concludes that a holistic, data-driven approach supports an effective transition to sustainable mobility and offers a transferable model for other cities.

Keywords: climathe change, greenhouse gas emissions, sustainable mobility, Copenhagen

ECOLOGY, ENERGY EFFICIENCY
EKOLOGIJA, ENERGETSKA EFIKASNOST

VERMICOMPOSTING OF RABBIT MANURE FOR SUSTAINABLE ORGANIC WASTE MANAGEMENT AND ENVIRONMENTAL QUALITY IMPROVEMENT

Milena Milojević[1], Suzana Knežević[2*], Maja Došenović Marinković[2], Aleksandra Milošević[3]

[1]University of Belgrade, Faculty of Agriculture, Nemanjina 6, Zemun, Republic of Serbia, milenaminorka23@gmail.com
[2]Academy of Applied Studies Šabac, Unit for Agricultural and Business Studies and Tourism, Vojvode Putnika 56, Šabac, Republic of Serbia
s.knezevic@akademijasabac.edu.rs
[3]University of Belgrade, Faculty of Law, King Aleksandar Boulevard No 87, Belgrade, Republic of Serbia, alexandramilosevic77@gmail.com

ABSTRACT

This paper analyzes a model of sustainable organic waste management through the utilization of rabbit manure via vermicomposting. Rabbit manure, consisting of solid and liquid excreta combined with bedding materials (straw, sawdust), is not directly applied to agroecosystems but is biologically transformed using California red worms (*Eisenia fetida*). Given the high annual manure output (approximately 90 kg per animal), this approach represents an efficient valorization strategy. During vermicomposting, organic matter is decomposed and converted into stable humus with significantly increased macroelement content compared to conventional farmyard manure, including nitrogen, phosphorus, and potassium. The process is conducted under controlled conditions in wooden containers with continuous addition of fresh manure. The resulting vermicompost is applied in the production of fruit, vegetables, and ornamental plants without the use of synthetic fertilizers. The results indicate that this system enables nutrient cycling within the household, reduces waste generation, and improves soil fertility while simultaneously supporting the production of healthy feed for rabbits. The described approach represents a practical model of sustainable agricultural practice applicable in small-scale production systems.

Keywords: vermicomposting, *Eisenia fetida*, rabbit manure, organic waste management, soil fertility, environmental quality.

ECOCIDE AS A NEW CHALLENGE TO INTERNATIONAL CRIMINAL LAW IN RELATION TO DIRECTIVE (EU) 2024/1203

Aleksandra Milošević[1], Milena Milojević[2], Suzana Knežević[3*], Maja Došenović Marinković[3]

[1]University of Belgrade, Faculty of Law, King Aleksandar Boulevard No 87, Belgrade, Republic of Serbia, alexandramilosevic77@gmail.com
[2]University of Belgrade, Faculty of Agriculture, Nemanjina 6, Zemun, Republic of Serbia, milenaminorka23@gmail.com
[3]Academy of Applied Studies Šabac, Unit for Agricultural and Business Studies and Tourism, Vojvode Putnika 56, Šabac, Republic of Serbia, s.knezevic@akademijasabac.edu.rs

ABSTRACT

With the aim of defining the environmental crisis as a security and legal challenge, the author, in the first part of the paper, examines the genesis of the concept of ecocide, from the Vietnam War to the 2021 expert panel, presenting the evolution of ecocide from a political concept into a normative framework. The second part of the paper is dedicated to the analysis of the initiative to amend the Rome Statute with a fifth international crime through the prism of European Union legislative solutions, which have set new standards for the protection and sanctioning of various forms of environmental destruction. The final part of the paper is devoted to the analysis of key elements of the definition of ecocide and the challenges of proving the causal link in existing international judicial practice. The objective of this paper is to highlight the necessity of incorporating established standards into national legislation for a more efficient protection of the environment.

Keywords: ecocide, Rome Statute, International criminal law, Directive (EU) 2024/1203, environmental protection, International Court of Justice.

CIRCULAR ECONOMY IN BOSNIA AND HERZEGOVINA: FIRST STEPS IN DEVELOPING WASTE-TO-RESOURCE VALUE CHAINS

Draženko Bjelić[1*], Scott E. Crosset[2]

[1]University of Banja Luka, Faculty of Technology, Stepe Stepanovica 73, 78 000 Banja Luka, Bosnia and Herzegovina, drazenko.bjelic@tf.unibl.org
[2]Toggle Learning, 14 Eccles Rd, Hunters Quay, Dunoon PA23 8LB, Scotland, United Kingdom, scott@cetap.ba

ABSTRACT

This paper explores the development of the circular economy in Bosnia and Herzegovina by analysing the first concrete steps away from a linear, landfill-dependent model and towards more resource-efficient waste and material management. It builds on a comprehensive study of waste management systems, secondary raw materials and investment opportunities. Starting from low recycling rates and the predominance of landfilling, while gradual alignment with European Union policies and regulations is underway, the paper analyses the institutional, infrastructural and market preconditions for the development of circular value chains. Particular emphasis is placed on glass, plastics, waste tyres and construction and demolition waste streams, where specific investment models (e.g. facilities for glass cullet processing, tyre granulation, and mobile C&D waste crushing) and indicative ranges of required capital investments and operating costs are identified. By examining the role of extended producer responsibility schemes, local public utility companies and the private sector, the paper identifies "low-hanging fruit" of the circular economy that can be implemented relatively quickly through a combination of regulatory measures, targeted public support and private investments. Finally, the proposed approach underlines the importance of phased development, from pilot projects and modular facilities to the scaling-up of regional capacities, as a realistic pathway to reducing dependence on landfilling, increasing material circularity and retaining more added value within the domestic economy.

Keywords: Circular economy, waste management, secondary raw materials.

TYRES WEAR, HARMFUL EFFECT ON HUMAN AND MEASUREMENTS FOR IT REDUCTION: A REVIEW

Nadica Stojanović[1], Ivan Grujić[2], Milan Ivković[3], Danijela Miloradović[4], Suzana Petrović Savić[5]

[1]University of Kragujevac, Faculty of Engineering, Department for Motor Vehicles and Motors, Sestre Janjić 6, Kragujevac, Serbia, nadica.stojanovic@kg.ac.rs
[2]University of Kragujevac, Faculty of Engineering, Department for Motor Vehicles and Motors, Sestre Janjić 6, Kragujevac, Serbia, ivan.grujic@kg.ac.rs
[3]University of Kragujevac, Faculty of Engineering, Department for Production Engineering, Sestre Janjić 6, Kragujevac, Serbia, milan.ivkovic@kg.ac.rs
[4]University of Kragujevac, Faculty of Engineering, Department for Motor Vehicles and Motors, Sestre Janjić 6, Kragujevac, Serbia, neja@kg.ac.rs
[5]University of Kragujevac, Faculty of Engineering, Department for Production Engineering, Sestre Janjić 6, Kragujevac, Serbia, petrovic.savic@kg.ac.rs

ABSTRACT

The tires are the acting organs of the vehicle by which it achieves its movement. During the vehicle movement/drive it comes to the friction between the tires and road, which causes the tires wear. The particles formed due to the tires wear, are harmful for human and its environment. In the paper is conducted the review of existing literature, where firstly are presented factors which contribute to the tires wear. After, it is given the representation, how these particles enter into human organism, and how this further influence on human health. Further are presented measurements for wear reduction. On the basis of the comprehensive analysis of the observed papers from the subject field, have come to the very useful conclusions as well as propositions to what should give attention during the future researches, as well as during the development of new tires, in order to reduce their wear.

Keywords: particles, tires wear, environment, human health.

BEES AS BIOINDICATORS OF THE ENVIRONMENTAL QUALITY: ASSESSMENT OF POLLUTION AND ECOLOGICAL RISK

Maja Došenović Marinković[1], Suzana Knežević[1*], Milena Milojević[2], Aleksandra Milošević[3]

[1]Academy of Applied Studies Šabac, Unit for Agricultural and Business Studies and Tourism, Vojvode Putnika 56, 15000 Šabac, Serbia,s.knezevic@akademijasabac.edu.rs, m.d.marinkovic@akademijasabac.edu.rs
[2]University of Belgrade, Faculty of Agriculture, Nemanjina 6, Zemun, Republic of Serbia, milenaminorka23@gmail.com
[3]University of Belgrade, Faculty of Law, King Aleksandar Boulevard No 87, 11000 Belgrade, Serbia, alexandramilosevic77@gmail.com

ABSTRACT

Honey bees (*Apis mellifera*) represent reliable bioindicators of environmental quality due to their role as pollinators, wide foraging range, and continuous interaction with various ecosystem components. The aim of this paper is to examine the significance of bees as bioindicators through the analysis of pollutant accumulation mechanisms and their application in ecological risk assessment. During the collection of nectar, pollen, water, and resinous materials, bees come into contact with contaminants from air, water, and soil, including heavy metals, pesticides, and microplastic particles, which can be detected in their tissues and bee products. In addition to chemical analyses, changes in behavior, physiological condition, and mortality of bee colonies represent important indicators of environmental pollution. Particular attention is given to pesticides, especially neonicotinoids, due to their pronounced toxic and sublethal effects. Although research on the presence of microplastics in bee products is still developing, current findings indicate their potential in biomonitoring. Overall, bees can serve as an efficient and cost-effective tool for environmental biomonitoring, with significant implications for ecological risk assessment and biodiversity protection.

Keywords: Bees, bioindicators, biomonitoring, environment, ecological risk.

BIOCHAR APPLICATION IN MANURE MANAGEMENT: ENVIRONMENTAL IMPACTS, GAS EMISSIONS, AND NUTRIENT RETENTION

Suzana Knežević[1*], Milena Milojević[2], Maja Došenović Marinković[1], Aleksandra Milošević[3]

[1]Academy of Applied Studies Šabac, Unit for Agricultural and Business Studies and Tourism, Vojvode Putnika 56, 15000 Šabac, Serbia,s.knezevic@akademijasabac.edu.rs, m.d.marinkovic@akademijasabac.edu.rs
[2]University of Belgrade, Faculty of Agriculture, Nemanjina 6, Zemun, Republic of Serbia, milenaminorka23@gmail.com
[3]University of Belgrade, Faculty of Law, King Aleksandar Boulevard No 87, 11000 Belgrade, Serbia, alexandramilosevic77@gmail.com

ABSTRACT

Manure management in intensive livestock production represents a major environmental challenge due to gas emissions, nutrient losses, and potential air and water pollution. Biochar is a carbon-rich material produced through biomass pyrolysis under limited oxygen conditions. It is used as an amendment in manure management systems due to its porous structure and ability to adsorb ammonia and other compounds present in manure. This paper reviews the available scientific literature on biochar application in manure management, with the aim of summarizing its effects on environmental impact, gas emissions, and nutrient retention. The literature most commonly indicates that biochar application may reduce ammonia and greenhouse gas emissions and improve nutrient retention in manure. However, these effects are not consistent and depend on biochar physicochemical properties, manure type, and application conditions. The reviewed findings highlight biochar as a potentially useful amendment that can contribute to reducing environmental burdens and improving the sustainability of manure management systems.

Keywords: biochar, manure, gas emissions, environmental impact, nutrient retention, sustainability.

SAFETY ASPECTS OF OPERATING MARINE SCRUBBER SYSTEMS ON PASSENGER SHIPS

Miroslav Vukičević, Marija Čukić

University of Montenegro, Faculty of Maritime Studies Kotor, Put I Bokeljske brigade 44, 85330 Dobrota, Kotor, Montenegro, miroslav.v@ucg.ac.me, marijac@gmail.com

ABSTRACT

Marine scrubber systems (Exhaust Gas Cleaning Systems – EGCS) have become a critical compliance technology in modern maritime transport, enabling ships to meet IMO MARPOL Annex VI sulphur oxide emission limits. Passenger vessels are particularly dependent on these systems due to their high fuel consumption and continuous operation. However, while scrubbers effectively reduce air pollution, their operation introduces substantial technical, chemical, and safety risks that require systematic analysis.

This paper examines the safety aspects of operating hybrid marine scrubber systems aboard passenger ships, combining regulatory analysis with direct operational experience gained aboard Mein Schiff 3, equipped with a Wärtsilä hybrid EGCS. The research draws on original Wärtsilä technical manuals, onboard safety procedures, maintenance documentation, and practical engineering observations.

Key findings show that corrosion of pipelines, washwater systems, and overboard discharge areas represents the most significant long-term operational risk. Chemical handling of sodium hydroxide (NaOH) used in closed-loop and hybrid modes demands strict safety protocols and specialized crew training. Maintenance procedures — including scrubber tower cleaning and catalyst maintenance — are physically demanding and performed under hazardous engine room conditions. Continuous monitoring of exhaust gas parameters, pH values, and washwater quality proved essential for both environmental compliance and operational safety.

The findings confirm that safe scrubber operation depends on the combination of advanced technology, preventive maintenance, and experienced, well-trained engineering crews. Clearly defined crew responsibilities and shift-based monitoring protocols — from the Chief Engineer's overall accountability to the night duty engineer's hourly parameter checks — emerge as key organizational factors alongside technical systems in ensuring reliable and environmentally compliant scrubber operation aboard modern passenger ships.

Keywords: marine scrubber, passenger ships, maritime safety, environmental protection, exhaust gas cleaning systems.

ECONOMY AND MANAGEMENT
EKONOMIJA I MENADŽMENT

DEVELOPMENT OF INCLUSIVE INSTITUTIONS: A COMPARATIVE ANALYSIS OF THE WESTERN BALKAN COUNTRIES AND THE EU-27

Danijela Despotović[1], Miroljub Nikolić[2], Andrea Andrejević Panić[3], Slobodan Cvetanović[4]

[1]University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, Kragujevac, Serbia, danijela.despotovic@uni.kg.ac.rs
[2]Academy of Technical & Applied Studies Belgrade, Zdravka Čelara 14, Belgrade, Serbia, nbskonsalting@gmail.com
[3]Educons University, Vojvode Putnika 85–87, Sremska Kamenica, Serbia, andrea.andrejevic@educons.edu.rs
[4]Educons University, Vojvode Putnika 85–87, Sremska Kamenica, Serbia, prof.cvet@gmail.com

ABSTRACT

This paper develops a Composite Institutional Index (InstIndex) as a synthetic measure of the development of inclusive institutions, based on five Worldwide Governance Indicators dimensions: Control of Corruption, Government Effectiveness, Regulatory Quality and Rule of Law, Voice and Accountability. The index is calculated as a simple arithmetic mean of the five dimensions, min–max normalized to a 0–100 scale, for the 1998–2024 period. A comparative analysis is conducted for the five Western Balkan countries (WB5: Serbia, Montenegro, North Macedonia, Albania, and Bosnia and Herzegovina) and the EU27 average, with emphasis on three reference years: 2004, 2014, and 2024. Findings reveal a structural and persistent institutional gap: the WB5 average in 2024 is 47.92, compared with 71.39 for the EU27 – a relative gap of approximately 33%. Sigma-convergence indicates internal homogenization within WB5 (standard deviation declining from 7.37 to 4.78) with no convergence toward the EU27. Beta-convergence regression confirms absolute convergence across the full 32-country sample ($\beta = -0.0096$, $p < 0.01$), with an implied convergence rate of only 1.07% per annum and a half-life of about 65 years. A robustness check using Principal Component Analysis produces an index almost perfectly correlated with the baseline ($r \approx 1.00$), confirming that conclusions are not sensitive to the weighting scheme.

Keywords: inclusive institutions, Western Balkans, European Union, Worldwide Governance Indicators, composite index, beta convergence, PCA.

INVESTMENT IN HUMAN CAPITAL AND ECONOMIC GROWTH: A COMPARATIVE ANALYSIS OF WESTERN BALKAN COUNTRIES AND NEIGHBORING EU MEMBER STATES

Miroljub Nikolić[1], Andrea Andrejević Panić[2], Danijela Despotović[3], Slobodan Cvetanović[4]

[1]Academy of Technical & Applied Studies Belgrade, Zdravka Čelara 14, Belgrade, Serbia, nbskonsalting@gmail.com
[2]Educons University, Vojvode Putnika 85–87, Sremska Kamenica, Serbia, andrea.andrejevic@educons.edu.rs
[3]University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, Kragujevac, Serbia, danijela.despotovic@uni.kg.ac.rs
[4]Educons University, Vojvode Putnika 85–87, Sremska Kamenica, Serbia, prof.cvet@gmail.com

ABSTRACT

This paper examines investment in human capital as a determinant of economic growth in ten countries – five from the Western Balkans (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia) and five neighboring European Union member states (Bulgaria, Greece, Croatia, Hungary, and Romania) – over the period 2013–2023. Based on a balanced panel of 110 observations, three hypotheses are tested regarding the impact of expenditures on education, research and development (R&D), and healthcare on GDP per capita in purchasing power parity terms. The analysis employs the pooled ordinary least squares (Pooled OLS), fixed effects (FE), and random effects (RE) models. The Hausman test ($\chi^2(3) = 13.50$; $p = 0.0037$) confirms the fixed effects model as a consistent estimator. The results indicate that R&D expenditures have a statistically highly significant positive effect on GDP per capita ($\beta = 0.254$; $p < 0.001$), supporting hypothesis H2. Healthcare expenditures also exhibit a positive effect in the FE model ($\beta = 0.045$; $p = 0.031$), confirming H3. In contrast, education expenditures do not show a short-term positive effect within countries, and thus H1 is not supported. The average development gap between Western Balkan countries and their EU neighbors amounts to approximately USD 13,184 per capita annually (PPP, 2021 prices). The paper provides an empirical basis for formulating policies aimed at reducing the development gap through strategic investments in innovation and healthcare.

Keywords: human capital, economic growth, Western Balkan countries.

THE CONCEPT OF CLINICAL MARKETING: BACKROUND AND THEORY

Iuliia Zuenkova

Russian State University of the Humanities, Miusskaya Ploshchad', 6, 125993 Moscow, Russian Federation, zuenkova@bk.ru

ABSTRACT

The rapidly changing health needs of society and the unmet demands of healthcare systems around the world provide a powerful impetus for the development of new marketing concepts. The formation and progress of industry-specific marketing tools are driven by the evolution of marketing ideas. The specifics of the healthcare industry impose restrictions on the use of conventional marketing tools. Currently, industry-specific marketing concepts do not describe the characteristics of professional users (medical staff), the principles of their decision-making process when purchasing a product, or the mechanisms of demand. Medical professionals make the purchasing decisions based on different principles than those used in the consumer segment. These principles are primarily based on solid evidence supported by complex and costly clinical and cost-effectiveness studies. This decision-making imperative virtually eliminates the use of conventional persuasion techniques commonly employed in the consumer market. The principles of evidence-based medicine strictly regulate the sources of data and their positioning, which requires a review of approaches to the design of marketing messages. The restrictions imposed by the advertising law also limit the choice of communication channels. When defining marketing goals and selecting channels for promoting products in this market, strict adherence to clinical and organizational aspects is required. Until now, clinical and organizational factors have not been considered as management principles and marketing philosophies by industry stakeholders. The emergence of the clinical imperative has transformed the canons of industry marketing, laying the foundation for the differentiation of a conceptually new marketing doctrine.

Keywords: clinical marketing, healthcare marketing, medical devices, MedTech, marketing concept.

IMPACT OF DIGITAL TRANSFORMATION ON MARKETING COMMUNICATION IN THE BANKING SECTOR

Jelena Vukićević, Ljiljana Jović

Academy of applied studies Novi Sad, Department Novi Sad School of Business, Vladimira Perića Valtera 4, Novi Sad, Republic of Serbia, jelena.obradovic@vps.ns.ac.rs, ljiljana09@hotmail.com

ABSTRACT

The aim of this paper is to analyze the impact of digital transformations on changes in marketing communication in the banking sector, with special reference to digital communication channels such as social networks, mobile applications and internet platforms. The paper deals with the problem of the impact of the use of these channels on communication with clients and the competitive position of banks. It is assumed that using these digital channels improves communication with clients and strengthens banks' competitive advantages. The paper also clarifies the key challenges banks face when using digital communication channels. The research is based on a descriptive and comparative analysis of relevant domestic and international literature in the fields of banking, digital marketing and information technology. The analysis was conducted to identify key trends and changes in the marketing communication of banks in a dynamic digital environment. The findings indicate that, in the modern business environment, digital communication channels enable banks to improve communication with customers, strengthen their brand and achieve competitive advantages in the market. Future research could focus on the empirical analysis of the impact of modern digital technologies on the effectiveness of marketing communication, as well as customer satisfaction in the banking sector.

Keywords: Banking, Digital Marketing, Digital Communication Channels.

APPLICATION OF DIGITAL TECHNOLOGIES IN INTERNAL CONTROLS IN THE PUBLIC SECTOR OF REPUBLIKA SRPSKA

Ljiljana Jović, Jelena Vukićević

Academy of applied studies Novi Sad, Department Novi Sad School of Business, Vladimira Perića Valtera 4, Novi Sad, Republic of Serbia, ljiljana09@hotmail.com, jelena.obradovic.vps@gmail.com

ABSTRACT

The subject of this paper is the analysis of the application of digital tools in the procedures of implementation, reporting, and interaction within financial management and control, as well as internal audit in the public sector of Republika Srpska. The paper analyzes consolidated reports of the Central Harmonization Unit, together with recommendations and conclusions from professional seminars and conferences which, considering the number of participants engaged in internal control activities, may be regarded as a representative sample.

The main hypothesis and starting point of the research is that, although the technical and IT infrastructure is at a satisfactory level, the process of digitalizing internal controls remains challenging to implement in a fast and appropriate manner. This is due to the low level of digital literacy, particularly among employees nearing the end of their working careers, as well as the specific characteristics of leadership and human resource management in the public sector on the one hand, and the complexity of the internal control system on the other.

Keywords: internal financial controls, digitalization, Republika Srpska.

INTEGRATION OF DIGITAL MANAGERIAL ACCOUNTING IN OPTIMIZING BUSINESS PERFORMANCE OF SMALL AND MEDIUM-SIZED TOURISM ENTERPRISES IN THE POST-PANDEMIC ERA

Denis Stojkanović[1], Zdravka Petković[2], Aleksandar Lukić[3], Aleksandar Mrđen[4]

[1]College of Communications, Terazije 27/VI, 11000 Belgrade, Republic of Serbia, denisstojkanovic@gmail.com
[2]Belgrade Academy of Business and Artistic Vocational Studies, Kraljice Marije 73, 11000 Belgrade, Republic of Serbia, zdravka.petkovic@bpa.edu.rs
[3]College of Professional Business Studies Čačak, City Park, 11000 Belgrade, Republic of Serbia, aleksandarlukic.info@gmail.com
[4]High School of Professional Studies for Management and Business Communication, Ratarski put 8a, 11000 Belgrade, Republic of Serbia, mrdjenaleksandardr@gmail.com

ABSTRACT

This paper examines the impact of digital managerial accounting on the business performance of small and medium-sized tourism enterprises in the post-pandemic period, with a focus on the use of modern digital tools and software solutions that allow managers to closely monitor costs, revenues, and profitability across individual business segments. The use of digital systems provides not only more accurate and timely financial information, but also the possibility to improve strategic and operational decision-making processes. The aim of the research is to identify the advantages, challenges, and limitations of implementing digital managerial accounting in the tourism sector, especially in the context of small and medium-sized enterprises that face seasonal fluctuations, changing market conditions, and post-pandemic challenges.

The study analyzes how the digitalization of managerial accounting can contribute to cost optimization, increased profitability, better resource organization, and enhanced market competitiveness. The research methodology includes the analysis of recent case studies, available financial reports, scholarly literature, and studies on digitalization in managerial accounting and tourism. Special attention is given to practical examples of digital tools implementation in the hotel and hospitality sectors, agencies, and tourism organizations, in order to assess their real impact on business performance and decision-making.

The results indicate that the use of digital systems in managerial accounting can significantly improve business transparency, increase efficiency in cost monitoring, enable timely identification of problems, and reduce the risk of financial losses. Furthermore, digitalization contributes to better preparedness for seasonal and market changes, enabling managers to make informed and strategically sound decisions that support long-term sustainability and competitiveness.

Keywords: digital managerial accounting, business performance optimization, small and medium-sized tourism enterprises, post-pandemic tourism, cost management.

LEADERSHIP AND COMMUNICATION AS DRIVERS OF ORGANIZATIONAL RESILIENCE IN TOURISM CRISIS MANAGEMENT

Zdravka Petković[1], Denis Stojkanović[2], Aleksandar Mrđen[3], Aleksandar Lukić[4]

[1]Belgrade Academy of Business and Artistic Vocational Studies, Kraljice Marije 73, Belgrade, Republic of Serbia, zdravka.petkovic@bpa.edu.rs
[2]College of Communications, Terazije 27/VI, Belgrade, Republic of Serbia, denisstojkanovic@gmail.com
[3]High School of Professional Studies for Management and Business Communication, Ratarski put 8a, Belgrade, Republic of Serbia, mrdjenaleksandardr@gmail.com
[4]College of Professional Business Studies Čačak, City Park, Belgrade, Republic of Serbia, aleksandarlukic.info@gmail.com

ABSTRACT

Crisis situations in tourism, such as pandemics, natural disasters, and economic downturns, pose significant challenges to the continuity of operations in tourism enterprises. In such circumstances, the way organizations manage human resources and information becomes a critical factor for their resilience. The aim of this study is to analyze the impact of leadership styles and communication practices on the organizational resilience of tourism enterprises during crises, with a particular focus on the role of participative leadership and two-way communication in enhancing organizations' capacity to adapt to crisis-induced changes. The research was conducted through a qualitative analysis of relevant scientific literature and selected case studies from the tourism sector. The analysis focused on identifying patterns in managerial practices and communication strategies during crisis situations. Results indicate that organizations implementing inclusive, participative leadership and transparent, two-way communication achieve higher adaptability, greater employee engagement, and more efficient recovery compared to organizations employing hierarchical or autocratic management models. Digital communication tools play a significant role in maintaining organizational stability during crises, enabling timely information dissemination to employees and clients, better team coordination, and continuity of operations. Case studies show that organizations integrating participative leadership with two-way and digital communication achieve resilience levels between 80% and 95%, whereas organizations with autocratic or transformational leadership styles and one-way communication demonstrate lower resilience levels (50–70%). These findings confirm previous research and emphasize the practical application of theoretical insights in real-world business environments. The synergy of leadership and communication enables organizations to adapt more rapidly during crisis periods, enhance flexibility in business processes, achieve more stable financial outcomes, and strengthen employee engagement, which directly impacts service quality and client satisfaction. The study also highlights the importance of organizational adaptive capacity, the ability to learn from previous crisis experiences, and process innovation as additional factors contributing to resilience. Based on the results, practical recommendations for managers can be drawn: tourism enterprises should promote participative leadership, implement digital two-way communication channels, and develop comprehensive crisis management plans. These strategies not only enable organizations to survive crises but also allow them to emerge stronger, with improved internal processes and a greater ability to respond to future challenges.

Keywords: leadership, participative leadership, communication, crisis management, tourism, organizational resilience.

SUBSIDIES AND STRUCTURAL TRANSFORMATION IN SERBIA: IS A PARADIGM SHIFT IN INDUSTRIAL POLICY WARRANTED?

Marija Marčetić, Bojan Kocić, Jovana Andjelković

Toplica Academy of Applied studies, Ćirila i Metodija 1, 18 400 Prokuplje, Serbia,
neimar.marija@gmail.com, bojan.kocic@yahoo.com, jovana.andjelkovic@vpskp.edu.rs

ABSTRACT

This paper analyzes the impact of Serbia's subsidization policy during 2015–2025 on the structural transformation of the economy. Subsidies in Serbia have been widely used as tools of industrial and fiscal policy aimed at increasing employment, attracting foreign direct investment and supporting domestic sectors. Integrating industrial policy theory, political economy and structural transformation frameworks, the study evaluates whether the current subsidization model has led to a shift toward high-productivity, technologically advanced sectors, or merely sustained a low-cost, investment-dependent growth pattern. The analysis indicates that subsidies have produced short-term gains in employment and investment but have not significantly enhanced long-term productivity or structural change. Additionally, the fiscal burden of subsidies remains considerable, and institutional mechanisms lack transparency and systematic impact evaluation. The paper concludes that reform of the subsidization model is warranted — toward productivity-linked, innovation-oriented support that fosters domestic value chains. Policy recommendations include shifting from employment-based subsidies to productivity-conditioned instruments, instituting rigorous ex-post evaluations, and strengthening domestic supplier networks.

Keywords: subsidies, industrial policy, structural transformation, Serbia, productivity, fiscal policy, FDI, development strategy.

LEGAL ASPECTS OF THE CUSTOM SYSTEM

Jovana Anđelković, Marija Marčetić, Bojan Kocić

Toplica Academy of Applied studies, Ćirila i Metodija 1, 18 400 Prokuplje, Serbia,
jovana.andjelkovic@vpskp.edu.rs, neimar.marija@gmail.com, bojan.kocic@yahoo.com

ABSTRACT

Contemporary customs systems in the context of globalization and digitalization pose a challenge to national systems and their legal frameworks, as they, on the one hand, require the ensuring of legal certainty and legality in the actions of customs authorities, while, on the other hand, necessitate efficient and flexible control mechanisms. In this context, particular importance is attached to the harmonization of national legislation with international standards and European Union law, as well as to the strengthening of the institutional capacities of customs officials.

This paper examines the legal aspects of the customs system as a significant component of public law regulation and an instrument of the state's economic and security policy. The research focuses on the normative framework of customs law in the Republic of Serbia, with reference to relevant international standards and European Union law. Particular attention is devoted to the legal status of entities involved in customs procedures, as well as to mechanisms for the protection of their rights.

In addition, the paper analyzes forms of legal liability for violations of customs regulations, including misdemeanor and criminal liability, as well as the importance of applying the principles of legality, legal certainty, and good governance in the work of customs authorities.

Keywords: customs system, customs law, legal certainty, good governance, liability.

INFLUENCE OF LOYALTY CARDS ON CONSUMER BEHAVIOR

Mladen Milić[1], Marko Milić[2]

[1]University PIM, Faculty of Economics, despota Stefana Lazarevića bb, 78 000 Banja Luka, Bosnia and Herzegovina, mladen.milic@fondpiors.org
[2]The College of Service Business, Sokolac - East Sarajevo, Cara Lazara 71350 Sokolac – East Sarajevo, Bosnia and Herzegovina, milicmarko.milic@gmail.com

ABSTRACT

Consumer loyalty is the dream and desire of every trader. In order to make the customer loyal, many factors, knowledge and effort need to be fulfilled and invested, not only by the sales staff, but by all the employees in the organization. A loyal consumer significantly influences the degree of demand for certain products and services, thereby increasing the volume of sales.

For marketing experts, the behavior of consumers in the process of purchasing products is particularly interesting, where having a loyalty card enables purchases under certain more favorable conditions. The results of numerous studies carried out so far show us that more products and services are purchased with a loyalty card, achieving additional benefits such as a lower price, i.e. collecting points that are later converted into cash, etc.

Shops that want to operate successfully on the market and at the same time make a profit must strive for consumer loyalty and retention of existing ones while attracting new dependent and able-to-pay consumers, and one of the ways is to issue a loyalty card.

A satisfied consumer certainly and in the long term ensures constant turnover and its increase as a reflection of loyalty with an increase in the frequency and volume of consumption and the expansion of the market.

Loyal consumers will spend more often and more in the stores of merchants whose loyalty card they have, thus directly influencing the volume of sales and the amount of profit achieved.

Key words: consumer, loyalty card, consumer satisfaction and profit.

CLIMATE SHOCKS AND REAL ESTATE INVESTMENT RISK IN DEVELOPING COUNTRIES: CASE STUDY OF NIGERIA

Muhammad Umar Faruk

University of Pécs, Faculty of Business and Economics, Rákóczi út 80, 7622 Pécs, Hungary, ufarukmuhd84@gmail.com

ABSTRACT

Real estate sector is one of the most lucrative and fastest-growing investments in Nigeria, apart from the oil sector. It employed about 42% of the labour force and contributed significantly to the Gross Domestic Product (GDP) in the country. However, the sector has been experiencing disruption from the effect of climate shocks. Climate change has been widely acknowledged across the globe with devastating effects on various sectors of the economy. These shocks include among the flooding, erratic rainfall, storms, rising temperature, carbon emission, droughts e.t.c. this pose the question if the investment still viable in this area? The uncertainty with greater dispersion in real estate returns and limited economy life cycle due to climate shocks This study aims to examine the effect of climate shocks on the real estate investment risks with the view to understanding the implications that characterized the climate risks to real estate investment decision in the developing countries. This study will employ an integrated methodological approach combining GIS-based hazard mapping, inferential statistical analysis, system dynamic modeling, and qualitative stakeholder inquiry to detect, measure, and explain climate-driven investment relocation The study intends to collect data through secondary sources and compared the relationship and effect of these climate variables to the real estate investment risks.

Keywords: Climate variables, GDPreal estate, regression analysis, temperature, precipitations.

DIGITAL FASHION COMMUNICATION: CONSUMER PERCEPTIONS OF ONLINE CAMPAIGNS AND INFLUENCER IMPACT

Neda Srnić[1], Milica Slijepčević[1], Jelena Krstić[2]

[1]University Metropolitan, Faculty of Management and Digital Arts, Tadeuša Košćuška 63, 11158 Belgrade, Serbia, neda.srnic@metropolitan.ac.rs, milicaslijepcevic27@gmail.com,
[2]Institute of Economic Sciences, Zmaj Jovina 12, 11000 Belgrade, Serbia, jelena.krstic@ien.bg.ac.rs

ABSTRACT

This paper examines the role of the digital environment in shaping communication between fashion brands and consumers, with a particular focus on digital marketing campaigns and influencer impact. The study explores respondents' attitudes toward fashion brands' digital presence, the frequency and patterns of following brand activities on digital platforms, and the perceived effectiveness of online campaigns. Special attention is given to the role of influencers in shaping consumer attitudes, purchase decisions, and overall behavior. The findings indicate that digital platforms represent a crucial communication channel for fashion brands, while influencer marketing significantly contributes to consumer engagement and trust. The paper highlights key trends relevant for both academic research and marketing practice in the fashion industry.

Keywords: Digital marketing communication, Fashion brands, Influencer marketing, Consumer behavior

EDUCATION FOR SUSTAINABLE DEVELOPMENT IN CENTRAL & EASTERN EUROPE: CHALLENGES AND BEST PRACTICES

Sirine Haj Taieb

University of Pécs, Doctoral School of Regional Policy and Economics, Rákóczi út 80, 7622 Pécs, Hungary, sirinehajtaieb@gmail.com

ABSTRACT

Since the early 2000s, sustainable development has become increasingly embedded in the structures and missions of universities. Sustainability educators are calling for a transformational shift in curricula to better equip universities to contribute to sustainability efforts. While undergoing these transformations, universities face various challenges and barriers that may slow down their contribution to sustainable development goals and the greater good. Universities serve as key actors in implementing sustainable development, acting as an essential link between knowledge creation and knowledge transfer to society and beyond. However, this is not without challenges. These challenges extend to various aspects of higher education. In this paper, we will examine the educational challenges that universities face in the process of sustainability integration. We conducted 33 in-depth interviews with academic and non-academic staff associated with sustainability-related activities. The aim of this paper is to identify the challenges related to educational pursuits in line with sustainable principles and to outline best practices that can be transferred to other contexts. The challenges include (1) structural and institutional challenges, primarily related to curriculum reform, lack of awareness, insufficient teaching staff, lack of time; (2) curriculum and pedagogical integration constraints, such as ambiguous sustainability classification, incoherence between sustainability goals, curricula, and pedagogical practices, limited integration of sustainability in curricula, weak institutionalization of sustainability education, and inefficiencies in educational systems; (3) student-related outcomes, such as insufficient sustainability competencies among graduates, limited perceived relevance, uncertain and indirect influence of sustainability education on student behavior, and limited student social integration.

Keywords: educational challenges, sustainability, Central and Eastern Europe, universities.

CHALLENGES & BEST PERSPECTIVES ON SUSTAINABILITY OPERATIONS IN CENTRAL & EASTERN EUROPEAN UNIVERSITIES: BARRIERS AND ENABLERS

Sirine Haj Taieb

University of Pécs, Doctoral School of Regional Policy and Economics, Rákóczi út 80, 7622 Pécs, Hungary, sirinehajtaieb@gmail.com

ABSTRACT

The concept of sustainability is viewed as a broad, long-term, and context-dependent process. Although it is complex and requires substantial resources and a long-term vision, sustainable development is viewed as a central priority in higher education. Universities are expected to be leading in advancing the United Nations' Sustainable Development Goals, contributing to policymaking, advising policymakers, and supporting evidence-based decision-making related to sustainability, while also conveying sustainable principles in the way they conduct their operations. Based on in-depth interviews with directors and staff at university-based sustainability centers as well as professors, lecturers, and researchers with peer-reviewed impact publications on sustainability, we aim to pinpoint the operational challenges facing universities in their quest of sustainability integration and to identify best practices enabling this integration. The challenges include infrastructure barriers, lack of knowledge and expertise, structural and organizational challenges, and limitations in processes and tools.

Keywords: universities, Central and Eastern Europe, challenges, operations, sustainability.

FOOD WASTE IN THE HOSPITALITY SECTOR OF MONTENEGRO: CONTEMPORARY CHALLENGES AND LIMITATIONS

Vesna Vujačić[1*], Kristina Davidović[1], Marko Kukanja[2]

[1]University of Montenegro, Faculty of Tourism and Hospitality, Stari grad 320, Kotor, Montenegro, vuvesna@ucg.ac.me
[2]University of Primorska, Faculty of Tourism Studies-Turistica, Obala 11a, Portorož, Slovenia

ABSTRACT

Montenegro is an attractive Mediterranean tourist destination, with tourism representing one of the key pillars of its economic development. Gastronomy occupies an important place in the tourism offer and constitutes a significant element of the destination's identity. However, food waste is becoming an increasingly prominent issue, particularly in the hospitality sector, where it has notable economic and environmental implications. At the global level, it is estimated that more than 30% of food waste is generated in hospitality and catering, with substantial quantities arising at different stages of food preparation, cooking, and serving. Notably, over 20% of food waste occurs during the initial preparation phase, indicating the need to improve management practices at this level. The main research problem relates to the insufficiently systematized understanding of food waste in Montenegro's hospitality sector, as well as the identification of key factors influencing its volume. The aim of the study is to identify limitations in reducing food waste in hospitality, with a comparative overview of European and global practices. The research methodology includes an analysis of relevant scientific literature, with a particular focus on the environmental aspects of food waste, as well as the application of SWOT analysis. The paper examines opportunities for improving food waste management in Montenegro's hospitality sector, drawing on positive practices from European Union countries, particularly Slovenia, with the aim of reducing negative environmental impacts. At the same time, it highlights the potential for improving existing practices through their alignment with the principles of sustainable tourism, there by contributing not only to the reduction of food waste, but also to a more effective response to contemporary consumer demands and to the overall reduction of the environmental footprint of the hospitality industry.

Keywords: Food waste, hospitality industry, food, environment, Montenegro.

EXAMINATION OF THE STRATEGY OF HUNGARIAN YOUTH FOOTBALL ORGANISATIONS

Zoltán Szalánczi, Éva Judit Bartha

[1]University of Debrecen, Faculty of Economics and Business, Institute of Sports Economy and Management, Böszörményi út 138, 4032 Debrecen, Hungary, szalanczi.zoltan@econ.unideb.hu, bartha.eva.judit@econ.unideb.hu

ABSTRACT

Youth education is of strategic importance for sport enterprises, as it ensures long-term sustainability and competitiveness. A well-designed after-school programme allows for the discovery and development of talent, which is essential for success in adulthood (Kiss, 2021). However, the success of after-school programmes depends largely on the strategy adopted by sports organisations. A well-chosen strategy not only affects the development of young athletes but also influences the long-term functioning of the whole club or organisation (Szalánczi, 2024).

In my research, I examine the entire vertical of Hungarian youth football, as it is essential for a sports organisation to develop the right strategy in order to remain stable and successful in the long run. A well-structured strategy helps to optimally allocate resources, ensuring that athletes receive the best possible professional and infrastructural support (Faragó, 2017). Defining the right strategy allows clubs to effectively integrate home-grown athletes into adult teams, reducing transfer costs and fostering team unity. With a well-designed strategy, a sporting organisation can accurately define the goals, development directions and resources needed for post-school education, ensuring long-term sustainability and success (Alaa, 2017). This approach is also key to economic stability. For economic sustainability, it is essential for organisations to develop diversified sources of income, especially given the long-term uncertainty of public funding. Effective youth development can reduce the operating costs of a sporting organisation, as less financial outlay is required for external certification through the incorporation of home-grown players (Faragó, 2017). In addition, a strong youth base makes a club more attractive to sponsors and investors, as a well-functioning youth programme ensures continuous development and long-term competitiveness. With a successful strategy, sport organisations can also increase their brand equity, which can lead to greater popularity and financial stability in the long term (Vörös & Szörényi-Neubauer, 2019). The results of this research highlighted that talent development and training strategies differ between academies and lower-ranked organisations and sample revealed limited employee involvement in setting strategic goals, which can reduce employee engagement and the effectiveness of strategy implementation in practice.

Keywords: sport, youth sport, talent management, football.

ECONOMIC BENEFITS AND ECOLOGICAL CHALLENGES OF SUSTAINABLE REAL ESTATE DEVELOPMENT

Dragan Dukić[1], Nataša Papić Blagojević[2], Dragan Đuranović[1], Milica Ničić[1], Milica Obadović[1]

[1]Academy of Applied Studies – Sirmium, Sremska Mitrovica, Zmaj Jovina 29, Serbia, dmadukic@gmail.com, gandra.djuranovic@gmail.com, nicicmilica1@gmail.com, mobadovic@gmail.com
[2]Academy of Applied Studies Novi Sad, Vladimira Perića-Valtera 4, Novi Sad, Serbia, npapic.blagojevic@gmail.com

ABSTRACT

Real estate development represents a powerful driver of economic and overall societal growth, while achieving a balance between economic benefits and environmental protection has become imperative for current and future decision-making by stakeholders in this field. This paper explores the economic advantages of implementing sustainable practices in the real estate sector, including the increase in property market value, the reduction of operational costs through energy efficiency, as well as attracting investments through "green" certifications and environmentally responsible projects. It also analyzes the environmental challenges associated with sustainable development, such as the high initial capital required for the implementation of ecological technologies, the complexity of compliance with legislative frameworks, and technical limitations in the construction process. The paper examines the long-term effects of sustainable investments, which not only reduce greenhouse gas emissions but also contribute to the preservation of natural resources and the improvement of quality of life. Given the growing demand for environmentally friendly solutions, sustainable real estate development is emerging as a potential driver not only of economic growth, but also of positive social and environmental change. The conclusion of the paper indicates that, although the implementation of sustainable principles in the real estate sector involves certain challenges, in the long run it provides significant economic and environmental benefits that are essential for achieving sustainable market development.

Keywords: Economic efficiency, sustainable real estate development, environmental protection

Acknowledgements

The realization of this research and work is supported by the Provincial Secretariat for Higher Education and Scientific Research, Autonomous Province of Vojvodina, Republic of Serbia, through the Public competition for funding development and research projects of higher vocational schools and academies of vocational studies from the territory of the Autonomous Province of Vojvodina in 2026.

THE IMPACT OF INDUSTRIAL ROBOTICS ON PRODUCTIVITY AND THE LABOR MARKET

Biljana Bjelica, Stefan Tomanić, Bahta Halilović*

The Collage for Business and Management Studies, Cara Lazara bb, 71350 Sokolac – Istočno Sarajevo, Bosnia and Herzegovina, bahta.221@gmail.com,

ABSTRACT

The development of industrial robotics and automation is significantly transforming the organization of production processes and business operations in modern companies. The use of robots in manufacturing contributes to higher efficiency, precision, and productivity, while also leading to changes ih the labor market.

This paper analyzes the impact of industrial robotics on enterprise productivity and the changes in employment structure resulting from automation. Special attenation is given to the economic effects of robot implementation, as well as the challenges related to adapting the workforce to new technological conditions. The focus is on shifts in demand for certain occupations, the need for additional employee training, and the emergence of new jobs connected to digital technologies.

The research is based on analytical, descriptive, and comparative methods, along with a review of domestic and international literature. The results indicate that industrial robotics contributes to the growth of productivity and the competitiveness of companies, but at the same time requires continuous investment in knowledge development and adaptation of the labor market to modern technological changes.

Keywords: Industrial robotics, automation, productivity, labor market, digitalization, employment.

CRISIS MANAGEMENT AND BUSINESS CONTINUITY IN CONDITIONS OF GLOBAL INSTABILITY

Ognjen Bakmaz, Predrag Obrenović*

College of Service Business East Sarajevo - Sokolac, Bosnia and Herzegovina – Republic of Srpska,
predrag.obrenovic@vub.edu.ba, ognjen@vub.edu.ba,

ABSTRACT

The subject of this paper is the examination of the correlation between crisis management strategies and the preservation of business continuity in the context of contemporary asymmetric global threats. In the era of "polycrisis," characterized by the simultaneous impact of geopolitical tensions, hybrid threats, and climate change, traditional reactive security models are becoming inadequate. The scientific objective of the paper is a critical analysis of the transition from the concept of passive protection to the doctrine of organizational resilience, which implies the ability of a system to absorb shocks and transform under pressure.

The methodological framework of the paper is based on the qualitative content analysis of relevant international standards (such as ISO 22301) and on the comparative method used to examine different risk management models. Particular focus is placed on identifying critical success factors within business continuity plans. Accordingly, the main hypothesis of the paper is that an integrated risk assessment directly determines the speed of a system's functional recovery. The paper also re-examines the role of leadership and security culture as variables that significantly modify the effectiveness of crisis communication and decision-making under conditions of extreme uncertainty.

The results of previous research indicate that business continuity in conditions of global instability is no longer an isolated technical process, but rather a strategic scientific discipline requiring a holistic approach. The paper provides a theoretical contribution to the systematization of crisis mitigation measures, while in practical terms it offers a framework for the development of adaptive security strategies tailored to a dynamic international environment.

Keywords: crisis management, business continuity, organizational resilience, global instability, risk assessment, asymmetric threats

CIRCULAR ECONOMY IN MARITIME INDUSTRY: LITERATURE INSIGHTS AND EMERGING PRACTICES

Senka Šekularac-Ivošević, Špiro Ivošević, Selma Medunjanin, Dragana Milošević

University of Montenegro,Faculty of Maritime Studies Kotor, Put I Bokeljske brigade 44, Dobrota, Kotor, Montenegro, senkas@ucg.ac.me, spiroi@ucg.ac.me, medunjaninselma@gmail.com, milosevic.d@ucg.ac.me

ABSTRACT

The maritime industry is increasingly undergoing profound transformation driven by digitalization, decarbonization, and the adoption of circular economy principles. These trends represent key enablers of the transition toward a more sustainable and resilient maritime sector, aligned with the United Nations Sustainable Development Goals (SDGs) and the strategic framework established by the International Maritime Organization. Particular relevance is attributed to the goals related to responsible consumption and production, climate action, the protection of marine resources, and the development of sustainable infrastructure, with the circular economy emerging as one of the most effective mechanisms for their practical implementation.

The aim of this paper is to examine the role of the circular economy in achieving strategic sustainability objectives within the maritime industry. The first part of the study identifies and systematizes the relevant goals and initiatives promoted by the IMO and other international institutions that support sustainable maritime practices. The second part applies a systematic literature review methodology to identify the key areas in which circular economy principles have been most intensively implemented in the maritime industry over the past ten years.

The third segment of the paper focuses on the current status and future prospects for the implementation of circular economy principles in maritime industry in Montenegro. Through a comparative analysis of existing domestic practices and international experiences, the study identifies opportunities and challenges for the adoption of circular models in small coastal states. The scientific and practical contribution of the paper lies in the formulation of recommendations that may support policymakers, industry stakeholders, and the academic community in fostering a more sustainable and competitive maritime sector in Montenegro.

Keywords: Maritime industry, circular economy, Sustainable Development Goals (SDGs), Montenegro.

ANALYSIS OF THE APPLICATION OF SUSTAINABLE AND CIRCULAR PRACTICES IN THE MARITIME SECTOR OF MONTENEGRO

Ivana Bacović, Dragana Milošević

University of Montenegro, Faculty of Maritime Studies Kotor, Put I Bokeljske brigade 44, 85330 Kotor, Montenegro, ivanabacovic@edu.ucg.ac.me, milosevic.d@ucg.ac.me

ABSTRACT

Sustainability and the circular economy are increasingly shaping the modern maritime sector through more efficient resource use, less waste, and better recycling practices. Ports, marinas and shipyards play an important role in the application of sustainable business models due to their intensive use of resources, the generation of various types of waste, and their environmental impact. Although the focus on sustainability in the maritime economy has been increasing in Montenegro in recent years, the application of the principles of circular economy and recycling is still not sufficiently researched. The subject of this review is the analysis of existing sustainable and circular practices in the maritime sector of Montenegro, with a special focus on ports, marinas and shipyards. The analysis includes activities related to waste management, material recycling, resource reuse, energy efficiency improvements, and the implementation of sustainable business practices. A particular focus is placed on activities in the port sector, including waste tire recycling and wastewater recycling projects, as well as sustainable marina practices. The results of the research indicate that in Montenegro there are initial steps towards the application of the circular economy in the maritime sector, but also numerous limitations related to the lack of standardized indicators of sustainability, limited availability of data and insufficiently developed recycling systems. At the same time, the growing focus on sustainable resource management indicates a significant potential for further development of circular and recycling practices in the maritime economy of Montenegro.

Keywords: sustainability, circular economy, recycling, maritime.

DIGITAL PLATFORMS AS ENABLERS OF CIRCULAR ECONOMY TRANSITION: A FRAMEWORK FOR ORGANIZATIONAL RESILIENCE

Andrea Ivanišević[1], Marijana Dukić Mijatović[1], Otilija Sedlak[2], Aleksandra Marcikić Horvat[2], Biljana Pajin[3]

[1]University of Novi Sad, Faculty of Technical Sciences, Dositeja Obradovića 3, 21000 Novi Sad, Serbia, andrea.ivanisevic@gmail.com, marijana.mijatovic@uns.ac.rs
[2]University of Novi Sad, Faculty of Economics, Segedinski put 9-11, 24000 Subotica, Serbia, otilija.sedlak@ef.uns.ac.rs, aleksandra.marcikic.horvat@ef.uns.ac.rs
[3]University of Novi Sad, Faculty of Technology, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia, biljana.pajin@uns.ac.rs

ABSTRACT

Organizations across emerging economies face mounting pressure to transi-tion from linear to circular business models while simultaneously navi-gating rapid digital disruption. This paper proposes a conceptual framework that positions digital platforms as key enablers of circular economy (CE) adoption, with a particular focus on small and medium-sized enterprises (SMEs) in Serbia.

Grounded in the Quadruple Helix model of innovation, the framework maps the roles of academia, government, industry, and civil society in facil-itating the implementation of CE. The paper further proposes a digital waste exchange platform that enables SMEs to offer surplus materials as inputs to other enterprises, reducing waste while enhancing operational resilience. Key barriers to adoption – including low managerial awareness, regulatory gaps, and limited digital infrastructure – are identified and addressed through targeted organizational interventions.

The proposed framework contributes to understanding how digital trans-formation and green transition can be pursued jointly, offering practical guidance for managers and policymakers seeking to build resilient, sustain-able organizations..

Keywords: circular economy, digital transformation, SMEs, organizational resilience, Quadruple Helix.

Acknowledgment

This research was supported by the Autonomous Province of Vojvodina, the Provincial Secretariat for Higher Education and Scientific Research, within the framework of financing a joint research project of scientific research organizations founded by the Autonomous Province of Vojvodina in cooperation with scientific research organizations from the Republic of Srpska, through the project: *Sustainable Development and the Building of a Circular Economy through the Integration of Digital Technologies.* (Contract No.: 004351354 2025 09418 003 000 000 001 04 002).

THE PRODUCTIVITY-ENERGY NEXUS IN NIGERIA: ASYMMETRIC IMPACTS OF EFFICIENCY AND FACTOR SUBSTITUTION

Fatai Asimi, Atoyebi Kehinde

Lagos State University, Faculty of Social Sciences, Ojo (Main campus), Lagos State, Nigeria,
fasimi@gmail.com, kehindeatoyebi24@gmail.com

ABSTRACT

This study investigates the dynamic relationship between energy efficiency, productivity, and factor substitution in Nigeria's manufacturing sector from 1981 to 2023. Using a post-positivist framework and secondary time-series data, we employ Stochastic Frontier Analysis (SFA) to estimate energy efficiency, a Nonlinear Autoregressive Distributed Lag (NARDL) model to assess its asymmetric impact on manufacturing output, and a Translog cost function to compute Morishima Elasticities of Substitution (MES). Results indicate an average energy efficiency score of 82.2%, highlighting significant potential for improvement. The NARDL estimates reveal that energy efficiency asymmetrically affects manufacturing output, with negative shocks exerting a disproportionately larger long-run impact than positive improvements. Furthermore, capital and energy are substitutes (MES > 0), while capital and labor are complements (MES < 0), suggesting that energy price policies could reshape the sector's input structure. The study concludes that energy efficiency is not merely an environmental or cost-saving concern but a strategic determinant of industrial productivity in Nigeria. Policy should therefore prioritize institutionalizing energy efficiency within the national industrial strategy, supported by incentives for technology adoption and skills development.

Keywords: Energy Efficiency, Total Factor Productivity, Input Substitution, Nigerian Manufacturing, Stochastic Frontier Analysis, NARDL, Morishima Elasticity.

ENERGY TRANSITION, ENVIRONMENTAL QUALITY, AND FINANCIAL DEVELOPMENT IN NIGERIA: AN EMPIRICAL ANALYSIS

Olatokunbo D. Salami, Olajide S. Gbemisola, Hassan T. Bello, Arogundade S. Lawal

Lagos State University, Faculty of Social Sciences, Department of Economics, Ojo (Main campus), Lagos State, Nigeria, osalami2022@gmail.com, Gosworld1@gmail.com, hrfemabproperties@gmail.com, olatokunbo4thr@proton.me

ABSTRACT

This study investigates the dynamic relationship between renewable energy consumption and financial development in Nigeria from 1990 to 2023. Against the backdrop of Nigeria's significant energy poverty, underutilized renewable resources, and a growing yet challenged financial sector, the research aims to determine the nature of the nexus between these two critical variables. Employing a quantitative research design and the Autoregressive Distributed Lag (ARDL) bounds testing approach, the study analyzes annual time series data on financial development (proxied by domestic credit to the private sector), renewable energy consumption, economic growth (GDP per capita), and CO_2 emissions.

The empirical results confirm a significant long-run cointegrating relationship among the variables. The findings reveal that renewable energy consumption has a positive and statistically significant impact on financial development in the long run, suggesting that investments in clean energy technologies act as a catalyst for deepening financial markets. Economic growth also exhibits a strong positive effect on financial development. In contrast, CO_2 emissions show a marginally significant negative relationship, indicating that environmental degradation may slightly erode investor confidence.

The study concludes that renewable energy adoption is not only an environmental imperative but also a financial catalyst for Nigeria. It recommends the integration of financial sector reforms with energy policies to enhance credit availability, attract green investments, and foster a sustainable economic transformation. Strengthening the financial system is thus crucial for scaling up renewable energy technologies and achieving inclusive long-term development.

Keywords: Renewable Energy, Financial Development, ARDL, Nigeria, Sustainable Growth, CO_2 Emissions.

DETERMINING THE IMPORTANCE OF PERFORMANCE INDICATORS FOR THE ANALYSIS OF PRODUCTION SECTOR EFFICIENCY USING DATA ENVELOPMENT ANALYSIS (DEA): A CASE STUDY OF THE COMPANY VENDOM

Sandra Đukanović

University of Belgrade, Faculty of Organizational Sciences, Jove Ilića 154, 11000 Belgrade, Serbia, sd20255012@student.fon.bg.ac.rs

ABSTRACT

The efficiency of the production sector largely relates to the effectiveness of management practices in optimizing company performance while minimizing resources and costs, and it represents a key factor in determining productivity and the overall success of a company. Inefficient production and overall operations do not merely result in the loss of valuable time, but also significantly affect a company's market positioning, profitability, customer satisfaction, and overall business image. This paper analyzes the efficiency of the production sector of the company Vendom, which operates within the metal industry, using Data Envelopment Analysis (DEA). DEA is considered one of the most successful and widely used non-parametric methods for performance measurement and efficiency analysis. It is a data-driven method designed to assess the efficiency of complex entities that utilize diverse inputs to generate diverse outputs. Given the availability of data, typical indicators were selected as input and output variables: material costs, service costs, the number of service operations, and similar indicators (as inputs), and the commercial price (as the output). Prior to the selection of input and output units, data preprocessing was conducted, and inputs and outputs were constructed as derived indicators by aggregating the relevant basic cost or revenue indicators. The obtained correlation coefficients indicated a high degree of interdependence among the selected variables, thereby confirming the justification for applying DEA in efficiency analysis. Results of this paper indicate opportunities for improving the efficiency of the production sector for certain decision-making units.

Keywords: production, DEA method, decision-making units, correlation coefficient, relative efficiency.

ARTIFICIAL INTELLIGENCE IN THE FUNCTION OF OPTIMIZING INTERNATIONAL BUSINESS PROCESSES

Nikša Grgurević

University Adriatic, Faculty of Management, Zemunska 143, 85348 Meljine, Herceg Novi, Montenegro, niksagrgurevic@t-com.me
University of Business Engineering and Management Banja Luka, Faculty of Economics, despota Stefana Lazaervića bb, 78000 Banja Luka, Bosnia and Herzegovina

ABSTRACT

Digitalization and automation are transforming traditional business models in contemporary market conditions. Artificial intelligence (AI) is reshaping international business operations through various forms of process optimization. The subject of this paper is the impact of digitalization, and particularly AI, on the optimization of international business processes. The aim of the paper is to present, on a scientific research basis, all the positive effects that digitalization and AI bring through the improvement of business processes, faster decision-making, and increased productivity, which directly contribute to the optimization of business operations and greater efficiency, as well as to identify and analyze potential negative effects. Although the development of AI brings numerous advantages to the international economy, it also creates certain challenges, since AI, like every major technological change, brings both opportunities and risks.

Keywords: digitalization, optimization, artificial intelligence, international business processes.

STRATEGIC MANAGEMENT FOR THE LONG-TERM SUSTAINABILITY OF SMALL AND MEDIUM-SIZED ENTERPRISES - CHALLENGES AND OPPORTUNITIES

Filip Marković[1], Goran Babić[2]

[1]Academy of Technical and Art Applied Studies Belgrade: Department School of Railroad Transport, Zdravka Čelara 14, Belgrade, Serbia, filip.markovic@vzs.edu.rs
[2]MB University, Faculty of Business and Law, Teodora Drajzera 27, Belgrade, Serbia, goranbabic91@gmail.com

ABSTRACT

The SME sector plays an important role in the economy as it contributes to employment, the development of local markets and overall economic growth. However, these enterprises often face limited resources, lack of capital and weaker application of modern management approaches. The paper discusses how strategic management can contribute to better adaptability of SMEs to market changes, strengthening competitiveness and long-term business stability. Special emphasis was placed on factors from the external environment, such as economic changes, digitization and access to financial sources, but also on internal weaknesses such as insufficiently developed strategies and lack of professional staff. The empirical part of the work is based on a SWOT analysis of the SME sector in Serbia, which identified key strengths, weaknesses, opportunities and threats. Based on the analysis, it can be concluded that SMEs have a significant potential for development, but that for its realization it is necessary to improve the strategic approach to management.

Keywords: SME sector, Strategic management, sustainability, SWOT.

LAW AND SECURITY SECTION
PRAVO I BEZBJEDNOST

ENVIRONMENTAL CRIME

Darko Dimovski[1], Jelena Dimovski[2]

[1]Faculty of Law, University of Niš, Trg kralja Aleksandra 11, Niš, Serbia, darko@prafak.ni.ac.rs
[2]Innovation Center, University of Niš, Univerzitetski trg 2, Niš, Serbia, jelena.dimovski@icun.ni.ac.rs

ABSTRACT

The authors examine the concept of environmental crime from both legal and philosophical perspectives, emphasizing that such a dual approach is necessary for its proper understanding. A purely normative definition, they argue, cannot fully capture the broader social and ethical dimensions of this complex phenomenon. By combining these perspectives, the paper aims to offer a more precise and comprehensive conceptualization of environmental crime.

The paper further provides an overview of the most relevant international legal instruments addressing environmental crime, including key conventions, directives, and policy frameworks. Special attention is paid to their scope, applicability, and practical significance, placing them within the wider context of contemporary environmental protection efforts.

In addition, the authors analyze the domestic legal framework governing environmental crime. This analysis includes a critical assessment of existing normative solutions, highlighting both their strengths and weaknesses. Particular focus is given to the clarity of legal definitions, the effectiveness of enforcement mechanisms, and the adequacy of sanctions. The authors identify areas where the legal system functions effectively, as well as those requiring further improvement.

Recognizing the diverse and complex nature of environmental crime, the paper also examines its various manifestations in detail, supported by examples from practice. This approach contributes to a clearer and more concrete understanding of how such crimes occur in real-world contexts.

By integrating theoretical analysis with practical insights, the paper seeks to bring this multifaceted issue closer to scholars and practitioners in the fields of environmental law and criminology.

Keywords: environmental crime, concept, manifestations.

WOMEN'S RIGHTS AS HUMAN RIGHTS: ANALYSIS OF THE IMPLEMENTATION OF WOMEN'S RIGHTS IN DEVELOPING COUNTRIES

Merjema Pašović, Predrag Raosavljević

University PIM, Faculty of Law, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, pasovicka206@gmail.com, predragraosavljevic@yahoo.com

ABSTRACT

This paper analyzes women's rights as an integral part of human rights, with a particular focus on their realization in developing countries. Although international legal frameworks formally guarantee equality and non-discrimination, the practical implementation of women's rights remains inconsistent across different socio-economic and cultural contexts. The aim of the study is to analyze key structural, legal and socio-cultural barriers that limit the effective enjoyment of women's rights, including unequal access to education, employment, healthcare and political participation. The research is based on a qualitative analysis of relevant international legal instruments, academic literature and selected reports from international organizations. Special attention is given to the gap between normative standards and their actual enforcement in practice. The results indicate that, despite certain progress in specific areas, significant systemic inequalities persist, largely due to deeply rooted social norms and weak institutional enforcement mechanisms. The paper concludes that stronger institutional frameworks, improved legal enforcement, and targeted policy measures are necessary to ensure the effective protection and full realization of women's rights as human rights.

Keywords: women's rights, human rights, devepoling countries, discrimination, international law.

THE IMPACT OF DIGITAL TRANSFORMATION ON LEGAL PRACTICE IN BOSNIA AND HERZEGOVINA-CHALLENGES, ADVANTAGES AND DIRECTIONS FOR DEVELOPMENT

Snježana Radošević

Pension and Disability Insurance Fund of the Republic of Srpska, Central Office Bijeljina, Kneza Miloša 1, 76 300 Bijeljina, Bosnia and Herzegovina, radosevicsnjezana@gmail.com

ABSTRACT

This paper examines the impact of digital transformation on legal practice in Bosnia and Herzegovina. It analyses how technological advances, including artificial intelligence (AI), digital case management systems and online legal databases, affect the efficiency, accessibility and quality of legal services. A qualitative methodology is applied, included interviews with legal professionals, analysis of legal technology implementation and a review of relevant literature. The paper highlights the benefits of digitalization, such as accelerated case management, improved communication with clients, easier access to legal information and improved legal research capabilities, but also challenges such as security risks, data protection, resistance to new technologies and the need for additional training. Finally, recommendations areprovided for legal institutions and policymakers to ensure the effective and ethical integration of digital tools into legal practice.

Keywords: digital transformation, e-justice, legal practice, Bosnia and Herzegovina, information technologies.

GESTALT PSYCHOLOGY AND THE VISUALIZATION OF LAW IN THE ERA OF ARTIFICIAL INTELLIGENCE

Živorad Rašević[1], Darjana Sredić[2], Mladen Nikolić[3]

[1]University PIM, Faculty of Law, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, rasevic71@gmail.com
[2]University PIM, Faculty of Philosophy, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, sredic50@gmail.com
[3]University „Bijeljina“, Pavlovića put 024, 76300, Bijeljina, Bosnia and Herzegovina

ABSTRACT

The use of artificial intelligence (AI) systems in the legal profession is accompanied by a particular challenge. More than in other professions, legal practitioners should understand how AI systems make decisions and critically assess the compliance of those decisions with fundamental social values such as morality, justice, the rule of law, etc. This challenge raises complex hermeneutical questions: how to mediate communication between human experience and computer-based formal logic, how to translate human language embodied in legal norms into a numerical language suitable for machine decision-making, and how to ensure that such decisions do not exceed the limits set by societal values.

This paper proposes the use of algorithmic visualization of law through the application of methods derived from Gestalt psychology as an effective means of communication equally understandable to both humans and computers. Within an interdisciplinary approach that combines methods from psychology and legal theory, the paper explains how Gestalt psychology can serve as a useful tool in the visualization of law. Furthermore, it demonstrates how the algorithmic visualization of law contributes to improved human communication and oversight of automated decision-making, while also supporting legal practitioners in constructing more persuasive arguments, and legal theorists and legislators in the logical structuring of legal norms.

Therefore, the integration of algorithmic visualization based on Gestalt psychology methods into legal education may be considered a valuable preparation for future challenges arising from the application of artificial intelligence in legal theory and practice.

Keywords: Gestalt psychology, visualization of law, algorithms, legal norms, legal hermeneutics.

CRIMINAL LAW ASPECTS OF THE JUSTICE AGAINST SPONSORS OF TERRORISM ACT (JASTA) IN U.S. LEGISLATION

Boriša Lečić, Nikola Trajković

[1]Union University, Faculty of Legal and Business Studies Dr. Lazar Vrkatić, Bulevar Oslobođenja 76, 21000 Novi Sad, Serbia, borisalecic@gmail.com, ntrajkovickk93@gmail.com

ABSTRACT

This paper examines the unique legal nature of the U.S. federal law JASTA (Justice Against Sponsors of Terrorism Act), focusing on its criminal law implications within civil litigation. While its primary objective is to enable private tort claims against foreign states, the act fundamentally redefines criminal liability standards through the doctrines of aiding and abetting terrorist acts. By analyzing recent judicial precedents from 2025 and 2026, the research explores how U.S. courts interpret the standard of „conscious and culpable participation“. Special attention is given to JASTA's conflict with the core principles of public international law, primarily the doctrine of foreign sovereign immunity, as well as the potential for reciprocal measures by other states, that could jeopardize the legal stability of international relations.

Keywords: JASTA, terrorism, sovereign immunity, criminal liability, USA, international law.

CHRONOLOGY OF TRIAD HISTORY: SECURITY AND POLITICAL ASPECTS OF THE EXISTENCE OF CHINESE SECRET SOCIETIES

Boriša Lečić[1,2], Nikola Tadić[3]

[1]Union University, Faculty of Legal and Business Studies Dr. Lazar Vrkatić, Bulevar Oslobođenja 76, 21000 Novi Sad, Serbia, borisalecic@gmail.com
[2]International University in the Brčko District of Bosnia and Herzegovina, M.Malića i I.Džindića bb, 76100 Brčko, Bosnia and Herzegovina, borisalecic@gmail.com
[3]University of Criminal Investigation and Police Studies, Cara Dušana 196, 11080 Belgrade, Serbia, nikola0tadic0@gmail.com

ABSTRACT

The history of China is inherently intertwined with the concept of secret societies, whose criminal activities have significantly shaped the social and political climate of Chinese society. Their direct involvement in rebellions and revolutions consequently threatened the security and stability of both state structures and the general population. The earliest historical sources indicate the existence of the White Lotus secret society in the 13th century, during the Yuan Dynasty, whose members were Buddhist monks. According to some authors, they represent the genesis of modern Triads. Their members were involved in numerous rebellions rooted in hardships brought about by drought, unemployment, rising poverty, and corruption. Among the superstitious Chinese populace, these crises signified that the ruler had lost the "Mandate of Heaven," which in turn necessitated a popular revolt. From these uprisings emerged the Triads—secret societies that would over time evolve into the most powerful criminal organizations in China, and subsequently, the world. On one hand, this paper will examine the emergence of rebellions and revolutions that featured secret societies, specifically the Triads, as key actors. On the other hand, it aims to present the chronology of the origin and development of the Triads, as well as the means and methods implemented by the dynasties' political leadership to eliminate this destructive phenomenon.

Keywords: Triads, White Lotus, Hongmen, Tiandihui, secret societies, criminal organizations, revolutions, rebellions.

TECHNOLOGICAL EXCLUSION AND THE REALIZATION OF HUMAN RIGHTS IN DIGITALIZED SOCIAL PROTECTION

Draško Gajić

University of Banja Luka, Faculty of Political Sciences, Bulevar vojvode Petra Bojovića 1A, 78000 Banja Luka, Bosnia and Herzegovina, drasko.gajic@fpn.unibl.org

ABSTRACT

The digitalization of social protection is increasingly presented as an instrument for improving the efficiency, accessibility and transparency of public services. However, when access to social rights becomes predominantly mediated by digital platforms, electronic procedures, databases and automated forms of decision-making, new forms of exclusion may emerge. This paper analyzes technological exclusion as a human rights issue within digitalized social protection systems. It focuses on the position of users who lack digital skills, stable internet access, adequate devices, accessible digital interfaces or institutional support in navigating digital procedures. Special attention is given to the risks that digital transformation may create for older persons, persons with disabilities, people living in poverty, rural populations and other socially vulnerable groups. The paper discusses the relationship between administrative modernization and the effective realization of human rights, particularly the principles of equality, non-discrimination, accessibility, privacy, transparency and the right to an effective remedy. The central argument is that digitalization should not replace the substantive accessibility of social protection, but should function as an additional and socially sensitive channel for exercising rights. The paper concludes that digitalized social protection requires human rights safeguards, non-digital alternatives and institutional mechanisms that prevent technological exclusion from becoming a new form of social inequality.

Keywords: social protection, human rights, technological exclusion, digitalization, social rights.

INFORMATION TECHNOLOGY
INFORMACIONE TEHNOLOGIJE

THE ROLE OF ARTIFICIAL INTELLIGENCE IN RESTRUCTURING IT JOBS: DESKILLING AND REDUCING THE NEED FOR ROUTINE TASKS IN THE FINANCIAL SECTOR

Alen Kamiš[1], Jelena Ruzic[2], Stevan Stankovski[3], Aleksandra Markovic[4]

[1]The College of Service Business, Sokolac - East Sarajevo, Cara Lazara bb, Bosnia and Herzegovina, alen@vub.edu.ba
[2]Faculty of Project and Innovation Mangement, Boze Jankovica 14, Belgarde, Republic of Serbia, jruzic45@gmail.com
[3]University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovica 6, Belgarde, Republic of Serbia, stevan@uns.ac.rs
[4]Toplicka Academy of Applied Studies - Department of Business Studies, Kralja Petra I Karadjordjevica 1, Blace, Republic of Serbia, aleksandra.markovic@vpskp.edu.rs

ABSTRACT

This paper analyzes the impact of artificial intelligence (AI) on the transformation of IT jobs in the financial sector, with a particular focus on the phenomenon of deskilling and the reduced need for routine tasks. The development of AI technologies has enabled the automation of numerous tasks that traditionally required the involvement of helpdesk staff and junior programmers. As a result, changes are occurring in the structure of employment and the competencies required.

The research is based on a survey conducted among employees in the financial sector, with the aim of examining their perception of the impact of AI on job security and the level of required skills. The results indicate that respondents recognize a reduced need for routine tasks, as well as an increased reliance on AI tools in everyday work.

The paper highlights the need for continuous development of competencies and the adaptation of educational and organizational strategies in order to mitigate the negative effects of deskilling.

Keywords: Artificial intelligence, deskilling, IT jobs, financial sector, automation.

PERFORMANCE OF SIMPLE NEURAL NETWORKS IN THE DETECTION OF RECTAL TUMORS

Edib Dobardžić[1], Ivana Mišković[2], Bećko Kasalica[1], Mladen Marinković[2], Aleksandra Bibić[3*]

[1]University of Belgrade, Faculty of Physics, Cara Dušana 13, 11000 Belgrade, Serbia, edib.dobardzic@ff.bg.ac.rs, kasalica@ff.bg.ac.rs
[2]Clinic for Radiation Oncology, Institute of Oncology and Radiology of Serbia, Pasterova 14, 11000 Belgrade, Serbia, aainv.m@gmail.com, mladen309@gmail.com
[3]University of Belgrade, Faculty of Medicine, dr Subotića starijeg, 11000 Belgrade, Serbia, aleksandra.bibic@med.bg.ac.rs

ABSTRACT

This study investigated the application of neural networks for detecting rectal tumor regions in patients using computed tomography (CT) images. The study included 138 patients, while two CT scans with a healthy rectum were included to balance the dataset, resulting in a total of 3566 images. For each image, pixel values along the contour and within the rectal region were extracted, and tissue mass density values were obtained using calibration curves. To account for variations in rectal volume, statistical distribution functions of tissue density were used. The most relevant features were selected using Mutual Information (MI) and Principal Component Analysis (PCA). These data were then used to train different neural network architectures, including layer configurations such as n–2n–n–1 and n–2n–4n–2n–n–1, where n represents the number of input features, which ranged from three to seven. We trained the networks with batch sizes of 1, 11, 107, and 1069, and evaluated their performance based on sensitivity and specificity.We observed the highest accuracy (~79%) with a 4–8–4–1 network, batch size 1069, and 4 PCA-selected features. The highest sensitivity (~85%) was achieved with 6–12–24–12–6–1 and 4–16–8–4–1 networks (batch size 1), using 6 PCA-selected features in the first and 4 MI-selected features in the second. We recorded the highest specificity (~80%) for the 4–8–4–1 network with batch size 1069 and 4 PCA-selected features.

Keywords: neural networks, rectal tumor detection, computed tomography, feature selection, Mutual Information, Principal Component Analysis.

PROBABILITY ASSESSMENT OF RECTAL TUMOR PRESENCE USING CLASSICAL MACHINE LEARNING ALGORITHMS

Aleksandra Bibić[1], Ivana Mišković[2], Mira Sarvan[3], Mladen Marinković[2], Edib Dobardžić[3]

[1]University of Belgrade, Faculty of Medicine, dr Subotića starijeg, 11000 Belgrade, Serbia, aleksandra.bibic@med.bg.ac.rs
[2]Clinic for Radiation Oncology, Institute of Oncology and Radiology of Serbia, Pasterova 14, 11000 Belgrade, Serbia, aainv.m@gmail.com, mladen309@gmail.com
[3] University of Belgrade, Faculty of Physics, Cara Dušana 13, 11000 Belgrade, Serbia, miras@ff.bg.ac.rs, edib.dobardzic@ff.bg.ac.rs

ABSTRACT

The aim of this study was to investigate the application of classical machine learning algorithms for the detection of rectal tumors on computed tomography (CT) images of patients following neoadjuvant chemoradiotherapy. The study included 138 patients, of whom 136 had a confirmed tumor, while two subjects with a healthy rectum were included to balance the dataset. We extracted CT slices in which a portion of the rectum was visualized, resulting in a dataset of 3566 images. Due to variations in rectal volume, statistical distribution functions of tissue density along the contour and within the interior of the segmented region were used as input features. The most relevant features were selected using feature selection and dimensionality reduction methods, namely Mutual Information (MI) and Principal Component Analysis (PCA), and used for training and testing multiple machine learning algorithms. We used several machine learning algorithms: Logistic Regression (LR), Linear Discriminant Analysis (LDA), Support Vector Machines (SVM), Classification and Regression Trees (CART), Naive Bayes (NB), k-Nearest Neighbors (KNN), and Random Forest (RF). We trained all models on the same feature sets, and evaluated their performance using sensitivity and specificity, which are crucial in medical diagnostics. We achieved the highest accuracy (~80%) using RF models trained on six and seven features selected by MI. We obtained the highest sensitivity (~85%) with RF and NB models using seven features. We observed that specificity was highest for the LDA model with three features and the RF model with seven features (~80%).

Keywords: rectal tumor detection, computed tomography, machine learning, feature selection.

SYNTHETIC MEDIA AS A THREAT TO CRISIS COMMUNICATION: AI-GENERATED VIDEOS, DISINFORMATION, AND ALGORITHMIC AMPLIFICATION IN EMERGENCY SITUATIONS

Ljilja Šikman[1*], Isidora Kojić[2], Biljana Vranješ[3], Đorđe Stojisavljević[4], Aleksandar Gaćina[4]

[1*]University of Banjaluka, Faculty of Technology, Bulevar vojvode Stepe Stepanovića 73, 78000 Banjaluka, Bosnia and Herzegovina, ljilja.sikman@tf.unibl.org
[2]University of Banjaluka, Faculty of security science, Bulevar vojvode Živojina Mišića 10A, 78000 Banjaluka, Bosnia and Herzegovina, isidora.kojic@fbn.unibl.org
[3]University of Banjaluka, Faculty of Mechanical Engineering, Bulevar vojvode Stepe Stepanovića 71, 78000 Banjaluka, Bosnia and Herzegovina, biljana.vranjes@mf.unibl.org
[4]University of Banjaluka, University Computer Center, Bulevar vojvode Petra Bojovića 1A, 78000 Banjaluka Bosnia and Herzegovina, djordje.stojisavljevic@unibl.org, aleksandar.gacina@unibl.org

ABSTRACT

The development of generative artificial intelligence and its multimodal capabilities—particularly in the domain of producing realistic video content and synthesized speech—constitutes one of the most significant contemporary threats to effective crisis communication. This paper examines the ways in which AI-generated video and audio content function as vectors of disinformation in the context of natural disasters and crisis situations, and analyzes the mechanisms of their algorithmic dissemination across platforms such as TikTok, YouTube, Instagram, and X (Twitter). Adopting a theoretical-analytical approach, and combining a review of relevant academic literature, reports by international organizations, and case studies—including Hurricane Melisa and the associated AI-generated viral content—the paper maps the key risks this phenomenon poses to crisis management. Particular attention is devoted to the psychological mechanisms that render AI-generated visual and auditory content especially persuasive under conditions of heightened anxiety, as well as to institutional and technological responses to these threats. These include synthetic media detection tools, regulatory frameworks such as the EU AI Act and the Digital Services Act, and the C2PA initiative for digital media authenticity verification.

The paper concludes that there is no single technical solution capable of effectively suppressing the spread of AI-generated disinformation in real time, and that a comprehensive approach is required—one that integrates technological tools, regulatory measures, proactive institutional communication, and investment in public digital literacy.

Keywords: generative artificial intelligence, deepfake, crisis communication, disinformation, crisis management

RFID-BASED IOT SYSTEM FOR WIRELESS IDENTIFICATION

Milan Vesković[1*], Veljko Ćorić[2], Srđan Nogo[3]

[1]University of Kragujevac, Faculty of technical sciences, Svetog Save 65, 32000 Čačak, Serbia
[2]Active Electrical Engineering Teachers, Technical school Čačak, Čačak, Serbia,
milan.veskovic@ftn.kg.ac.rs
[3]University of East Sarajevo, Faculty of Electrical Engineering, Vuka Karadžića 30, 71123 East Sarajevo, Bosnia and Hercegovina

ABSTRACT

This paper examines the development and application of integrated circuits for wireless communication in IoT networks, with a particular focus on their role in the design and implementation of practical low-power systems. The theoretical part of the paper addresses the fundamental concepts of IoT architecture, the principles of wireless communication, and the role of integrated communication circuits in device connectivity, data acquisition, and remote system control. Special attention is devoted to the analysis of the characteristics of low-power microcontrollers and communication modules, as well as their application in smart infrastructure solutions.

The practical part of the paper includes the design and implementation of a toll-gate system prototype based on the Arduino UNO R3 platform, representing an example of an IoT device with wireless user identification. The system uses an RFID integrated circuit for contactless communication and authentication, a servo motor for mechanical barrier control, and an LCD display for user interaction. Before the physical prototype was implemented, a system simulation was developed in the Tinkercad environment, enabling verification of the operating logic, sequence of actions, and system behaviour under controlled conditions.

Based on the simulation, a physical prototype was developed, confirming the correctness of communication between the integrated circuits, as well as the functionality of the system under real operating conditions. The obtained results show that it is possible to implement a reliable and energy-efficient IoT system using simple and widely available integrated circuits. The paper emphasizes the importance of integrating hardware and software components in the development of IoT solutions and indicates the potential application of such systems in smart traffic and automated infrastructure.

Keywords: Internet of Things, low-power integrated circuits, System-on-Chip, duty cycling, energy efficiency.

REGULATORY FRAGMENTATION AND CYBER RISK MANAGEMENT IN BOSNIA AND HERZEGOVINA: BETWEEN FORMAL HARMONIZATION AND OPERATIONAL RESILIENCE

Muhamed Ćosić[1*], Edin Alić[2]

[1]Unversity PIM, Faculty of Computer Sciences, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, drmuhamedcosic@gmail.com
University of Vitez, Školska 23, 72270 Travnik, Bosnia and Herzegovina, edin.alic@unvi.edu.ba

ABSTRACT

The relationship between formal regulatory harmonization and actual cyber resilience in Bosnia and Herzegovina is examined within the context of the contemporary regulatory model of the European Union. Through the GDPR and NIS2, the EU has established a cyber risk management system based on risk assessment, incident reporting obligations, supervision, and managerial accountability. This framework is further developed through sectoral and horizontal acts such as DORA, the CER Directive, the Cybersecurity Act, and the Cyber Resilience Act. In 2025, Bosnia and Herzegovina adopted a new Law on Personal Data Protection, marking a significant step toward alignment with European standards and the normative modernization of the domestic regulatory framework. However, normative modernization alone does not guarantee a higher level of cyber resilience. The complex constitutional structure, fragmentation of competences, the absence of a unified cybersecurity framework, and uneven institutional capacities create an implementation gap between prescribed obligations and their actual enforcement. The analysis shows that resilience depends on effective coordination, professionally and technically capable supervision, operational CERT/CSIRT capacities, a standardized incident reporting system, and the clear integration of cyber risk into organizational governance structures. Without institutional strengthening, functional inter-institutional cooperation, and consistent enforcement of regulations, harmonization remains largely formal, while actual cyber resilience remains limited, partial, and unevenly developed.

Keywords: cybersecurity, regulatory fragmentation, GDPR, NIS2, Bosnia and Herzegovina, Personal Data Protection Agency (AZLP), CERT/CSIRT, risk management.

DEEP NEURAL NETWORKS FOR SCOLIOSIS DETECTION AND ANALYSIS: A LITERATURE REVIEW

Dijana Stojić, Vanja Luković, Dejan Vujičić

University of Kragujevac, Faculty of Technical Sciences in Čačak, Svetog Save 65, 32000 Čačak, Serbia, dijana.stojic@ftn.kg.ac.rs

ABSTRACT

Scoliosis affects 2–3% of the population, and manual measurement using the Cobb angle — the gold standard since 1948 — is subject to interobserver variability and too slow for use in large-scale screening programs.

This paper presents a systematic review of the application of deep neural networks (DNNs) in scoliosis detection and analysis through an examination of relevant literature published between 2015 and 2024 from the PubMed, IEEE Xplore, Scopus, and Web of Science databases. Various architectures were considered — ranging from classical convolutional neural networks and encoder–decoder models to Transformer and hybrid CNN–Transformer approaches — together with key datasets, evaluation metrics, and open challenges in the field.

Technical progress is both visible and measurable: recent literature reports that hybrid CNN–Transformer models achieve Cobb angle estimation errors approaching the level of disagreement between two experienced radiologists. Nevertheless, most published models have been tested exclusively on data from their institution of origin, raising a serious concern regarding external validity — it remains unclear whether these models would perform equally well in another hospital, using different imaging equipment and involving different patient populations. This remains one of the key open questions in the field and a major direction for future research.

Keywords: deep learning, convolutional neural networks, scoliosis, Cobb angle, medical image analysis, literature review.

AUTOMATA AS COALGEBRAS IN CATEGORY OF MATRICES

Nada Damljanović[1], Vučelja Lekić[1], Katarina Pavlović[1], Ljubica Đurović[2]

[1]Univerzitet u Kragujevcu, Fakultet tehničkih nauka u Čačku, Svetog Save 65, 32000 Čačak, Srbija, nada.damljanovic@ftn.kg.ac.rs, vucelja.lekic@ftn.kg.ac.rs, katarina.tasic@ftn.kg.ac.rs
[2]University of Kragujevac, Faculty of Science, Radoja Domanovića 12, 34000 Kragujevac, Srbija, ljubica.milevic@pmf.kg.ac.rs

ABSTRACT

This paper considers automata as models of systems used for information processing and computational execution. Special attention is devoted to the coalgebraic approach and the category of matrices as modern methods for the formal description of dynamic and state-based systems. By viewing automata as coalgebras, it becomes possible to model system behavior through sets of states and transitions while emphasizing behavioral equivalence. On the other hand, the category of matrices provides a natural algebraic framework for representing transitions, relations, and weights between states. The combination of these approaches establishes a unified theoretical model suitable for the analysis of finite, probabilistic, and weighted automata, as well as for applications in formal verification, communication protocols, and programming language theory. The results indicate that the coalgebraic interpretation within the category of matrices enables a deeper understanding of the structure and behavior of computational systems, thereby connecting automata theory with modern developments in computer science.

Keywords: Automaton, coalgebra, category of matrices.

DESIGN METHODOLOGY FOR FUZZY LOGIC CONTROLLERS

Nada Damljanović, Vučelja Lekić, Katarina Pavlović, Mladen Janjić

[1]University of Kragujevac, Faculty of Technical Sciences Čačak, Svetog Save 65, 32000 Čačak, Srbija, nada.damljanovic@ftn.kg.ac.rs, vucelja.lekic@ftn.kg.ac.rs, katarina.tasic@ftn.kg.ac.rs, mladen.janjic@ftn.kg.ac.rs

ABSTRACT

The paper presents an insight into the mathematical basis of fuzzy linguistic modeling and discusses the sensitivity of fuzzy rule-based systems with respect to membership function parameters, rule structure, and inference mechanisms. Examples with different inference models are analyzed and compared in order to illustrate their influence on the behavior and performance of fuzzy systems. Particular attention is devoted to the effects of parameter variations on system stability, robustness, accuracy, and interpretability. The study highlights the importance of sensitivity analysis in the design of reliable fuzzy controllers.

Keywords: Fuzzy logic, linguistic variable, inference, controller.

ENGINEERING, TECHNOLOGY AND MATERIALS
INŽENJERSTVO, TEHNOLOGIJE I MATERIJALI

PHYSICOCHEMICAL AND SENSORY CHARACTERIZATION OF HONEY AND ITS ADULTERANTS

Ana Velemir*, Snježana Mandić, Danica Savanović, Aleksandar Savić, Predrag Janković

University of Banja Luka, Faculty of Technology, Bulevar S.Stepanović 73, Banja Luka, Republic of Srpska, Bosnia and Herzegovina, ana.velemir@tf.unibl.org

ABSTRACT

The honey market in Bosnia and Herzegovina faces significant challenges regarding product authenticity and quality control. The lack of a well-regulated inspection system, combined with limited consumer awareness, creates favorable conditions for the distribution of adulterated products. This study examined 25 samples in total: 10 honey samples within their declared shelf life, 7 samples older than three years, 3 commercially available samples suspected of adulteration, and 5 laboratory-prepared adulterants consisting of inverted sugar syrups with varying proportions of honey and tartaric acid. Physicochemical analysis included determination of sugar content, ash content, water content, total acidity, hydroxymethylfurfural (HMF) concentration, and electrical conductivity, conducted in accordance with applicable regulations. Sensory evaluation was performed using descriptive testing methods by trained assessors. Only four of the ten samples within shelf life were in accordance with all chemical parameters, while the remaining six exhibited elevated HMF values, excessive moisture, or increased acidity. All samples older than three years showed markedly elevated HMF content (174–1478 mg/kg). Two of the three suspected commercial samples were confirmed as adulterated by chemical analysis, and none passed sensory evaluation. All laboratory adulterants failed chemical testing, while sensory evaluation identified them as adulterated in only 55% of cases. Overall, two-thirds of declared honey samples were sensorily accepted, while fewer than half were chemically correct. The findings demonstrate that current prescribed analytical methods are insufficient to guarantee honey authenticity, and the introduction of additional detection methods along with stricter market surveillance is strongly recommended.

Keywords: honey, adulteration, quality control, physicochemical analysis, sensory evaluation.

POSTMORTEM PH AND TEMPERATURE DYNAMICS IN PORK HAM UNDER CONVENTIONAL CHILLING

Ana Velemir*, Snježana Mandić, Danica Savanović, Aleksandar Savić, Sanja Resanović

University of Banja Luka, Faculty of Technology, Bulevar S.Stepanović 73, Banja Luka, Republic of Srpska, Bosnia and Herzegovina, ana.velemir@tf.unibl.org

ABSTRACT

Meat quality is largely determined by post mortem biochemical processes, particularly the rate and extent of pH decrease resulting from glycogen conversion to lactic acid. The intensity of these changes depends on the animal's genetic background, pre-slaughter conditions, and the technology applied during slaughter and chilling. This study investigated the effect of conventional chilling on pH value and temperature changes in the *Semimembranosus muscle* of 15 randomly selected pork carcass halves, measured at 30 minutes, and 1, 2, 4, 24, 48, and 72 hours post mortem. Measuring of pH and temperature were recorded using a portable pH meter equipped with a calibrated glass insertion electrode. Results showed that, at 30 minutes post mortem, pH value was 6.33 with a muscle temperature of 29.74°C. A progressive decrease in pH was observed at all time points, reaching a mean of 5.61 24 hours post mortem, with temperatures dropping by an average of 4.15 °C. After 48 hours, pH value was 5.98, and after 72 hours, the mean pH stabilized at 5.54. The study confirmed that under conventional chilling, the required internal temperature of 7°C in the ham is reached 24 hours post mortem, which consequently extends the overall pork production process. The results support the conclusion that pH measurement post mortem represents a reliable method for meat quality classification and selection for further processing or sale.

Keywords: *Semimembranosus* muscle, post mortem changes, pH values, temperature, conventional chilling.

EFFECT OF TURMERIC (*CURCUMA LONGA* L.) ON SENSORY PROPERTIES OF FRESH CHEESE

Danica Savanović[1*], Ana Velemir[1], Aleksandar Savić[1], Jovo Savanović[2], Milana Kecman[1]

[1]University of Banja Luka, Faculty of Technology, Vojvode Stepe Stepanovića 73, 78000 Banja Luka, Bosnia and Herzegovina, danica.savanovic@tf.unibl.org
[2]Higher School "Banja Luka College", Miloša Obilića 30, 78000 Banja Luka, Bosnia and Herzegovina

ABSTRACT

The aim of this study was to evaluate the sensory quality and acceptability of fresh cheese enriched with turmeric (*Curcuma longa* L.) and curry (a spice mixture containing turmeric). The cheese was produced by heat-acid coagulation of cow's milk at 85°C with the addition of 0.3% citric acid. Five samples were analyzed: a control sample and four experimental samples with the addition of turmeric and curry at concentrations of 0.5% and 1.0%. Sensory analysis was performed using a descriptive method, where appearance, colour, odour, flavour, and consistency were evaluated using a 1–5 scale. The results showed that samples with 0.5% turmeric achieved the highest scores among the experimental samples, maintaining a pleasant texture along with a mild, characteristic flavour and acceptable appearance. In contrast, higher concentrations (1.0% turmeric and 1.0% curry) received lower scores due to overly intense colour and flavour. Curry-enriched samples showed slightly softer consistency, with the 1.0% curry sample receiving the lowest overall sensory score. The sensory colour evaluation indicated that the yellow colour of the sample with 1.0% turmeric was too intense and could negatively affect acceptability. Based on the obtained results, it can be concluded that the addition of turmeric at moderate concentrations (0.5%) is sensorially acceptable, contributing to product distinctiveness without compromising texture. For curry-containing samples, due to their pronounced impact on odour, flavour intensity, and consistency, concentrations below 0.5% are recommended.

Keywords: sensory analysis, turmeric, curry, fresh cheese.

INFLUENCE OF SELECTED PLANT ADDITIVES ON THE FATTY ACID PROFILE OF TRADITIONAL JANJ CHEESE

Danica Savanović[1*], Ana Velemir[1], Aleksandar Savić[1], Jovo Savanović[2], Branislav Šojić[3], Vesna Muždeka[1]

[1]University of Banja Luka, Faculty of Technology, Vojvode Stepe Stepanovića 73, 78000 Banja Luka, Bosnia and Herzegovina, danica.savanovic@tf.unibl.org
[2]Higher School "Banja Luka College", Miloša Obilića 30, 78000 Banja Luka, Bosnia and Herzegovina
[3]University of Novi Sad, Faculty of Technology, Boulevard cara Lazara 1, 21102 Novi Sad, Serbia

ABSTRACT

Janj cheese is a traditional dairy product produced from raw cow's milk in the mountainous Janj region of Bosnia and Herzegovina, where cattle are mainly fed on natural mountain pastures. This study investigated the effect of adding selected plant additives (oregano, basil, parsley, rosemary, and chives) at a concentration of 0.50% on the fatty acid composition of Janj cheese. Six cheese samples were produced, including one control sample without additives and five experimental samples with plant additions. Fatty acid composition was determined by gas chromatography with flame ionization detection (GC–FID), and data were analyzed using one-way ANOVA at $p<0.05$. The results showed that saturated fatty acids (SFA) were dominant in all samples (59.44–61.48%), with palmitic (C16:0), stearic (C18:0), and myristic acid (C14:0) as the most abundant. Monounsaturated fatty acids (MUFA) ranged from 33.39% to 34.86%, with oleic acid (C18:1) as the major component. Polyunsaturated fatty acids (PUFA) ranged from 4.81% to 6.52%, with linoleic (C18:2) and α-linolenic acid (C18:3 n3) as the major components. α-Linolenic acid was markedly higher in most treated samples compared to the control, indicating a potential nutritional benefit of plant enrichment. Lipid quality indices (atherogenic index (AI), thrombogenic index (TI), h/H ratio, and desirable fatty acids (DFA)) showed slight modifications in treated samples, indicating subtle changes in lipid nutritional quality. These findings suggest that the addition of plant additives at 0.50% can slightly modify the fatty acid profile of Janj cheese, particularly contributing to an increase in the n-3 PUFA fraction.

Keywords: Janj cheese, plant additives, fatty acids, lipid quality indices.

ANTIFUNGAL EFFECTS OF ROSEMARY ESSENTIAL OIL IN PHYLLO PASTRY PROTECTION

Dragana Plavšić[1*], Dragan Psodorov[2], Ljubiša Šarić[1], Ana Varga[1], Ivana Čabarkapa[1], Olja Todorić[1], Zorica Tomičić[1]

[1]Institute of Food Technology, University of Novi Sad, Bulevar cara Lazara 1, 21 000 Novi Sad, Serbia, dragana.plavsic@fins.uns.ac.rs
[2]College of Professional Studies – ICEPS - International Centre of Professional Studies, Cvećarska 2, 21 000 Novi Sad, Serbia

ABSTRACT

The aim of this study was to investigate the effects of application rosemary essential oil in the antifungal protection of phyllo pastry made from type 500 wheat flour and phyllo pastry with the addition of 10% whole wheat flour.

The phyllo pastry were stored and examined at intervals of 0, 5, 7, 14 and 21 days at a temperature of 8°C. The examinations included mycological analyses to determine the total mold count and the identification of isolated species.

The mycopopulation of the samples of phyllo pastry made from type 500 wheat flour and those with the addition of 10% whole wheat flour, without the addition of essential oil, was classified into 3 genera and 4 species: *P. aurantiogriseum*, *P. expansum*, *A. candidus* and *C. cladosporioides*,

When rosemary essential oil was applied at concentrations of 2.13%, it exhibited the best antifungal effects on the examined phyllo pastry made from type 500 wheat flour during 7 days of storage. The greatest differences in the total mold count of the phyllo pastry compared to the control samples were observed, being 1.5 log cfu/g. When rosemary essential oil was applied at concentrations of 2.13%, it exhibited the best antifungal effects on the examined phyllo pastry with the addition of 10% whole wheat flour during 14 days of storage. The greatest differences in the total mold count of the phyllo pastry compared to the control samples were observed, being 1.1 log cfu/g.

These studies represent the base for further research on the effects of essential oils on other bakery products using different concentrations, combinations of essential oils, as well as combinations of essential oils with various packaging conditions.

Keywords: molds, rosemary essential oil, antifungal protection, phyllo pastry.

Acknowledgements

This research was financially supported by Ministry of Science, Technological Development and Innovation Republic of Serbia, Institute of Food Technology in Novi Sad (Grant Number: 451-03-33/2026-03/200222).

SOXHLET DEFATTING AND ITS EFFECT ON THE ANTIOXIDANT CAPACITY OF COLD-PRESSED OILSEED CAKES

Tanja Krunić

University of Belgrade, Innovation Center of the Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia, tkrunic@tmf.bg.ac.rs

ABSTRACT

Cold pressing of oilseeds such as poppy, pumpkin, and sesame yields high-quality edible oils and generates nutritionally rich oilseed cakes that retain a certain proportion of residual oil. This study aimed to quantify the residual oil content in cold-pressed poppy, sesame, and pumpkin seed cakes and to evaluate the effect of its complete removal by Soxhlet extraction on their antioxidant capacity. The results showed that the highest proportion of residual oil remained in pumpkin seed cake, while the lowest was found in sesame cake. In terms of antioxidant properties, poppy seed cake exhibited the highest antioxidant capacity, whereas sesame cake showed the lowest. Following Soxhlet defatting, antioxidant capacity increased in all samples. The most pronounced enhancement was recorded in poppy seed cake, while the smallest increase was observed in pumpkin seed cake. These findings indicate that the removal of residual oil contributes to an improvement in antioxidant capacity; however, this effect is not directly proportional to the amount of oil removed. Although pumpkin seed cake contained the highest residual oil content and underwent the greatest degree of oil extraction, it exhibited the least change in antioxidant activity. This suggests that factors other than residual oil content, such as the composition of phenolic compounds, play a significant role in determining the antioxidant potential of defatted oilseed cakes. Overall, Soxhlet defatting can be considered a useful step in enhancing the functional properties of oilseed cakes, supporting their potential application as value-added ingredients in food and nutraceutical formulations.

Keywords: pumpkin seed, sesame, poppy seed, DPPH, ABTS.

EFFECT OF FLAXSEED–BASED HYDROGEL COMPOSITION ON MECHANICAL PROPERTIES OF EXTRUDED MICROSPHERS

Tanja Krunić[1*], Nataša Obradović[2]

[1]University of Belgrade, Innovation Center of the Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia, tkrunic@tmf.bg.ac.rs
[2]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia, ntomovic@tmf.bg.ac.rs

ABSTRACT

Encapsulating probiotics within hydrogels is a promising approach to enhancing their protection and stability. Mechanical properties and structural integrity of hydrogels play a crucial role in maintaining carrier functionality during processing and application. In this study, the mechanical properties of hydrogels based on flaxseed cake, alginate, and pectin were investigated, together with the effect of fermentation on their strength. Probiotics were immobilized by the extrusion technique, producing seven types of spherical particles (alginate-pectin, alginate-pectin-flaxseed, alginate-flaxseed, different ratios, and alginate-flaxseed mucilage different ratios) with an average diameter of approximately 2.8 mm. Results showed that the addition of pectin to alginate improved the mechanical properties of hydrogels more than the addition of flaxseed cake or flaxseed mucilage, while the optimal composition was achieved with a flaxseed mucilage to alginate ratio of 35:100. Increasing alginate concentration in flaxseed mucilage reduced hydrogel firmness from 0.525 to 0.120 N. Fermentation affected particle strength differently depending on hydrogel composition, indicating a strong influence of fermentation on hydrogel structure and intermolecular interactions among components. Fermentation caused a pronounced weakening of alginate-pectin hydrogel from 0.622 to 0.229 N (63% reduction in firmness), indicating substantial disruption of its gel network, while alginate-flaxseed showed improved structural integrity after fermentation from 0.279 to 0.470 N, suggesting greater matrix tolerance or even reinforcement under fermentation conditions. These findings highlight the importance of formulation design and fermentation in tailoring hydrogel properties for probiotic immobilization and suggest significant potential for developing stable, functional delivery systems.

Keywords: encapsulation, alginate, pectin, probiotic, flaxseed cake.

ULTRASOUND-ASSISTED EXTRACTION OF AMYGDALIN FROM WASTE PLUM KERNELS

Anita Jović[1*], Milan Đorić[1,2], Viktorija Petković[1], Biljana Đorđević[1], Milan Kostić[1], Marija Miladinović[1], Olivera Stamenković[1]

[1]University of Niš, Faculty of Technology, Bulevar Oslobodjenja 124, 16000 Leskovac, Serbia, anitajovic64@gmail.com, petkovicviktorija89@gmail.com, djbiljana89@gmail.com, milankostic285@yahoo.com, marijamiladi@gmail.com, oliverastam@yahoo.com
[2]The Academy of applied technical and preschool studies Niš -department of Vranje, Filipa Filipovića 20, Vranje, Serbia, djoricmilan98@gmail.com

ABSTRACT

Amygdalin, a cyanogenic glycoside predominantly found in the seeds of stone fruits such as plums, apricots, and peaches, has long been recognized for its potential antitumor properties. The biological activity of amygdalin is attributed to the selective release of hydrocyanic acid, which exhibits cytotoxicity toward cancer cells. Given that extraction efficiency is highly dependent on process parameters, developing optimized methods for amygdalin recovery remains a significant challenge. This study investigates the efficacy of lactic acid as a solvent, combined with ultrasound-assisted extraction (UAE), for recovering amygdalin from waste plum kernels. The performance of UAE (180 W, 40 kHz) was compared against conventional extraction (magnetic stirring, 500 rpm). Both methods were conducted at a kernel-to-solvent ratio of 1:15 w/v, a temperature of 30 °C, and a duration of 30 min. Furthermore, the efficiency of lactic acid was benchmarked against ethanol. Results showed that amygdalin yields using lactic acid reached 40.6% via UAE and 32.8% via conventional extraction. In stark contrast, ethanol yields were significantly lower, reaching only 0.8% and 0.07% for UAE and conventional extraction, respectively. These findings demonstrate that lactic acid is a highly effective and promising green solvent for amygdalin extraction, particularly when integrated with process intensification techniques such as ultrasound.

Keywords: amygdalin, lactic acid, plum kernels, ultrasonic extraction.

Acknowledgements

This work was supported by the Republic of Serbia - Ministry of Science, Technological Development and Innovations of Serbia, Programs for Financing Scientific Research Work, No. 451-03-34/2026-03/200133 (Project assigned to the Faculty of Technology, Leskovac, University of Niš).

DEEP EUTECTIC SOLVENT-ASSISTED BIODIESEL PRODUCTION FROM PLUM KERNEL OIL: IMPACT ON REACTION RATE AND FUEL QUALITY

Anita Jović*, Viktorija Petković, Biljana Đorđević, Milan Kostić, Marija Miladinović, Olivera Stamenković

University of Niš, Faculty of Technology, Bulevar Oslobodjenja 124, 16000 Leskovac, Serbia, anitajovic64@gmail.com, petkovicviktorija89@gmail.com, djbiljana89@gmail.com, milankostic285@yahoo.com, marijamiladi@gmail.com, oliverastam@yahoo.com

ABSTRACT

Plum kernel oil (PKO) is a promising feedstock for biodiesel production as it is obtained from plum kernels that are a significant by-product of the fruit processing industry. The kernels contain a high oil content (up to 46.9%) with a favorable fatty acid profile dominated by oleic acid (over 70%). This study investigates the effect of the deep eutectic solvent (DES) triethanolamine:menthol (TEA:M, 1:2 mol/mol) on the reaction rate of PKO methanolysis and the resulting biodiesel properties. The reaction was catalyzed by 35CaO/CFA-Z (35% CaO supported on coal fly ash-derived zeolite). The oil was recovered using a screw press with an 8 mm nozzle. Methanolysis was conducted at 60 °C, with a 6:1 methanol-to-oil molar ratio, and 9% catalyst and 5% DES (by oil mass). The addition of TEA:M significantly accelerated the process, achieving a fatty acid methyl ester (FAME) content of 98.4% within 75 min, compared to a mere 7.7% without the DES. The resulting biodiesel exhibited a density of 867 kg/m³, kinematic viscosity of 3.92 mm²/s, acid number of 0.33 mg KOH/g, iodine value of 99.3 g I_2/100 g, and water content of 255 mg/kg. The FAME, mono- (MAG), di-(DAG), and triacylglycerol (TAG) contents were 98.25%, 0%, 0.20%, and 0.11%, respectively. All properties complied with the EN 14214 standard and were comparable to biodiesel produced without DES. Consequently, TEA:M is recommended as an effective additive to accelerate PKO methanolysis without compromising fuel quality.

Keywords: biodiesel, deep eutectic solvent, methanolysis, physicochemical properties, plum kernel oil.

Acknowledgements

This work was supported by the Republic of Serbia - Ministry of Science, Technological Development and Innovations of Serbia, Programs for Financing Scientific Research Work, No. 451-03-34/2026-03/200133 (Project assigned to the Faculty of Technology, Leskovac, University of Niš).

DOES PECTIN METHYLATION MODULATE ITS ANTIMICROBIAL POTENTIAL? INSIGHTS FROM MOLECULAR DOCKING

Marija M. Petković Benazzouz[1*], Jelena B. Martinov Nestorov[2], Goran V. Janjić[3], Sara V. Ristić[1], Katarina M. Miletić[1]

[1]University of Belgrade, Faculty of Physics, Studentski trg 12-16, 11001 Belgrade, Serbia, marijapetkovic@ff.bg.ac.rs, sara.ristic.f@gmail.com,
[2]University of Belgrade, Faculty of Medicine, dr Subotića starijeg 8, 11000 Belgrade, Serbia, jelenamartinov@yahoo.com
[3]University of Belgrade, Institute od Chemistry, Technology and Methallurgy, National Institute of the Republic of Serbia, Njegoševa 12, 11000 Beograd, Serbia, goran.janjic@ihtm.bg.ac.rs

ABSTRACT

Pectin is widely studied due to its favorable physicochemical properties, biocompatibility, and non-toxic nature. Methylation of pectin represents a natural structural modification occurring within plant cell walls and is considered part of the defense mechanism against microbial pathogens.

In this study, molecular docking analysis was performed to evaluate whether the degree of methylation influences the predicted antimicrobial activity of pectin derivatives. Four model compounds consisting of three α-1,4-linked D-galacturonic acid units were investigated: non-methylated, mono-methylated, di-methylated and fully methylated derivatives. The negatively charged derivatives (pKa ≈ 3.5) differ in the number of esterified carboxyl groups, while the fully methylated compound is neutral due to complete esterification. Prior to docking, all structures were optimized at the ωB97XD/def2-TZVP level of theory. Docking simulations were carried out against selected microbial protein targets, including *Salmonella Typhi* TtsA, *Pseudomonas aeruginosa* Earp, *Streptococcus mutans* MetE, and *Staphylococcus aureus* Cas9. The analysis focused on predicted binding modes, interaction patterns, and the potential influence of methylation on ligand–protein recognition. The results suggest that variations in methylation do not significantly alter binding site preference or predicted binding affinity among the investigated derivatives. Notably, the fully methylated derivative exhibited distinct binding behavior in the case of *Streptococcus mutans* MetE.

Keywords: pectin; methylation; antimicrobial activity; molecular docking.

Acknowledgment

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contracts No. 451-03-136/2025-03/200026 and 451-03-137/2025-03/200162).

ADVANCED IONIC-LIQUID-BASED HYDRAULIC FLUIDS: FROM MOLECULAR DESIGN TO SUSTAINABLE HIGH-PERFORMANCE SYSTEMS

Milan Vraneš, Andrija Vukov, Teona Teodora Borović, Jovana Selak, Snežana Papović, Sara Klimenta

University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, milan.vranes@dh.uns.ac.rs, andrija.vukov@dh.uns.ac.rs, teona@dh.uns.ac.rs, snezana.papovic@dh.uns.ac.rs, saraklimenta@hotmail.com

ABSTRACT

Hydraulic fluids are essential for power transmission, lubrication, cooling and corrosion protection in modern mechanical systems. Although petroleum-based hydraulic oils are still widely used, their flammability, limited thermal stability, environmental persistence and dependence on complex additive packages motivate the search for safer and more sustainable alternatives. Ionic liquids represent a promising class of next-generation functional fluids due to their negligible vapor pressure, high thermal stability, tunable structure and excellent lubrication potential.

This contribution discusses the role and perspectives of ionic liquids as advanced hydraulic fluids, with emphasis on the relationship between molecular structure, physicochemical properties and practical performance. Particular attention is given to ionic-liquid–water systems and protic ionic liquids that can be prepared by simple acid–base neutralization directly in aqueous media. Such formulations may combine the favorable heat-transfer properties of water with the lubricating, anti-wear and anticorrosive effects of ionic species.

The main advantages of ionic liquids include reduced volatility and flammability, improved lubricity, adjustable viscosity, low compressibility and potential formation of protective interfacial layers on metal surfaces. Selected formulations may also improve thermal management through higher heat capacity and thermal conductivity than conventional mineral oils. However, challenges related to production cost, viscosity optimization, biodegradability, toxicity and compatibility with seals and metals still limit their wider application.

Overall, ionic liquids should be considered not only as alternative solvents, but as programmable engineering fluids with significant potential for the development of safer, more efficient and more sustainable hydraulic systems.

Keywords: ionic liquids, hydraulic fluids, green solvents, tribology, sustainable engineering fluids.

Acknowledgements

The authors would like to acknowledge the contributions of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia for grants No. 451-03-33/2026-03/ 200125 & 451-03-34/2026-03/ 200125.

EFFECT OF CATIONIZATION ON THE FUNCTIONAL PROPERTIES OF STARCH

Sanda Pilipović, Tatjana Botić, Borislav N. Malinović, Tijana Đuričić, Aleksandra Borković, Dajana Dragić

University of Banja Luka, Faculty of Technology, Stepe Stepanovića 73, 78000 Banja Luka, Bosnia and Herzegovina

ABSTRACT

Native starch exhibits significant limitations in its application in the chemical, food, and pharmaceutical industries due to unfavourable properties such as low solubility, retrogradation, syneresis, thermal degradation, and high viscosity after gelatinization. To improve its functional properties and broaden its range of applications, native starch requires modification. There are numerous methods of modification, most often classified into three categories: physical, chemical, and enzymatic. Chemical modification techniques enable a wide range of functionalization without degrading the polymer chain. Cationization, as a type of chemical modification, is considered one of the most effective methods for improving starch properties. It enhances swelling power and solubility, increases water absorption capacity, improves emulsion stability, resistance to syneresis, and stability at high pH values, while reducing retrogradation tendency and gelatinization temperature. This study investigates the effect of starch cationization on swelling power (g/g), water absorption capacity (g/g), and solubility (%) of modified starch compared to native starch. The results show that even at a very low degree of cationization, these properties determined at room temperature can be improved. The swelling power of cationic starch synthesized at a temperature of 50 °C for 2.5 h can be increased up to 16.5 times, and the water absorption capacity about 25.5 times. Solubility also changes significantly. After modification, about one quarter of the starch mass became water-soluble, whereas the native starch before modification contained only 1.66% of water-soluble components.

Keywords: native starch, cationization, swelling power, water absorption, solubility.

TREATMENT OF TEXTILE DYE WASTEWATER BY SOLAR-POWERED ELECTROOXIDATION

Tijana Đuričić[1], Borislav N. Malinović[1], Draženko Bjelić[1], Aleksandra Borković[1], Dajana Dragić[1], Sanda Pilipović[1], Tatjana Vulić[2]

[1]University of Banja Luka, Faculty of Technology, Stepe Stepanovića 73, 78000 Banja Luka, Bosnia and Herzegovina, tijana.djuricic@tf.unibl.org, borislav.malinovic@tf.unibl.org, borislav.malinovic@tf.unibl.org, aleksandra.borkovic@tf.unibl.org, dajana.dragic@tf.unibl.org, sanda.pilipovic@tf.unibl.org
[2]University of Novi Sad, Faculty of Technology, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia, tvulic@uns.ac.rs

ABSTRACT

Wastewaters represent one of the biggest problems today as they contain many pollutants, some of which are well-known pollutants, while there are also those whose impact on human health and the ecosystem has not been fully investigated. There are many persistent pollutants that cannot be removed by conventional wastewater treatment technologies, which causes great concern regarding their impact on human health. For this reason, the study, development and implementation of advanced technologies in wastewater treatment are of great importance. In recent years, new advanced oxidation processes based on electrochemical technology - electrochemical advanced oxidation processes (EAOPs), have been developed for the treatment of persistent pollutants. EAOPs are known not only as very efficient technologies but also as large consumers of electricity. In this research EAOP were used for the treatment of textile dye wastewater. In order to eliminate their biggest drawback, instead of being powered by the distribution network, the electrochemical reactor was powered by solar panel. A battery was used to store the energy obtained from the solar panel to ensure continuous operation and avoid energy fluctuations. The key parameters that affect the efficiency of the process, the economic feasibility and the potential for real-scale application were examined.

Keywords: green energy, EAOPs, electrooxidation, dye removal.

Acknowledgments

This work was supported by the Environmental Protection and Energy Efficiency Fund of the Republic of Srpska trough the grant 2.01.1-1790-2/23 and the Ministry of Scientific and Technological Development and Higher Education of Republic of Srpska trough the grant 19.032/431-1-98/23

EVALUATION OF THE PERFORMANCE OF COMMERCIAL BAKING PAPERS ON THE BIH MARKET

Aleksandra Borković[1], Tatjana Botić[1], Sanja Vovčuk[2], Draženko Bjelić[1*], Dijana Drljača[1]

[1]Faculty of Technology, University of Banja Luka, Stepe Stepanovića 73, 78 000 Banja Luka, Bosnia and Herzegovina, drazenko.bjelic@tf.unibl.org, tatjana.botic@tf.unibl.org,
[2]D i S EUROSTANDARD d.o.o. Prnjavor, Magistralni put bb, 78 430, Prnjavor, Bosnia and Herzegovina

ABSTRACT

In the paper, the properties of paper intended for baking food were tested, with the aim of evaluating its functionality and quality in practical application. Five commercially available samples from the market of Bosnia and Herzegovina were analyzed. The tests included basic physical-chemical and mechanical parameters as well as functional properties such as absorption power and thermal stability. FTIR spectroscopy was used to identify the type of coating on the paper. The results of these expressions showed significant differences among the tested samples. Samples with higher silicon content showed lower absorption power and better resistance to fat penetration, which was also confirmed by practical baking tests. On the other hand, the mechanical properties were not directly proportional to the coating content, which indicates the influence of the quality of the underlying cellulosic structure. Thermal tests showed the stability of all samples up to 220 °C, while material degradation occurs at higher temperatures. The quality and quantity of the silicone coating play a key role in the functionality of greaseproof paper, especially in terms of the ease of separation of sweet and savory dough and resistance to grease, while the overall mechanical properties also depend on the characteristics of the base paper.

Keywords: baking paper, silicone coating, FTIR spectroscopy, thermal stability, physical-mechanical properties

RESEARCH OF PROCEDURAL MODALITIES OF INVESTIGATING SAFETY INCIDENTS IN THE BUSINESS SYSTEM

Biljana Vranješ[1], Ljilja Šikman[2], Mile Vajkić[3], Đorđe Stojisavljević[4], Bojana Zoraja[5]

[1]University of Banja Luka - Faculty of Mechanical Engineering, Bulevar vojvode Stepe Stepanovića 71, Banja Luka, B&H, biljana.vranjes@mf.unibl.org
[2]University of Banja Luka - Faculty of Technology, Bulevar vojvode Stepe Stepanovića 73, Banja Luka, B&H, ljilja.sikman@tf.unibl.org
[3]Secondary school center Laktaši, Svetozara Markovića 15, Laktaši, B&H
[4]University of Banja Luka - University Computer Center, Bulevar vojvode Petra Bojovića 1A, Banja Luka, B&H, djordje.stojisavljevic@unibl.org
[5]University of Novi Sad - Faculty of Technical Sciences, Trg Dositeja Obradovića 6, Novi Sad, Serbia

ABSTRACT

The goal of occupational safety is to protect employees from unfavorable working conditions in the working environment, i.e. from the consequences of the realization of the present dangers and harmfulness in the working environment, which are manifested in the form of injuries at work and occupational diseases. This is achieved by designing preventive measures for occupational safety in order to reduce to the smallest possible measure the risks for safety and health at work and by designing corrective measures for protection after the realization of incident situations. The choice and effectiveness of designing corrective measures in the field of occupational safety depends on the way of investigating incident situations and determining the cause, i.e. factors that led to the realization of such events.

This paper presents the research conducted in business entities of the region on the perception of the need to investigate incidents in the field of occupational safety, operational procedures for investigating such events, as well as possible consequences for the business system. Also, the factors that are the most common causes of incident events in the field of occupational safety were identified in order to improve the investigation procedures of these incidents through the design of corrective measures.

The improvement of the occupational safety system in the business system should go in the direction of building an adequate information system that will enable the monitoring of all relevant factors important for the occupational safety system. This approach should ensure a more efficient investigation of incidents in the field of occupational safety, identification of the causes of their occurrence, and the design of preventive and corrective measures. In conditions of accelerated development and use of information technologies and artificial intelligence in many areas, they also find their place in the field of occupational safety. The implementation of these technologies in occupational safety systems should contribute to the implementation and development of sustainable occupational safety systems, and within them new modalities of investigation of incident situations.

Keywords: occupational safety, incident situation, investigation.

SEISMIC EFFECTS OF BLASTING AND THEIR INFLUENCE ON THE STABILITY OF SLOPES IN SURFACE MINES

Radmila Karanakova Stefanovska, Zoran Panov, Risto Popovski, Blagica Doneva

Goce Delcev University, Faculty of Natural and Technical Sciences, Krste Misirkov 10-A, 2000 Stip, North Macedonia, radmila.karanakova@ugd.edu.mk, zoran.panov@ugd.edu.mk, risto.popovski@ugd.edu.mk, blagica.doneva@ugd.edu.mk

ABSTRACT

Blasting represents a fundamental technological operation in the surface exploitation of mineral resources, however, it also generates dynamic loads that can effect on the stability of bench slopes. During mass blasting operations in open pit mines, seismic vibrations are generated, leading to damage in the rock mass and the formation of secondary fractures that propagate into the depth of the rock massif. This process disturbs the equilibrium state of the rock mass and consequently affects the bench slopes. This paper analyzes the seismic effects of explosive blasting and their influence on the geomechanical stability of slopes in an open pit mines.

Keywords: blasting, seismic effects, seismic waves, slope stability, open pit mines.

UNDERGROUND COAL GASIFICATION: FROM CONCEPT TO COMMERCIAL APPLICATION

Radmila Karanakova Stefanovska, Zoran Panov, Risto Popovski, Blagica Doneva

Goce Delcev University, Faculty of Natural and Technical Sciences, Krste Misirkov 10-A, 2000 Stip, North Macedonia, radmila.karanakova@ugd.edu.mk, zoran.panov@ugd.edu.mk, risto.popovski@ugd.edu.mk, blagica.doneva@ugd.edu.mk

ABSTRACT

Ensuring a reliable and sustainable energy supply represents one of the most critical environmental, economic and societal challenges of the 21st century. Despite the accelerated transition to renewable energy sources, fossil fuels- especially coal are expected to remain a significant energy component in the foreseeable future. Researches indicates a continued increase in coal demand, underscoring the necessity for more efficient, economically viable, and environmentally acceptable utilization technologies. Underground coal gasification has emerged as a promising in situ technology that enables the exploitation of deep, thin, or otherwise uneconomic coal seams that are not accessible through conventional mining technologies. A lot of researches point to the potential advantages of UCG over traditional coal mining technologies, including higher recovery rates, reduced land degradation, improved economic performance, and potentially lower greenhouse gas emissions, especially when it is integrated with carbon capture and storage (CCS) technologies. This paper provides a comprehensive overview of the current state of UCG development globally, where we can critically analyze the technological maturity, its economic viability and environmental implications.

Keywords: underground coal gasification, clean coal technology, CCS, ecology, coal.

A COMPUTATIONALLY EFFICIENT ALGORITHM FOR ACCURATE PHASOR ESTIMATION IN THE PRESENCE OF DECAYING DC COMPONENT IN FAULT CURRENT SIGNALS

Dimitrije Rozgić, Predrag Petrović

University of Kragujevac, Faculty of Technical Sciences Čačak, Svetog Save 65, 32102 Čačak, Sebia,
dimitrije.rozgic@ftn.kg.ac.rs

ABSTRACT

This paper presents a novel and computationally efficient algorithm for improving the accuracy of phasor estimation in the presence of a decaying DC (DDC) component in fault current signals of transmission lines. In digital protective relays, the Discrete Fourier Transform (DFT) is widely employed for estimating the fundamental frequency phasor. However, the presence of a DDC component—typically introduced due to asymmetrical fault conditions and system inductance—can significantly degrade estimation accuracy, leading to errors in both magnitude and phase. The proposed algorithm mitigates the adverse effects of the DDC component by introducing a two-step correction procedure. In the first step, the fault current samples are cumulatively summed over a one-period data window, which is then shifted sample-by-sample across the signal to generate a sequence of aggregated values. In the second step, a logarithmic transformation is applied to these values to estimate the parameters of the DDC component analytically. The method requires only N+4 samples, where N corresponds to one fundamental period, making it suitable for real-time implementation in protective relays with limited computational resources. Unlike conventional filtering or compensation techniques, the proposed approach enables direct analytical extraction of DDC parameters without iterative procedures. The algorithm has been validated using computer-generated fault signals, demonstrating strong robustness against measurement noise and higher-order harmonics. These characteristics make the method particularly attractive for high-speed and reliable protection schemes in modern power systems.

Keywords: Phasor estimation, fault current, Discrete Fourier Transform (DFT), decaying DC component (DDC), logarithmic transformation, protective relays.

INTEGRATED THERMAL KINETICS AND MOLECULAR DOCKING ANALYSIS OF *ARBUTUS UNEDO* POLYPHENOLS FOR ANTIDIABETIC APPLICATIONS

Luka Golubović[1], Đurica Katnić[1*], Ognjen Todorović[1], Marija Milenković[1], Aleksandra A. Rakić[2], Milena Marinović Cincović[1], Slavica Porobić Katnić[1]

[1]University of Belgrade, VINČA Institute of Nuclear Sciences - National Institute of the Republic of Serbia, Mike Petrovića Alasa 12-14, 11001 Belgrade, Serbia, luka.golubovic@vin.bg.ac.rs, djurica.katnic@vin.bg.ac.rs, ognjen.todorovic@vin.bg.ac.rs, marija.kojic@vin.bg.ac.rs, milena@vin.bg.ac.rs, slavicaporobic@vin.bg.ac.rs
[2]University of Belgrade, Faculty of Physical Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia, saska@ffh.bg.ac.rs

ABSTRACT

Arbutus unedo L. is a Mediterranean species rich in bioactive polyphenols, including gallic acid, catechin, quercetin, and arbutin, which exhibit pronounced inhibitory activity toward α-glucosidase and α-amylase, often exceeding that of the standard antidiabetic drug Acarbose. However, the practical valorization of phytotherapeutic formulations based on *A. unedo* is limited by the thermal lability of its polyphenolic constituents, affecting stability during drying, extraction, formulation, and storage.

In this work, the thermal behavior of *A. unedo* fruit was investigated by thermogravimetric analysis (TGA) under inert and oxidative atmospheres at multiple heating rates. The kinetics of thermal and thermo-oxidative degradation were evaluated using four complementary isoconversion methods: Kissinger–Akahira–Sunose (KAS), Ozawa–Flynn–Wall (OFW), Starink, and Kissinger, through activation energies as a function of conversion. The variation of activation energy revealed distinct degradation phases, attributed to moisture and volatile loss, degradation of phenolic and sugar constituents, and carbonization reactions. The agreement among the four methods confirms the reliability of the obtained kinetic parameters, while comparison between inert and oxidative regimes highlights the role of oxygen in accelerating polyphenol degradation.

In parallel, molecular docking of the major polyphenols of *A. unedo*, previously characterized by UPLC–MS, was performed with the crystal structures of α-glucosidase and α-amylase, and binding affinities were compared with that of Acarbose. The integration of experimentally determined thermal stability with computationally predicted enzyme affinity enables ranking of polyphenols according to both criteria, providing a rational basis for selecting candidates for stable phytotherapeutic formulations based on *A. unedo.*

Keywords: Thermal kinetics, molecular docking, antidiabetic, thermogravimetry.

THERMAL PROPERTIES OF IRRADIATED POLYOLEFIN BLENDS FOR WASTE RECYCLING

Đurica Katnić[1], Ognjen Todorović[1], Luka Golubović[1], Snezana Brkovic[1], Slavica Porobić-Katnić[1], Marija Milenković[1], Milena Marinović-Cincović[1*]

[1]University of Belgrade, Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia, Mike Petrovića Alasa 12-14, Belgrade, djurica.katnic@vin.bg.ac.rs, ognjen.todorovic@vin.bg.ac.rs, luka.golubovic@vin.bg.ac.rs, snezana.miulovic@vin.bg.ac.rs, slavicaporobic@vin.bg.ac.rs, , marija.kojic@vin.bg.ac.rs, milena@vin.bg.ac.rs

ABSTRACT

This study investigates the influence of gamma irradiation on the thermal properties of polyolefins and polymer blends, aimed at improving polyolefin waste recycling. In addition to binary blends of isotactic polypropylene (iPP) and low-density polyethylene (LDPE), several commercial polymer samples were analyzed, including neat LDPE, neat iPP, iPP containing the antioxidant additive Irganox, red-colored iPP, and black-colored high-density polyethylene (HDPE). The study also aimed to evaluate the influence of pigments and additives on radiation-induced changes in thermal behavior of analysed materials. The investigated iPP/LDPE blends with different compositions and commercial polymers were exposed to gamma radiation using a ^{60}Co source at room temperature in air. All samples were irradiated at absorbed doses of 50, 100, and 150 kGy. Thermogravimetric analysis (TG), differential thermal analysis (DTA), and differential scanning calorimetry (DSC) were used to evaluate radiation-induced changes regarding thermal stability and phase transition behavior. The investigated parameters included melting temperature (Tm), crystallization temperature (Tc), heat capacity (Cp), melting enthalpy (Hm), and degree of crystallinity. DSC results showed a general trend of decreasing melting temperature and heat capacity with increasing radiation dose across the investigated polyolefin systems. These changes are associated with competing mechanisms of polymer crosslinking and macromolecular degradation caused by radiation-induced free radical formation within crystalline and amorphous regions of the polymer structure. The obtained results contribute to a better understanding of the thermal behavior of irradiated polyolefin materials and demonstrate the importance of radiation dose optimization for advanced recycling and modification of polymer-based packaging materials.

Keywords: Gamma irradiation, polyolefin blends, polymer degradation, thermal stability, iPP, LDPE.

INNOVATIVE APPROACH TO SAMPLING OF MICROPLASTICS IN THE MARINE ENVIRONMENT

Filip Radunović[1], Špiro Ivošević[1], Neven Cukrov[2]

[1]University of Montenegro, Faculty of Maritime Studies Kotor, Put I Bokeljske brigade 44, 85330 Kotor, Montenegro, fradunovic02@gmail.com, spiroi@ucg.ac.me,
[2]Ruđer Bošković Institute, Bijenička 55, 10000 Zagreb, Croatia, spiroi@ucg.ac.me

ABSTRACT

MARPOL recognises various types of marine pollution, including oil, garbage, sewage, and greenhouse gases pollutions. Garbage-sourced microplastics (MP), due to their small size and high resistance coupled with their chronic biological effects, pose a serious omnipresent environmental threat. This paper's research was motivated by the lack of methodology innovations in the field of sea environment monitoring and sampling of MPs.

Traditionally, microplastic sampling was conducted using big manta-ray nets, requiring deployment from motor-propelled vessels. Driving the question of possible usage of manta-ray net in combination with unmanned vehicles for a more economical, eco-friendly, flexible and precise approach. The innovative contribution of this research is highlighted through the design of a mini manta-ray net, successfully integrated on Remotely Operated Underwater Vehicles (ROV). Mini manta-ray was constructed in accordance with all relevant technical specifications using a special 300 micron net. First, the prototype was constructed for preliminary testing of structural integrity and stability. Based on experience and the results of preliminary prototype testing, the construction of the final product was used for our first MP sampling using an ROV. Sample of 1.5 liters of seawater obtained from the filtration of 5000 liters of seawater was then sent for laboratory analysis to evaluate system functionality under realistic operational conditions.

Practical testing confirmed stable and functional operational integration of mini manta-ray with ROV. From good water worthiness to positive results from laboratory analysis, indicating reliable sampling performance. The results show realistic functionality and potential for further improvements and optimization of the sampling of microplastics by ROV.

Keywords: Microplastics (MP), Innovative, Mini manta-ray net, Remotely Operated Underwater Vehicles (ROV).

OPTIMIZATION OF INDUSTRIAL DESIGN PROCESSES AND MATERIAL COMPOSITION FOR SUSTAINABLE DESIGN

Nevena Vukić[1], Jovana Krstović[1], Darina Dupláková[2], Nemanja Dopsaj[3]

[1]University of Kragujevac, Faculty of Technical Sciences Čačak, Svetog Save 65, Čačak, Serbia, nevena.vukic@gmail.com
[2]Technical University of Košice, Faculty of Manufacturing Technologies with a seat in Prešov, Institute of Advanced Technologies, Prešov, Slovakia, d.duplakova@gmail.com
[3]Crafton, Dr Dragiše Mišovića 169, Čačak, Serbia

ABSTRACT

Sustainable product development has become one of the central challenges of modern society, requiring the integration of environmental and functional aspects throughout the entire design process. The development of distinctive and competitive sustainable industrial designs plays a significant role in high-value-added production. This paper analyzes how industrial design can contribute to product sustainability with special attention to the role of materials and composite systems in achieving a balance between mechanical performance, aesthetics, and environmental requirements. The study combines theoretical analysis with a selected case study from practice in order to identify key strategies for optimizing sustainable product development. For this purpose, the design and development of concrete washbasins were selected. Specially formulated concrete mixtures were developed to achieve an optimal balance between aesthetics, functionality and sustainability. The cast concrete provided high strength, low porosity, and a refined tactile aesthetic. The material composition was enhanced with high-quality pigments and additives, enabling control of color, texture, and surface finish. The results indicate that interdisciplinary collaboration between industrial design, materials engineering, and manufacturing processes is essential for the successful implementation of sustainable design approaches. The presented findings contribute to a broader understanding of how the integration of innovation, advanced materials, and creative design strategies can support environmentally responsible industrial design and promote sustainable innovation in product development.

Keywords: sustainability, industrial design, materials, product development, eco design.

NATURAL SCIENCES
PRIRODNE NAUKE

GREEN APPROACH TO VALORIZATION OF TANGERINE PEEL WASTE: NADES-ASSISTED EXTRACTION AND PROCESS INTENSIFICATION FOR RECOVERY OF BIOACTIVE COMPOUNDS

Aleksandra Cvetanović Kljakić[1*], Biljana Lončar[1], Mirjana Petronijević[1], Jelena Arsenijević[2], Sanja Panić[1], Slavica Ražić[2]

[1]University of Novi Sad, Faculty of Technology Novi Sad, Bulevar cara Lazara 1, Novi Sad, Serbia, a.c.istrazivac@gmail.com, biljanacurcicc@gmail.com, petronijevic84mirjana@gmail.com, sanjar@tf.uns.ac.rs
[2]University of Belgrade, Faculty of Pharmacy, Vojvode Stepe 450, Belgrade, Serbia, jelena.arsenijevic@pharmacy.bg.ac.rs, slavica.razic@pharmacy.bg.ac.rs

ABSTRACT

Tangerine peel is a substantial source of underutilized biomass rich in bioactive constituents, particularly phenolic compounds and flavonoids. The increasing generation of this agro-industrial waste poses environmental and management challenges, necessitating the development of sustainable and efficient valorization strategies. In this study, bioactive compounds were extracted from tangerine peel using natural deep eutectic solvents (NADES), composed of naturally derived components, as alternative extraction media. Two NADES systems (glycerol:fructose (4:1) and choline chloride:glycerol (1:2)) were applied in maceration at room temperature and at 80 °C), while aqueous extractions were conducted using ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE) as process intensification techniques. The results indicate that both the extraction technique and the solvent significantly influence the composition and antioxidant activity of the extracts. The highest total phenolic content (TPC) was recorded in MAE (0.022 mg GAE/mg), confirming the high efficiency of microwave technology due to intensive heating and improved mass transfer. In contrast, NADES systems showed lower TPC and total flavonoid content (TFC) values, but significantly better antioxidant activity, indicating selective extraction of more potent antioxidant components. Differences between the two NADES systems, may be due to different polarity and intermolecular interactions which affect the extraction of specific phenolic compounds. Elevated temperature during maceration led to a slight increase in TPC with a variable impact on antioxidant activity, indicating a possible degradation of thermolabile components. Overall, NADES systems show a high potential for extracting more biologically active components, while MAE is superior in terms of total yield of phenolic compounds.

Keywords: agricultural waste, tangerine peel, NADES, green extraction, phenolic compounds, antioxidant activity.

Acknowledgements

This research was supported by the Science Fund of the Republic of Serbia, #GRANT No 7464, Novel Bio-linked Magnetite/geopolymer Composites in Phenol-containing Wastewater Treatment: Toward Zero-waste Technology - BioCompWaterClean.

FROM WASTE TO BIOACTIVITY: UNLOCKING THE POTENTIAL OF SWEET CHERRY PIT EXTRACTS VIA MICROWAVE AND ULTRASOUND-ASSISTED EXTRACTION

Aleksandra Cvetanović Kljakić[1*], Pavle Mašković[2], Jelena Mašković[2]

[1]University of Novi Sad, Faculty of Technology Novi Sad, Bulevar cara Lazara 1, Novi Sad, Serbia, a.c.istrazivac@gmail.com
[2]University of Kragujevac, Faculty of Agriculture, Cara Dušana 34, Čačak, Serbia, pavlemaskovic@yahoo.com, jelenav@kg.ac.rs

ABSTRACT

Sweet cherry pits, a significant fraction of agro-industrial bio-waste, are often underutilized despite their richness in bioactive compounds. In line with sustainable resource management and circular economy principles, their valorization using green extraction techniques has gained attention. Microwave-assisted extraction (MAE) and ultrasound-assisted extraction (UAE) are advanced methods that allow efficient recovery of bioactive compounds through reduced extraction time, lower solvent use, and enhanced mass transfer. In this study, dried and ground sweet cherry pits were extracted using MAE (70% ethanol, SSR 1:5, 30 min, 600 W) and UAE (70% ethanol, SSR 1:5, 30 min, 40 kHz). Extracts were evaluated for antioxidant, antimicrobial, and cytotoxic activities. Antioxidant potential was assessed using five complementary assays (DPPH, ABTS, OH, lipid peroxidation inhibition, and total antioxidant activity), showing no significant differences between MAE and UAE, with only minor variations. Pronounced differences were observed in cytotoxic activity, where UAE extracts exhibited significantly lower IC_{50} values, indicating stronger antiproliferative effects. This is likely due to ultrasound-assisted extraction favoring thermolabile and highly bioactive compounds. Conversely, UAE extracts displayed markedly weaker antimicrobial activity, with substantially higher MIC values for all tested microorganisms (e.g., *Proteus mirabilis* 625 µg/mL vs. 4.88 µg/mL for MAE; *Staphylococcus aureus* and *Escherichia coli* 312.5 µg/mL vs. 19.53 µg/mL). Overall, MAE proved more effective for antimicrobial activity, while UAE showed superior cytotoxic potential. These results confirm that cherry pits are a valuable source of bioactive compounds and that modern green extraction techniques provide an efficient strategy to convert bio-waste into high-value products with diverse biological applications.

Keywords: Sweet cherry pits, agro-industrial bio-waste, sustainable development, bioactive compounds, micowave extraction, ultrasound extraction.

Acknowledgements

This research was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Programm No#451-03-33/2026-03/ 200134).

FROM LABORATORY TO PUBLIC: HOW BIOLOGISTS TRANSLATE COMPLEX SCIENCE RESEARCH FOR PUBLIC UNDERSTANING

Ajla Vejzović

Science communication specialist, Sarajevo, Bosnia and Herzegovina, ajla@wayzux.com

ABSTRACT

Information about health and what to use is everywhere, the question is how to know if it is accurate?

As health information reaches consumers progressively via digital marketing and social media, an accurate explanation of complex scientific research is crucial yet lacking. This paper combines a literature review with comparative analysis to find out how biologists can contribute to simplifying health science for public audiences. It includes existing research on science communication challenges, health literacy, and misinformation bubbles, and reflects on their practical implications in health and wellness marketing.

Through case examples, I demonstrate how a background in life sciences helps identify pseudoscience, evaluate research quality, and explain complex topics clearly. Challenges include balancing accuracy with consumer engagement and navigating pressure from the commercial sector. Findings suggest biologists serve as "knowledge brokers" between research and public understanding, offering frameworks for using scientific rigor in commercial contexts while improving consumer health literacy and reducing misinformation in health marketing.

Keywords: science communication, evidence-based marketing, healthy literacy, biological expertise, public health

EFFECT OF IONIZATION ON NICOTINE'S HYDRATION BEHAVIOUR

Andrija Vukov[1], Bojan Šarac[2], Domen Goste[2], Teona Teodora Borović[1], Jovana Selak[1], Snežana Papović[1], Milan Vraneš[1]

[1]University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection , Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, andrija.vukov@dh.uns.ac.rs
[2] University of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113, 1000 Ljubljana, Slovenia

ABSTRACT

Nicotine is a naturally occurring bicyclic alkaloid, composed of a pyridine ring connected to a pyrrolidine ring. Possessing two heterocyclic nitrogen atoms, it behaves like a dibasic compound in water. The pyrrolidine nitrogen has a pKa of approximately 8.0 while the pyridine nitrogen has a pKa of 3.12-3.41. Therefore, at physiological pH of 7.4 about 69% percent is in a protonated form, while in some extreme regions of the body, such as the stomach (pH≈1,5-3,5), > 99% is in a diprotonated form. As the human body is a water medium, where water interaction is a major driver of molecular behaviour and distribution, understanding the differences in hydration behaviour between non-ionic, mono- and diprotonated forms of nicotine can elucidate it's biological activity within the body.

Nicotine, along with two synthesised nicotinium salts: nicotinium bromide and nicotinium dibromide were examined as water solutions. Measurements of density, sound velocity and viscosity of a series of aqueous solutions with a molality range of 0,02 to 0,25 mol/kg and at temperatures ranging 20-40 °C were performed. The results were interpreted in terms of solute/solute and solute/solvent interactions. The ionisation of nicotine significantly changes it's hydration behaviour, impacting characteristics such as solute/solvent interactions, structure making or breaking behaviour, hydration numbers and even taste. Differences between mono- and diprotonated forms were also observed. These findings underscore the critical role of ionization state in determining molecular behavior in aqueous systems and highlight its importance in evaluating substances for biological applications..

Keywords: Nicotine, ionization, hydration, density, acoustics, viscosity.

Acknowledgements

The authors would like to acknowledge the contributions of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia for the Doctoral Stipend for Andrija Vukov No. 451-418/2024-03/3324 and for grants No. 451-03-33/2026-03/ 200125 & 451-03-34/2026-03/ 200125.

EFFECT OF SELECTED BIOLOGICALLY ACTIVE CO-SOLUTES ON THE HYDRATION BEHAVIOR OF METFORMIN

Jelena Macanović*, Andrija Vukov, Teona Teodora Borović, Jovana Selak, Snežana Papović, Milan Vraneš

University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, andrija.vukov@dh.uns.ac.rs

ABSTRACT

Metformin is a first-line therapeutic agent for the management of Type 2 *diabetes mellitus*, owing to its well-balanced efficacy, safety profile, and affordability. As with all pharmacologically active compounds, understanding its behavior in aqueous environments is essential, particularly in the presence of additional components that may influence its properties. Given the wide range of molecules that may coexist with metformin in biological systems, four representative co-solutes were selected to capture different molecular classes. These include glutamine, the most abundant amino acid in the human body; sodium salicylate, representing other pharmacologically active substances; and nicotine and caffeine, chosen as commonly encountered psychoactive compounds.

To investigate their impact on metformin hydration, measurements of density, sound velocity, and viscosity were conducted. The results reveal notable variations in metformin's hydration characteristics depending on the co-solute present. These variations are reflected in parameters such as hydration numbers, taste-related properties, and structure-making or -breaking effects. Overall, the findings emphasize the importance of detailed and targeted analysis of hydration behavior to better understand and predict the physicochemical properties of pharmacologically active compounds like metformin.

Keywords: metformin, water, density, viscosity, sound velocity.

Acknowledgements

The authors would like to acknowledge the contributions of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia for the Doctoral Stipend for Andrija Vukov No. 451-418/2024-03/3324 and for grants No. 451-03-33/2026-03/ 200125 & 451-03-34/2026-03/ 200125.

ANION-DRIVEN DESIGN OF IMIDAZOLIUM-BASED IONIC LIQUIDS: INTEGRATING PHYSICOCHEMICAL PROFILING, IONICITY ANALYSIS, DFT/ADMET MODELING AND ANTIMICROBIAL PERFORMANCE

Sara Klimenta, Andrija Vukov, Teona Teodora Borović, Jovana Selak, Snežana Papović, Milan Vraneš

University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, milan.vranes@dh.uns.ac.rs,

ABSTRACT

Ionic liquids represent a highly tunable class of compounds whose physicochemical and biological properties can be modified through rational selection of cations and anions. In this study, three imidazolium-based ionic liquids containing oxychlorine anions were synthesized and characterized: 1-butyl-3-methylimidazolium chlorite, chlorate and perchlorate. The main objective was to evaluate how progressive anion oxygenation affects density, viscosity, conductivity, ionicity and antimicrobial activity.

The synthesized ionic liquids were characterized by NMR and IR spectroscopy, while density, viscosity and electrical conductivity were measured from 293.15 to 323.15 K. Density decreased linearly with temperature, whereas viscosity decreased with increasing temperature. The perchlorate-based ionic liquid showed the highest density and viscosity, suggesting stronger structural organization and reduced expansivity. Conductivity measurements revealed the highest molar conductivity for the chlorate-based ionic liquid, indicating an optimal balance between ionicity and viscous resistance. Walden analysis showed that chlorate and perchlorate ionic liquids behaved close to the ideal KCl reference line, with ionicity values above 90%, while the chlorite-based ionic liquid exhibited lower ionicity and stronger ion association.

DFT calculations supported the experimental trends by revealing specific C–H···O interactions and differences in anion charge distribution. Antimicrobial activity was tested against *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Candida guilliermondii*. The chlorite-based ionic liquid exhibited the strongest antimicrobial activity, likely due to enhanced formation of contact ion pairs or small aggregates that facilitate interactions with microbial cell envelopes.

Keywords: ionic liquids, oxychlorine anions, physicochemical properties, ionicity, antimicrobial activity, DFT calculations.

Acknowledgements

The authors would like to acknowledge the contributions of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia for grants No. 451-03-33/2026-03/ 200125 & 451-03-34/2026-03/ 200125.

COMPARATIVE STUDY OF NUMERICAL MODELS OF IONIZATION DYNAMICS IN LASER-INDUCED BREAKDOWN OF SOLIDS AND GASES

Jasna Stevanović[1], Violeta Petrović[1], Hristina Delibašić-Marković[1], Ivan Petrović[2]

[1]University of Kragujevac, Faculty of Science, Radoja Domanovića 12, 34000 Kragujevac, Serbia, jasna.stevanovic@pmf.kg.ac.rs, violeta.petrovickg@gmail.com, hristina.delibasic@pmf.kg.ac.rs
[2]Academy of Professional Studies Šumadija, Department in Kragujevac, Kosovska 8, 34000 Kragujevac, Serbia, kgivanpetrovic@gmail.com

ABSTRACT

Laser-induced breakdown in solids and gases involves complex ionization dynamics that occur on ultrafast time scales. In this work, we present a comparative review of the specific features of laser-induced breakdown (LIB) in gases and solid materials. We also present appropriate numerical approaches that allow the calculation of ionization event rates at given moments in time and for specific laser intensities (high-intensity Nd:YAG laser pulses within the 200–1064 nm wavelength range), enabling the study of the temporal evolution of a key parameter—free electron density. The influence of different parameters, such as wavelength, as well as various underlying physical phenomena, is considered. This approach makes it possible to analyze how different parameters affect laser-induced breakdown and to use that insight to predict and fine-tune laser settings for specific applications.

Keywords: numerical simulations, laser-induced breakdown, free-electron density.

Acknowledgements

Authors would like to acknowledge the support received from the Science Fund of the Republic of Serbia, #GRANT 6821, Atoms and (bio)molecules-dynamics and collisional processes on short time scale - ATMOLCOL. Our appreciation also goes to the Serbian Ministry of Education, Science and Technological Development (Agreement No. 451-03-34/2026-03/ 200122).

ENHANCEMENT OF IONIZATION RATES FORMULAS IN TUNNELING AND BARRIER-SUPPRESSION REGIMES

Jasna Stevanović[1], Violeta Petrović[1], Hristina Delibašić-Marković[1], Ivan Petrović[2]

[1]University of Kragujevac, Faculty of Science, Radoja Domanovića 12, 34000 Kragujevac, Serbia, jasna.stevanovic@pmf.kg.ac.rs, violeta.petrovickg@gmail.com, hristina.delibasic@pmf.kg.ac.rs
[2]Academy of Professional Studies Šumadija, Department in Kragujevac, Kosovska 8, 34000 Kragujevac, Serbia, kgivanpetrovic@gmail.com

ABSTRACT

The precise modeling of laser–target interactions in the regimes of tunneling ionization and barrier-suppression ionization is of significant importance, as these mechanisms dominate in the strong-field regime. In this study, we examine the dynamics of the transition from tunneling to barrier-suppression ionization by applying an empirically adapted formula. Within an enhanced analytical framework, the shift between these two ionization regimes is characterized more clearly.

While it is generally accepted that the ionization rate depends on the intensity of the applied laser field, our findings indicate that it is also influenced by the initial momentum of the outgoing electron, as well as by the laser frequency. We further demonstrate that, in addition to long-range Coulomb interactions, these effects play an important role in the strong-field ionization domain, providing a basis for exploring new mechanisms in intense laser–matter interactions.

Keywords: strong-field ionization, initial momentum, Coulomb interactions

Acknowledgements

Authors would like to acknowledge the support received from the Science Fund of the Republic of Serbia, #GRANT 6821, Atoms and (bio)molecules-dynamics and collisional processes on short time scale - ATMOLCOL. Our appreciation also goes to the Serbian Ministry of Education, Science and Technological Development (Agreement No. 451-03-34/2026-03/ 200122).

WHEN MACHINE LEARNING DOES NOT HELP: CLASSIFICATION OF RADIATION COUNTING DATA

Jelena Delibašić, Danilo Delibašić

University of Niš, Faculty of Sciences and Mathematics, Višegradska 33, 18106 Niš, Serbia,
jelena.aleksic@pmf.edu.rs, danilo.delibasic@pmf.edu.rs

ABSTRACT

Radiation measurements obtained with simple detectors are well described by Poisson counting statistics, where the mean count rate carries most of the relevant physical information. Here, we examine whether standard machine learning (ML) methods can improve the classification of radiation measurement scenarios beyond what can be achieved using basic statistical descriptors. Measurements were performed with a Geiger counter for seven distinct configurations, involving two radioactive sources of different strengths, varying source–detector distances, and shielding conditions. For each configuration, multiple samples were collected as short sequences of repeated count measurements. Several approaches were compared, including a nearest-mean classifier, Random Forests, and other standard classifiers (including distance-based and linear models). The results show that the simple nearest-mean approach consistently matches or outperforms the tested ML methods. Using the full sequence of counts or additional derived features did not lead to improved performance. This is consistent with the underlying Poisson statistics, for which the sample mean acts as a sufficient statistic for the count rate. These results illustrate a practical limitation of ML in settings where the data-generating process is well understood and dominated by simple statistical structure.

Keywords: radiation detection, machine learning, Poisson process, classification, Geiger counter.

CIRCADIAN RHYTHM DYNAMICS UNDER HEAVY METAL-INDUCED ABIOTIC STRESS IN PLANTS

Marija M. Petković Benazzouz[1*], Sara V. Ristić[1], Mošić S. Miloš[1], Jelena P. Bogosavljević Lipovac[2], Katarina M. Miletić[1]

[1]University of Belgrade, Faculty of Physics, Studentski trg 12-16, 11001 Belgrade, Serbia, marijapetkovic@ff.bg.ac.rs, sara.ristic.f@gmail.com, milos.mosic@ff.bg.ac.rs, katarinamiletic@ff.bg.ac.rs
[2]University of Belgrade, Faculty of Agriculture, Nemanjina street 6, 11080, Belgrade, Serbia, jelena.bogosavljevic90@gmail.com

ABSTRACT

Heavy metal soil contamination poses an increasing threat to agricultural sustainability and food security. Identifying early physiological disturbances before visible damage occurs remains a critical challenge in plant stress research.

In this study, we present the extension of a non-destructive real-time optical monitoring platform toward the assessment of heavy metal–induced abiotic stress in plants. The method is based on the continuous tracking of the optical transmission of the leaf combined with circadian rhythm analysis as a dynamic marker of metabolic regulation.

Seedlings of edible crop plants cultivated under controlled conditions and exposed to contaminated soil exhibited measurable reorganization of circadian oscillatory behavior compared to non-stressed controls. The detected modifications involved changes in modulation of amplitude, phase coordination, and rhythm stability, reflecting stress-induced perturbations in photosynthetic and metabolic homeostasis.

These findings reinforce the concept of circadian rhythm as a functional diagnostic signature of plant physiological state and suggest that optical monitoring enables the detection of subtle stress responses at an early stage. The presented approach opens new perspectives for integrating real-time plant monitoring into environmental risk assessment and precision agriculture frameworks.

Keywords: nondestructive optical spectroscopy, circadian rhythm, heavy metal stress, abiotic stress, precision agriculture.

Acknowledgment

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contracts No. 451-03-136/2025-03/200026 and 451-03-137/2025-03/200162)

A NOVEL INAR(1) MODEL WITH TWO LATENT MARKOV PROCESSES FOR REGIME AND DISTRIBUTION PARAMETER CONTROL

Milena S. Stojanović, Teodora D. Čamagić, Aleksandar S. Nastić

University of Niš, Faculty of Sciences and Mathematics, Višegradska 33, 18000 Niš, Serbia,
milena_aleksic93@yahoo.com teodora.camagic@pmf.edu.rs aleksandar.nastic@pmf.edu.rs

ABSTRACT

The authors propose a new model for count time series based on a hybrid structure that combines an autoregressive component with an innovation-driven component, where regime selection at each time point is governed by a latent Markov process. The key novelty of the model is the introduction of an additional, independent latent process that dynamically modulates the parameters of the marginal distribution within each regime. This dual-latent structure enables a separation between the dynamic behavior of the series and its distributional characteristics, thereby achieving substantially greater flexibility in modeling complex and nonstationary processes. The proposed framework is particularly suitable for data in which both the dependence structure and the distribution evolve over time due to varying environmental regimes. In this way, the model naturally captures structural changes and heterogeneity in the data. Applications to real-world count time series demonstrate that the model effectively captures these dynamics while providing a stable and interpretable representation of the underlying process, making it suitable for a wide range of applications in discrete-time series analysis.

Keywords: random environment, INAR(1) process, modified negative binomial thinning, Markov chains, geometric marginal.

ELECTRON-IMPACT INDUCED MOLECULAR DYNAMICS WITHIN THE ATMOLCOL FRAMEWORK

Sanja Tošić[1], Vladimir A. Srećković[1], Veljko Vujčić[2]

[1]University of Belgrade, Institute of Physics Belgrade, , Pregrevica 118, Belgrade, Serbia, seka@ipb.ac.rs, vlada@ipb.ac.rs,
[2]Astronomical Observatory, Volgina 7, 1100 Belgrade, Serbia, veljko@aob.rs

ABSTRACT

Within the ATMOLCOL project, experimental investigations of electron–molecule collisions increasingly require theoretical input capable of clarifying the molecular mechanisms that lead to fragmentation. The work presented here contributes to this effort through the development of a computational model aimed at simulating fragmentation of molecular cations formed from their ground-state electronic configurations. The primary scattering event is not treated explicitly. Instead, attention is directed to the nuclear dynamics that follow electronic perturbation, under internal energy conditions consistent with experimentally accessible regimes. Molecular dynamics simulations are used to examine dissociation pathways, locate transition structures, and estimate the corresponding activation energies. Particular care is devoted to numerical stability and to ensuring that the identified fragmentation channels are not artifacts of trajectory sampling or insufficient exploration of the potential energy surface. At the current stage, the methodology is tested on the N_2^+ molecular cation as a representative diatomic benchmark system. Although structurally simple, this system provides a controlled reference for analyzing bond cleavage and verifying energy conservation during dynamical propagation. It also allows systematic assessment of the model before extension to larger polyatomic molecules, where energy redistribution and competing pathways are expected to become more intricate. This work represents a methodological contribution toward a quantitative description of radiation-induced molecular fragmentation within ATMOLCOL project.

Keywords: electron–molecule collisions, fragmentation pathways, molecular dynamics, short-time processes.

Acknowledgments

This research was supported by the Science Fund of the Republic Serbia, Grant No. 6821, ATMOLCOL.

ENERGY THRESHOLDS AND DYNAMICAL REGIMES IN ELECTRON-IMPACT IONIZED MOLECULAR CATIONS

Sanja Tošić[1], Vladimir A. Srećković[1], Veljko Vujčić[2]

[1]University of Belgrade, Institute of Physics Belgrade, , Pregrevica 118, Belgrade, Serbian, seka@ipb.ac.rs, vlada@ipb.ac.rs
[2]Astronomical Observatory, Volgina 7, 1100 Belgrade, Serbia, veljko@aob.rs

ABSTRACT

Fragmentation of molecular cations formed by electron-impact ionization is governed primarily by the redistribution of internal energy deposited during the collision event. A detailed understanding of how this energy drives the transition from bound vibrational motion to irreversible bond cleavage is essential for interpreting energy-resolved fragmentation measurements. In this work, we analyze the dependence of dissociation behavior on internal energy using a controlled diatomic benchmark system. Electron-impact ionization is represented through controlled initialization of internal energy on the molecular cation potential energy surface, followed by classical propagation of the nuclear motion. The study focuses on identifying effective dissociation thresholds, characterizing near-threshold dynamical regimes, and examining the scaling of fragmentation times with increasing internal energy. Ensemble simulations are employed to determine dissociation probability as a function of deposited energy and to analyze the redistribution between kinetic and potential energy during bond stretching. The results provide a physically transparent description of energy-driven molecular breakup and offer a reference for interpreting energy-dependent fragmentation phenomena investigated within the ATMOLCOL project.

Keywords: energy redistribution, dissociation threshold, electron-impact ionization, molecular dynamics, fragmentation dynamics.

Acknowledgments

This research was supported by the Science Fund of the Republic Serbia, Grant No. 6821, ATMOLCOL.

EFFECT OF *B*-DIKETONATE ON GERMINATION AND EARLY SEEDLING GROWTH OF *TRIFOLIUM PRATENSE* L. IN INLET AND OUTLET WASTEWATER FROM THE CVETOJEVAC TREATMENT SYSTEM

Snežana Branković[1]*, Radmila Glišić[2], Rastko Ajtić[3], Glorija Ćirković[4], Nenad Joksimović[5], Jelena Bogosavljević Lipovac[6], Filip Grbović[7]

[1,2,3,4,7] University of Kragujevac, Faculty of Science, Department of Biology and Ecology, Radoja Domanovića 12, Kragujevac, Republic of Serbia, snezana.brankovic@pmf.kg.ac.rs; radmila.glisic@pmf.kg.ac.rs; filip.grbovic@pmf.kg.ac.rs; rastko.ajtic@pmf.kg.ac.rs; glorija.cirkovic@pmf.kg.ac.rs

[5]University of Kragujevac, Faculty of Science, Department of Chemistry, Radoja Domanovića 12, Kragujevac, Republic of Serbia, nenad.joksimovic@pmf.kg.ac.rs

[6] University of Belgrade, Faculty of Agriculture; Nemanjina 6, 11080, Belgrade, Republic of Serbia, jelena.bogosavljevic@agrif.bg.ac.rs

ABSTRACT

This study examined the effect of *β*-diketonate on the germination and early seedling growth of *Trifolium pratense* L. exposed to water samples from the Cvetojevac wastewater treatment system in Kragujevac. The experiment used a bioassay approach and included the following treatments: control, inlet wastewater, outlet wastewater, *β*-diketonate solution at a concentration of 50 mg/L, inlet wastewater combined with *β*-diketonate, and outlet wastewater combined with *β*-diketonate. The results showed that the greatest root length of *T. pratense* seedlings was recorded in the treatment with outlet wastewater and *β*-diketonate, while the greatest hypocotyl length was observed in the treatment with inlet wastewater and *β*-diketonate. Statistically significant differences in root length were found between the control and *β*-diketonate treatment, between the control and combined treatments, and between the combined treatments containing inlet and outlet wastewater. Significant differences in hypocotyl length were also observed among treatments, particularly among outlet wastewater, *β*-diketonate alone, and outlet wastewater combined with *β*-diketonate. The responses recorded in the combined treatments suggest possible stimulatory interactions between *β*-diketonate and wastewater constituents, although a true synergistic effect cannot be confirmed at this stage. These findings indicate that *β*-diketonate may influence early plant development under wastewater-related conditions and may be relevant for further phytoremediation-oriented studies and integrated wastewater management approaches. Further research should include additional plant species, different *β*-diketonate concentrations, chemical characterisation of the treated water, and assessment of pollutant mobility and bioavailability.

Keywords: *β*-diketonate, *Trifolium pratense* L., wastewater, seed germination, seedling growth, phytoremediation, wastewater treatment.

INFLUENCE OF PB AND CD ON GERMINATION AND ROOT GROWTH OF *TRIFOLIUM PRATENSE* L. IN TREATMENTS WITH *B*-DIKETONATE

Filip Grbović[1], Radmila Glišić[2], Slađan Adžić[3], Kristina Luković[4], Aleksandra Rakonjac[5], Marija Marin[6], Snežana Branković[7*]

[1,2,7] University of Kragujevac, Faculty of Science, Department of Biology and Ecology, Radoja Domanovića 12, Kragujevac, Republic of Serbia, snezana.brankovic@pmf.kg.ac.rs; radmila.glisic@pmf.kg.ac.rs; filip.grbovic@pmf.kg.ac.rs
[3,4,5] Institute for Vegetable Crops, Karađorđeva 71, Smederevska Palanka, Republic of Serbia, sadzic@institut-palanka.rs; klukovic@institut-palanka.rs; arakonjac@institut-palanka.rs
[6] University of Belgrade, Faculty of Biology, Studentski trg 16, Belgrade, Republic of Serbia, majamarin@bio.bg.ac.rs

ABSTRACT

This study examined the effects of Pb and Cd on seed germination and root growth of red clover (*Trifolium pratense* L.) under treatments with varying metal concentrations and equimolar amounts of *β*-diketonate, using an adapted bioassay method. The results showed that Pb and Cd reduced seed germination and root length in *T. pratense*. Root growth inhibition caused by Pb remained relatively stable at low and medium concentrations, while complete inhibition occurred at the highest concentration. Cd caused moderate inhibition at low concentrations and completely inhibited root growth at medium and high concentrations. The results also indicated that *β*-diketonate had selective effects depending on the metal type, metal concentration, and treatment combination. When applied alone in appropriate equimolar amounts, the synthesised *β*-diketonate promoted the highest levels of germination and root growth in the species studied, suggesting its potential to stimulate germination and early root development. In treatments combining the tested metals with equimolar amounts of *β*-diketonate, a significant reduction in the inhibition of *T. pratense* root growth was observed compared with treatments containing metals alone, indicating the potential of *β*-diketonate to mitigate the inhibitory effects of Pb and Cd. These findings highlight the potential of *β*-diketonate as a biologically active compound with possible metal-complexing capacity, plant growth biostimulatory effects, and relevance for certain phytoremediation approaches. Further research should focus on clarifying the interactions between *β*-diketonate and toxic metals, including its effects on metal mobility, bioavailability, and plant response under controlled and wastewater-related conditions.

Keywords: cadmium, lead, *β*-diketonate, *Trifolium pratense* L., seed germination, root growth, phytoremediation.

EJECTED ELECTRON SPECTRA FROM INHALATION ANESTHETIC MOLECULE N_2O

Jelena Maljković, Bratislav Marinković, Jozo Jureta

University of Belgrade, Institute of Physics Belgrade, , Pregrevica 118, Belgrade, Serbia, jelenam@ipb.ac.rs, bratislav.marinkovic@ipb.ac.rs, jureta@ipb.ac.rs

ABSTRACT

Nitrous oxide (N_2O) has important uses in medicine as inhalation anesthetic molecule, industry and major environmental impact. N_2O, whose life is about 116 ± 9 years (Feng and Li, 2023) has beenthe predominant ozone-depleting substance throughout this century. Reportedly, in terms of ozone-depleting potentials (ODP), in 2020, the ODP-weighted anthropogenic N_2O emissions were more than two times that of all chlorofluorocarbons (CFCs). It strongly influences the troposphere heat budget, in particular, the increase of its anthropogenic emissions is leading to a significant increase of the Earth's surface temperature. In fact, long average atmospheric residence time (about 116 years), currently, makes it the third most important long-lived greenhouse gas after carbon dioxide and methane. For all this reasons the spectra of ejected electrons of N_2O in the region 3-24 eV have been investigated by using Omicron High Resolution Hemispherical Analyzer (OHRHA) at different incident energies from 100 eV down to 30 eV eV and two scattering angles (40º and 90º). Details of the experimental setup and procedures can be found in (Jureta et al., 2026). In the present experiment a non-monochromatic electron beam in the energy range (30 – 100) eV (±0.4 eV) collides with an molecular beam effusing in the perpendicular direction to the scattering plane from a platinum-iridium non-biased needle with internal diameter of 0.5 mm. The interaction region has a cylindrical form (50 mm diameter) made by the two cylinders of thin μ-metal foils separated by10 mm in the collision plane in order to avoid scattering of electrons from metal surfaces. The ejected electrons are detected by a high-resolution hemispherical analyzer with a mean radius of 125 mm equipped with seven channeltrons. The analyzer operates at pass energy of 1 eV with defined retarding ratio and defined magnification determined by a two stage 11 elements lens system. The spectra are obtained in the Constant Analyzer Energy (CAE) mode in which the analyzer pass energy was constant, while the kinetic energy was scanned by varying the retarding ratio of the lens stack. The background pressure in the vacuum chamber was ~10^{-8} mbar, while the working pressure with N_2O gas in was ~10^{-6}.

Keywords: anesthetic molecules, ejected electron spectra.

Acknowledgments

This research was supported by the Science Fund of the Republic Serbia, Grant No. 6821, ATMOLCOL.

References

1. Feng, R., & Li, Z. (2023). Current investigations on global N2O emissions and reductions: Prospect and outlook. *Environmental Pollution*, *338*, 122664.
2. Jureta, J. J., Marinković, B. P., & Avaldi, L. (2026). A study of the Kr autoionizing states at high and low incident electron energies. *Adv. Space Res.* 77(3), 4098-4119.

A COMPARATIVE STUDY OF DIFFERENTIAL CROSS SECTIONS FOR ELASTIC ELECTRON SCATTERING FROM INHALATION HALOGENATED ANESTHETICS AT 150 EV

Jelena B. Maljković[1], Jelena Vukalović[1,2], Francisco Blanco[3], Gustavo García[4], Bratislav P. Marinković[1]

[1] University of Belgrade, Institute of Physics Belgrade, , Pregrevica 118, Belgrade, Serbia, jelenam@ipb.ac.rs, bratislav.marinkovic@ipb.ac.rs
[2]University of Banja Luka, Faculty of Science, Mladena Stojanovića 2, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina, jelena.vukalovic@ipb.ac.rs
[3]Universidad Complutense, Departamento de Física Atómica Molecular y Nuclear, Facultad de Ciencias Físicas, Avda. Complutense s/n, E-28040 Madrid, Spain, franciso.blanco@fis.ucm.es
[4]Instituto de Física Fundamental, Consejo Superior de Investigaciones Científicas, Serrano 121, 28006 Madrid, Spain, gustavo.garcia@fis.ucm.es

ABSTRACT

Inhalation halogenated anesthetics are of increasing environmental concern due to their high global warming potentials (GWPs), making the study of their interaction with low-energy electrons relevant for atmospheric processes. In this work, we report experimental differential cross sections (DCSs) for elastic electron scattering from three widely used anesthetics—sevoflurane, desflurane, and isoflurane. The measurements were performed using a crossed-beam setup under single-collision gas-phase conditions. The obtained angular distributions exhibit features related to molecular size, structure, and degree of halogenation. A comparative analysis reveals both similarities and notable differences among the molecules, indicating the influence of molecular geometry on scattering dynamics. The experimental results show overall good agreement with IAM-SCAR+I theoretical predictions, providing insight into interference and screening effects in electron–molecule scattering. These results contribute to the validation of theoretical models for complex molecular systems and improve the understanding of the environmental impact of inhalation halogenated anesthetics.

This research was supported by the Science Fund of the Republic of Serbia, Grant No. 6821, Project title – ATMOLCOL.

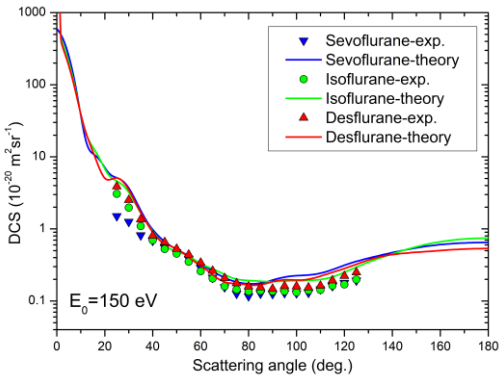

Figure 1 DCS for elastic electron scattering from sevoflurane, isoflurane and desflurane for 150eV incident electron energy.

Keywords: Anesthetics, electron scattering, cross section, global warming potential.

IT MIGHT BE A PRECURSOR TO SOME RANDOM ENVIRONMENT INAR MODELS

Miodrag Đorđević

University of Niš, Faculty of Sciences and Mathematics, Department of Mathematics, Višegradska 33, Niš, Serbia, miodrag.djordjevic@pmf.edu.rs

ABSTRACT

The subject of this paper is a combined integer-valued autoregressive time series model with both positive and negative values, constructed by means of a new thinning operator. The proposed model can be regarded as a precursor of random environment integer-valued INAR models with state space on the entire set $\mathbb{Z}$, providing a flexible framework for modeling count processes with changing dynamics and signed observations. Important probabilistic properties of the model are derived. Estimators of the unknown parameters are presented, and their asymptotic properties are established. Applicability of the model is illustrated using a real-data example. In the end, flows that involved into Finally, the limitations of the model are discussed, and the ways in which overcoming them led to the development of random environment INAR models are presented.

Keywords: INAR, Thinning, Discrete Laplace distribution.

PSYHOLOGY
PSIHOLOGIJA

THE INFLUENCE OF LIFE SCRIPTS ON ATTITUDE FORMATION

Ivana Jovčić

Unversity PIM, Faculty of Philosophy, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, centarskript@yahoo.com

ABSTRACT

This review paper explores the role of the life script, a concept from transactional analysis, in the formation of individual attitudes. Attitudes, understood as relatively stable cognitive, affective, and behavioral tendencies toward objects, people, or phenomena, are not solely shaped by rational processes but are often rooted in early childhood experiences. The author examines how script messages, prohibitions, and imperatives—internalized during development—influence basic life positions and lead to the formation of specific attitudes toward oneself and others. Particular attention is given to early script decisions, contamination of the Adult ego state, script logic, and antiscript dynamics. It is emphasized that attitudes are frequently governed by unconscious life plans, and that psychological work focused on awareness and restructuring of these patterns may contribute to greater autonomy and cognitive-emotional flexibility. Using the theoretical framework of transactional analysis, this paper highlights the importance of deconstructing script-based beliefs to understand the origins and potential for change in individual attitudes. In conclusion, the author argues that awareness and critical reflection on script messages is a key step toward forming healthier, more autonomous, and constructive attitudes—both in personal development and social interaction.

Keywords: life script, attitudes, script messages, transactional analysis, script logic.

EMOTIONS IN WHITE COATS: A PILOT STUDY ON ATTITUDES TOWARD EMOTIONS AND EMOTIONAL LITERACY AMONG PHYSICIANS AND NURSES

Ivana Jovčić

Unversity PIM, Faculty of Philosophy, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, centarskript@yahoo.com

ABSTRACT

The aim of this study was to examine differences in attitudes toward emotions between physicians and nurses, as well as to explore aspects of their emotional literacy in the context of everyday professional functioning. The pilot study included a total of 89 participants, evenly distributed by profession. A questionnaire assessing attitudes toward emotions was used, encompassing cognitive, affective, and regulatory dimensions of emotional functioning. Chi-square analysis identified 16 items with statistically significant differences between the two groups ($p < .01$). The results indicated that physicians more frequently expressed emotional inhibition, a tendency to suppress emotions, fear of emotional evaluation, and reliance on rationalization. In contrast, nurses demonstrated greater emotional openness, acceptance of the functionality of emotions, and a higher readiness to express affect. The discussion focused on the influence of professional socialization, educational systems, and organizational culture on the formation of specific patterns of emotional literacy. The findings of this study have important implications for the development of training programs aimed at enhancing the emotional competencies of healthcare professionals, improving interprofessional communication, and preventing burnout. Furthermore, they highlight the need for a deeper understanding of emotional labor in healthcare, with an emphasis on tailored interventions that consider the professional context and specific challenges of each occupation.

Keywords: emotions, emotional literacy, physicians, nurses, professional socialization

INDICATORS OF AGGRESSIVENESS ON PSYCHOLOGICAL PERSONALITY INVENTORIES

Snežana Samardzić

JZU Special hospital for psychiatry Sokolac, Podromanija bb, 71 350 Sokolac, Bosnia and Herzegovina, nenasok@yahoo.com

ABSTRACT

Man, since the earliest times, established two taboos: the taboo of incest and the taboo of killing, which shows how much importance has always been attached to aggressive behavior and destruction. When we talk about aggression and its motivation and consequences, it should be emphasized that it is the subject of interest primarily in forensics, but lately it has also been investigated in the framework of neuropsychological and neurobiological works. Unlike benign aggression, which has a biologically adaptive function and is characteristic of both humans and animals, malignant aggression can be "wrapped" in various forms and forms of violent behavior with the aim of satisfying the aggressor and characteristically occurs only in humans. The paper discusses the very concept of aggression and its indicators on two personality inventories, which have recently been more intensively used in psychological psychodiagnostic work: PAI and MCMI III.

Keywords: aggressiveness, PAI, MCMI III.

ATTITUDE TOWARDS DREAMS AS AN EXPRESSION OF THE SUBJECTIVE RELATION TO THE UNCONSCIOUS

Branka Blagojević Janković, Darjana Sredić

University PIM, Faculty of Philosophy, despota Stefana Lazarevića bb, 78 000 Banja Luka, Bosnia and Herzegovina, sredic50@gmail.com

ABSTRACT

Dreams occupy a central place in classical psychoanalytic theories, where they are seen as meaningful expressions of unconscious psychic processes. In the Freudian and Jungian theoretical tradition, dreams are viewed as an important source of insight into the inner psychic dynamics of an individual, whereby their interpretation and integration are linked to the understanding of emotional states and internal conflicts. The aim of this research is to examine the relationship between the attitude towards dreams and different aspects of the subjective psychological relevance of dreams in the general population. The research was conducted on a sample of 172 respondents from the general population. Data were collected through an anonymous online questionnaire that includes a sociodemographic questionnaire, the Attitudes Toward Dreams Scale (Cernovsky, 1984), indicators of the use of dreams for personal insight and understanding of internal conflicts - Mannheim Dream Questionnaire (Schredl et al., 2014), as well as measures of the frequency of recalling and sharing dreams. The results indicate statistically significant positive correlations between the attitude towards dreams and all examined aspects of their psychological relevance: the frequency of recalling dreams, using dreams for personal insight and understanding of internal conflicts, as well as the frequency of sharing dreams with others. These findings suggest that the subjective attitude toward dreams may be an important psychological variable related to the ways in which individuals remember, consider, and share their dream experiences.

Keywords: dreams, attitude towards dreams, sharing dreams, unconscious, personal insight.

PHENOMENOLOGY AND PATTERNS OF BULLYING IN SECONDARY SCHOOLS

Jelena Milić, Danijela Jokanović, Darjana Sredić

University PIM, Faculty of Philosophy, Despota Stefana Lazarevića bb, 78 000 Banja Luka, Bosnia and Herzegovina, jelamiljanic@gmail.com, djokanovic404@gmail.com, sredic50@gmail.com

ABSTRACT

This paper analyses the phenomenology of bullying in secondary schools in the area of Banja Luka, with the aim of examining its prevalence, forms and perception among students. Bullying is defined as intentional and repeated aggressive behaviour among same-age peers, which may take verbal, physical, social and digital forms, and may have significant consequences for the psychological and social functioning of young people.

The study was conducted on a sample of 100 students of Banja Luka Gymnasium and High School of Electrical Engineering, using an anonymous survey questionnaire comprising 15 questions related to prevalence, forms and context of bullying. Particular attention was given to the comparative analysis between the two schools, as well as to students' subjective perceptions of safety.

The results indicate the presence of bullying in both schools, with verbal violence being the most prevalent, particularly through spreading rumours and the use of offensive content. Physical and social violence were present to a lesser extent, while economic forms of violence have not been recorded. Cyber bullying has been significantly present, indicating the increasing influence of the digital environment on patterns of peer aggression. Certain statistically significant differences were also observed between the schools in specific forms of violence and in the perception of victims.

In conclusion, the findings confirm that bullying represents a relevant issue in the school context, with the dominance of verbal and digital forms. The obtained findings represent a preliminary insight into the phenomenon of bullying and point to the need to conduct more extensive research, as well as the need for the development and implementation of preventive programmes, the improvement of the school environment and the empowerment of students to cope effectively with violence.

Keywords: bullying, secondary school students, cyber bullying, prevention, school environment.

WORK MOTIVATION OF HEALTHCARE WORKERS FROM THE PERSPECTIVE OF SELF-DETERMINATION THEORY

Jelena Milić, Danijela Jokanović

University PIM, Faculty of Philosophy, Despota Stefana Lazarevića bb, 78 000 Banja Luka, Bosnia and Herzegovina, jelamiljanic@gmail.com, djokanovic404@gmail.com

ABSTRACT

This paper examines the relationship between different forms of work motivation of healthcare workers, whereby the motivation is conceptualised as a multidimensional construct shaped by the interaction of individual needs, organisational characteristics and the broader social context. The theoretical framework of the research is based on contemporary approaches to managing work motivation, including Frederick Herzberg's Motivation-Hygiene Theory: Two-factor Theory and Self-Determination Theory (Ryan & Deci, 2020), which emphasises the importance of the autonomy continuum in the regulation of behaviour.

The empirical research was conducted using a survey method on a sample of healthcare workers, using the adapted version of the Work Extrinsic and Intrinsic Motivation Scale (WEIMS). The collected data were analysed by using descriptive and inferential statistical procedures. The results indicate a statistically significant positive correlation between the intrinsic motivation and the identified regulation, while no significant correlations were found between the other dimensions of motivation. Furthermore, a statistically significant difference was identified between the intrinsic and the extrinsic motivation, whereby the intrinsic motivation is more pronounced among the respondents. Although work performance and engagement were not measured directly, the findings have been discussed in the context of their potential significance for the work functioning of healthcare workers.

The findings suggest that the internal motivational factors, such as the experience of meaningful work, professional satisfaction and autonomy contribute more strongly to employee engagement and work performance than external incentives. In accordance with the principles of Self-Determination Theory, the results highlight the importance of fostering autonomy, competence and relatedness in the work environment.

In conclusion, for improvement of work performance of healthcare workers, an integrated approach to motivation is recommended, combining material and non-material strategies, with a particular focus on strengthening intrinsic motivation through improvements in organisational climate and opportunities for professional development.

Keywords: intrinsic motivation, extrinsic motivation, Self-Determination Theory, healthcare workers, work performance, employee engagement.

EDUCATION
OBRAZOVANJE

PRACTICAL APPLICATION OF 3D SCANNING TECHNOLOGY IN THE VIRTUAL EDUCATION AND MAINTENANCE TRAINING OF MARINE EQUIPMENT

Miroslav Vukičević [1], Robert Janković [2], Darijan Hadžisalihović[3]

[1]University of Montenegro, Faculty of Maritime Studies Kotor, Put I Bokeljske brigade 44, 85330 Dobrota, Kotor, Montenegro, miroslav.v@ucg.ac.me
[2,3]Five Group, B. Knjaza Danila Petrovica 13/32, 81000 Podgorica, Montenegro, robert@mediamind.studio, darijan@fivegroup.me

ABSTRACT

3D scanning is an advanced technology that enables precise digital representation of physical objects and environments in three-dimensional form. By collecting spatial data from object surfaces and generating point clouds, it allows the creation of accurate digital 3D models suitable for analysis, inspection, and manufacturing applications. Compared to traditional measurement methods, 3D scanning provides higher precision, faster data acquisition, and non-contact digitization, which is especially important for sensitive or complex structures.

This paper presents the fundamental principles of 3D scanning technology and examines its application in modern engineering and industrial processes. Special emphasis is placed on quality control, reverse engineering, product development, predictive maintenance, and integration with CAD/CAM systems and additive manufacturing technologies. The role of 3D scanning in digital twin implementation and production process optimization is also discussed.

The idea of this work is the application of the Spider 3D scanner and Artec Studio software for the digitalization of large and complex ship equipment, enabling students to virtually study maintenance, servicing, and measurement procedures without physical access to the equipment. Such a system ensures continuous availability, requires minimal physical space, does not demand specialized tools, and reduces training costs. Its main limitations include the initial system setup and the number of available VR headsets.

The study highlights the advantages of 3D scanning in improving product quality, reducing development time, and increasing manufacturing flexibility and competitiveness. Despite initial investment costs, 3D scanning represents a key technology of Industry 4.0 with significant potential for further development and industrial integration.

Keywords: 3D scanning, reverse engineering, quality control, CAD/CAM, digital twin, Industry 4.0, virtual training.

PRIMARY SCHOOL STUDENTS' PERCEPTIONS OF USING CAD IN TECHNICAL DRAWING INSTRUCTION

Darko Suman[1], Stjepan Kovačević[1], Damir Purković[2]

[1]University of Split, Faculty of Science, Ruđera Boškovića 33, 21 000 Split, Croatia, darko.suman@skole.hr
[2]University of Rijeka, Faculty of Engineering, Vukovarska 58, 51 000 Rijeka, Croatia

ABSTRACT

Technical drawing is an integral part of general technology education and, consequently, of the Technical Culture curriculum in primary schools, with recommendations for the use of computer programs for drawing and three-dimensional modelling. This creates opportunities for the implementation of computer-aided design (CAD) in teaching. However, little is known about the extent to which CAD is used in primary schools and for what purposes. Therefore, this paper empirically examines the use of three-dimensional CAD software as a means through which students model and visualise technical creations, develop an understanding of spatial relationships, and connect a three-dimensional model with a technical drawing in regular classroom instruction. The research was conducted on a sample of 105 fifth- and seventh-grade primary school students who participated in the intervention. The aim was to examine students' perceptions of using CAD in teaching technical drawing with regard to content comprehensibility, self-perceived achievement, instructional interest, and the perceived advantages and difficulties of such an approach. The findings indicate that computer-aided design can contribute to the development and conceptualisation of a motivating and methodologically appropriate approach to learning technical drawing, thereby supporting the pedagogical justification and possibilities of applying CAD in the Technical Culture subject in primary schools.

Keywords: computer-aided design (CAD), technical drawing, technology education, primary school, student perceptions.

MATHEMATICS FOR ROBOTICS AND ARTIFICIAL INTELLIGENCE

Tatjana Stanivuk[1], Goran Kovačević[2]

[1]University of Split – Faculty of Maritime Studies, Ruđera Boškovića 37, 21000 Split, Croatia, tstanivu@pfst.hrl
[2]University of Split – Faculty of Maritime Studies, Ruđera Boškovića 37, 21000 Split, Croatia, gkovacev@pfst.hr

ABSTRACT

This paper will consider how mathematics helps in the development of robotics and artificial intelligence. The purpose of the paper is for each reader to see for himself that mathematics can be useful and interesting, especially when applied in technology. The paper contains 3 simple and interesting tasks with the application of mathematics in robotics and artificial intelligence.

Keywords: AI, application, mathematics, robots.

DIGITALIZATION OF EDUCATION: ADVANTAGES AND CHALLENGES

Isidora Milošević[1], Mirjana Bakmaz[1], Milica Grbić[2]

[1]College of Service Business East Sarajevo - Sokolac, Bosnia and Herzegovina – Republic of Srpska, isidora@vub.edu.ba
[2]Academy of Vocational Studies, Vladimira Perića Valtera 4, 21 000 Novi Sad, Serbia, miragrbili@gmail.com

ABSTRACT

In recent years, the digitalization of education has significantly transformed the organization of teaching and the overall approach to the learning process. The use of digital technologies has enabled faster access to information, greater availability of educational content, and the implementation of various forms of online learning. The aim of this paper is to present the main advantages and challenges of the digitalization of education, with a particular focus on the application of e-learning platforms and learning management systems in contemporary teaching. The paper analyzes the positive aspects of digital education, such as flexibility in teaching organization, opportunities for distance learning, and easier access to educational materials, as well as the challenges encountered in practice, including insufficient technical equipment, the digital divide, reduced motivation, and issues related to the quality of online teaching. The research is based on the analysis of relevant scientific and professional literature, as well as the examination of examples of the implementation of digital tools in educational institutions. The results indicate that digitalization has significant potential to improve the educational process. However, its successful implementation depends on adequate technical support, the development of digital competencies, and the adaptation of teaching methods to modern working conditions. It is concluded that continuous improvement of digital infrastructure and the encouragement of innovative teaching approaches are necessary in order to ensure a high-quality and accessible education system.

Keywords: digitalization of education, online learning, e-learning, learning management systems, digital divide.

XSTUDIO: TRANSFORMING STUDIO PEDAGOGY THROUGH POP-UP LIVE LEARNING ENVIRONMENTS

Igor Kuvač, Malina Čvoro, Zoran Uljarević

University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy, Petra Bojovića 1A, 78000 Banja Luka, Bosnia and Herzegovina, igor.kuvac@aggf.unibl.org, malina.cvoro@aggf.unibl.org, zoran.uljarevic@aggf.unibl.org

ABSTRACT

Contemporary architectural education increasingly faces the challenge of reconciling academic studio models with the complex realities of spatial practice, which demand collaboration, adaptability, and direct engagement with real-world actors. Conventional design studios, often centred on hypothetical briefs and representational outputs, struggle to address the social, material, ecological, and institutional conditions that shape the built environment. This paper examines xSTUDIO, an experimental teaching line developed within the APLE Lab Banja Luka, framing it as a Pop-Up Live Learning Environment that repositions the architectural design studio as an operative, constructivist, and stakeholder-driven pedagogical framework. Implemented through a sequence of studio iterations between 2022 and 2026, xSTUDIO integrates problem-based learning, collaborative design, material experimentation, and 1:1 realization within real spatial contexts. The methodology combines research, design, implementation, and reflection through direct engagement with students, academic staff, public institutions, cultural organizations, and private-sector stakeholders. The paper analyzes the gradual evolution of the xSTUDIO model—from experimental interior pedagogies and small-scale urban interventions to institutional interiors, landscape-scale environments, and living ecological systems. Rather than focusing on finalized architectural products, the emphasis is placed on process, collaboration, embodied spatial experience, and the negotiation of real constraints. The findings suggest that xSTUDIO enables the development of competencies often underrepresented in conventional studio teaching, including collective authorship, stakeholder communication, material awareness, and socially responsible spatial action. The paper argues that live learning environments such as xSTUDIO represent transferable pedagogical models capable of redefining architectural education through constructivist, experiential, and socially engaged approaches to studio pedagogy.

Keywords: architectural education, studio pedagogy, live learning environments, experiential learning, socially responsive practice.

MEDICAL AND BIOMEDICAL SCIENCES
MEDICINSKE I BIOMEDICINSKE NAUKE

APPLYING THE BEHAVIOR CHANGE TECHNIQUES FOR MODERNIZING HEALTHCARE AT THE NATIONAL LEVEL

Iuliia Zuenkova

Peoples' Friendship University of Russia, st. Miklukho-Maklaya, 6, 117198, Moscow, Russian Federation, zuenkova@bk.ru

ABSTRACT

Behavior change techniques (BCTs) represent a pivotal yet often overlooked component in the national-scale modernization of healthcare systems, particularly in resource-constrained settings where infrastructural upgrades alone are insufficient to improve clinical outcomes. The Integrated Perinatal Care Project in Uzbekistan provides a compelling case study of systematically embedding BCTs within a multi-component national initiative to strengthen perinatal services. Grounded in a comprehensive framework that addresses infrastructure, digital transformation, emergency response, and human resources, the project explicitly targets behavioral determinants at multiple levels. Provider-focused BCTs include structured training programs for medical staff in updated clinical guidelines, gender-sensitive approaches, effective communication skills, and readiness to manage complications such as violence-related issues and adolescent pregnancies. At the community level, capacity building of community health nurses equips them to influence women's and families' health-seeking behaviors, promoting earlier antenatal care and reducing delays in complication management. Population-level interventions comprise the development and dissemination of tailored communication materials and awareness campaigns designed to close knowledge gaps regarding pregnancy risks, climate-related threats, and service availability—directly informed by baseline survey findings. These BCTs are synergistically integrated with electronic health records enabling gender- and age-disaggregated monitoring, real-time inter-institutional data exchange, updated referral protocols, and climate-resilient infrastructure enhancements. Implementation proceeds in phased stages—from baseline assessment and planning to large-scale rollout, evaluation, and sustainability planning—offering a scalable model for integrating BCTs into national healthcare modernization. This approach underscores that sustainable quality improvement requires simultaneous investment in technical infrastructure and evidence-based behavioral interventions.

Keywords: behavior change, BCT-taxonomy, healthcare, healthcare management

OTHER TOPICS
OSTALE TEME

DIGITAL TOURISM AND TOURISM 4.0 AS A CONCEPT OF THE FUTURE

Branka Stipanović

University Hercegovina, Blajburških žrtava 100, 88000 Mostar, Bosnia and Herzegovina,
brankastipanovic7@gmail.com

ABSTRACT

Tourism 4.0 encompasses the integration of the most advanced digital technologies, including artificial intelligence (AI), the Internet of Things (IoT), virtual reality (VR), augmented reality (AR), blockchain technology, and advanced data analytics. These innovations facilitate a comprehensive transformation within the tourism industry, aimed at improving the user experience, optimizing operational efficiency, and promoting sustainable practices. Through a systematic literature review, meta-analysis, and thematic analysis, this study identifies key themes concerning service personalization, economic contributions to local communities, and challenges associated with digitalization. The research questions deal with the main advantages and obstacles presented by digital technologies, their role in sustainable development, their impact on service quality, and their contributions to local communities. The results indicate the transformative potential of digital technologies for the future of tourism, while also highlighting the challenges related to data security and privacy. This document provides a framework and practical recommendations for the advancement of Tourism 4.0 as an emerging field of study.

Keywords: tourism 4.0, AI, IoT, VR, AR, future tourist experience, impact on local communities.

VIRTUAL REALITY IN TOURISM: AN INCENTIVE OR OBSTACLE TO GAINING A REAL TOURIST EXPERIENCE

Branka Stipanović

University Hercegovina, Blajburških žrtava 100, 88000 Mostar, Bosnia and Herzegovina, brankastipanovic7@gmail.com

ABSTRACT

Virtual reality (VR) is becoming increasingly prevalent in the tourism industry due to its unique capabilities to simulate the experience of visiting remote locations and provide users with an immersive experience. The paper analyzes the role of VR in tourism in terms of its two effects, incentives and potential obstacles to physical travel. Based on the analysis of scientific literature and practical examples, it is investigated how VR can increase interest in real visits, but also how it can act as an alternative to physical visits, especially in the context of cultural and natural attractions. The aim of this research was to consider the motivational aspects of VR, its advantages and disadvantages, and the main factors influencing tourist behavior. It is concluded that VR has potential as a tool for destination promotion and protection, but that it can also be a barrier to authentic experiences, particularly due to its limitations in providing social interaction and emotional engagement. Further research into the long-term impact of VR on the tourism industry and its potential incorporation into sustainable practices that promote a balanced approach between virtual and real travel is recommended.

Keywords: Virtual reality, tourism, psychological presence, social interaction, authenticity of tourist experience, digital transformation in tourism.

ARTIFICIAL INTELLIGENCE ADOPTION, WELL BEING, AND PROFESSIONAL TRANSFORMATION IN SLOVENIA (2022–2026)

Anton Vorina[1], Tina Vorina[2], Svit Vorina[3], Vid Vorina[4], Ivanka Oberman[5]

[1]Abitura, d.o.o., Lava 7, 3000 Celje, Slovenia, *anton.vorina1@gmail.com*
[2]University of Maribor, Faculty of medicine, Taborska Ulica 8, 2000 Maribor, Slovenia, *tinavorina@gmail.com*
[3]University of Maribor, Faculty of Health Science, Žitna ulica 15, 2000 Maribor, Slovenia, *svitko555@gmail.com*
[4]Celje School Center, Lava Gymnasium, Pot na Lavo 22, 3000 Celje, Slovenia, *vid.vorina@gmail.com*
[5]New University, European Faculty of Law, Delpinova ulica 18B, 5000 Nova Gorica, Slovenia, *ivana.oberman@gmail.com*

ABSTRACT

Artificial intelligence (AI), especially generative artificial intelligence (GAI), is quickly changing education, work, and everyday life. Slovenia is an interesting example for studying these changes because it has adopted GAI very rapidly and there is already a growing number of empirical studies on its social and organisational impacts.

This paper provides a systematic review of Slovenian research published between 2022 and 2026. It organises the findings into key themes, including how GAI is adopted, trust in institutions, subjective well-being, work engagement, and leadership.

By examining national surveys, quantitative studies, and policy reports, the review shows that GAI has spread faster than most other digital technologies in Slovenia's recent history. Although its use is now very common, its effects on people's well-being and work life are complex and sometimes mixed. While general life satisfaction remains quite stable, the impact at work depends on whether employees see AI as a helpful tool or as an extra burden.

The study also found that trust in AI systems depends largely on algorithmic literacy. People with higher technical skills tend to be more critical towards AI. In many sectors, the results suggest that important human skills — such as empathy, ethical judgement, and mentoring — cannot be replaced by automated systems.

The paper emphasises the need for human-centred governance of GAI and better digital skills for everyone. It also calls for long-term studies to better understand the lasting effects of AI on Slovenian society.

Keywords: Generative Artificial Intelligence (GAI); wellbeing; work engagement; education; leadership; Slovenia.

THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE NEW PUBLIC MANAGEMENT: STATUS, CHALLENGES AND PERSPECTIVES IN THE REPUBLIC OF NORTH MACEDONIA

Jadranka Denkova, Jovan Ananiev, Strasko Stojanovski

Goce Delcev University, Faculty of Law, Krste Misirkov Streer, No.10-a Fax: 201, 2000Stip Republic of North Macedonia, jadranka.denkova@ugd.edu.mk, jovan.ananiev@ugd.edu.mk, strasko.stojanovski@ugd.edu.mk

ABSTRACT

This paper analyzes the role of artificial intelligence (AI) in the transformation of the public sector through the concept of new public management (NPM). In the Republic of North Macedonia, NPM has not been implemented as a single, coherent model, but as a set of reforms and instruments that are gradually introduced in various institutions, most often under the influence of European integration processes. In conditions of increased demands for efficiency, transparency and accountability, AI is emerging as a key instrument for the modernization of public administration. The concept of new public management emerges as a response to these challenges, promoting principles such as results orientation, competition and rationalization of resources. In parallel, technological development, especially in the field of artificial intelligence, opens up new opportunities for the transformation of public administration. AI enables automation, analysis of large amounts of data and improvement of processes in the The paper focuses on global trends and their application in the Republic of North Macedonia, identifying the main benefits, limitations and institutional challenges. This paper aims to analyze the institutional application of NPM in the country, as well as the key challenges associated with its implementation. The research methodology is based on a qualitative approach, which includes: analysis of relevant scientific literature, analysis of international reports, comparative approach that allows for a systematic understanding of trends and challenges. The results indicate that AI has significant potential for improving the public sector through: increased efficiency, reduced administrative costs, improved transparency, better decision-making. However, there are also serious risks: algorithmic bias, privacy threats. dependence on technology In the context of North Macedonia, these risks are further emphasized due to institutional unpreparedness. The research shows that while there is potential for significant progress, the implementation of AI is limited due to insufficient digital maturity, legal framework, and human resources.

Keywords: artificial intelligence, new public management, public administration, digitalization, public policies

ELECTIONS AND OPPORTUISM: EXPLORING THE DYNAMICS OF PARTY-HOPPING IN INDIA

Yajnya Dutta Nayak

Khallikote Unitary University, Sundar Nagar, Brahmapur, Bramapur, Odisha 760001, Indija,
yajnya.dutta@gmail.com

ABSTRACT

Party-hopping, a phenomenon in which elected representatives switch their allegiance from one political party to another, has become a prevalent and contentious issue in Indian politics. This abstract offers a glimpse into the dynamics of party-hopping in India, aiming to shed light on the motivations, consequences, and implications of this practice. The paper delves into the factors that drive elected officials to switch parties, ranging from ideological misalignment and personal ambitions to pragmatic considerations in a highly competitive political landscape. Furthermore, this research highlights the consequences of party-hopping on India's democracy, including its impact on voter trust, party structures, and the overall stability of the political system. It explores how party-hopping can both enhance and undermine democratic processes, depending on the context and the motivations behind the switches. Through a comprehensive analysis of historical and contemporary case studies, the paper seeks to provide insights into the underlying dynamics of party-hopping, its impact on Indian politics, and its broader implications for democratic governance. By understanding the multifaceted nature of this phenomenon, policymakers, scholars, and citizens can engage in informed discussions and potentially devise strategies to address the challenges it presents to the Indian political landscape.

Keywords: Elections, Party-hopping, Indian politics, Political Defections and Party Switching.

COGNITIVE MECHANISM OF CONCEPTUAL METAPHOR IN POLITICAL COMMUNICATION DURING THE LAST PRESIDENTIAL CAMPAIGN IN THE USA

Mladena Krajišnik

Unversity PIM, Faculty of Philosophy, despota Stefana Lazarevića bb, 78000 Banja Luka, Bosnia and Herzegovina, tmladena@gmail.com

ABSTRACT

In order to understand the connection between language and thought, we must look at the cognitive phenomena of the human mind. One of the disciplines that studies the mental functioning of an individual is cognitive linguistics. The subject of this paper is to analyse the phenomenon of metaphor as a means of experiencing and understanding abstract experiences. Therefore, the subject of this research project is to explore the metaphor not as a figure of speech but as a cognitive mechanism. Cognitive linguistics has been dealing with conceptual metaphor since 1980, with the publication of the works of George Lakoff and Mark Johnson. The data for this study is a corpus of several different conceptual metaphors excerpted from the speeches of two American political candidates in the 2024 presidential election. After the theoretical view of the cognitive-linguistic approach to metaphor, the author deals with the examination of all the categories found in the speeches of the two candidates. The aim of the study is to describe and classify, and then interpret and explain the types of metaphors and their representation in political discourse. Special attention was focused on the balance between the two models of corpus analysis: qualitative and quantitative. The corpus analysis resulted in nine basic categories that are deeply expanded and illustrated with the relevant examples. After the corpus has been analysed and the results compared, it can be concluded that the political discourse abounds in various metaphorical-linguistic expressions. Furthermore, it was concluded that the source domains of journey, war and buliding are the most productive categories. This proves the key role of structural metaphor, through which the understanding of an abstract concept is structured using a more concrete one.

Keywords: cognitive linguistics, conceptual metaphor, abstract domain, concrete domain, structural metaphor.

NEW MODELS OF MAINTENANCE OF ROTATING MACHINES

Stevan Petrović[1], Živoslav Adamović[1], Veljko Vuković[1], Branislav Gavrilović[1], Svetozar Bugarin[2], Goran Topić[3]

[1]European University Brčko distrikt, Bijeljinska bb, 76100 Brčko, Bosnia and Herzegovina, petrovic.stevan.73@gmail.com
[2]Railway Vehicles Factory "Želvoz", Miloša Velikog 39, 11300 Smederevo, Serbia
[3]Elnos Group HQ, Petra Kočića 49, 78 000 Banja Luka, Bosnia and Herzegovina

ABSTRACT

The paper provides an overview of methods for representing knowledge and knowledge frames. The hierarchical organization of knowledge as well as the apparatus of logical reasoning are defined. An expert evaluation system has been developed along with input-output composition models of the expert system for the maintenance of rotating machines.

Keywords: Knowledge, expert system, knowledge frames, reasoning, knowledge bases.

APPLICATION OF BENCHMARKING AS PART OF THE RE-ENGINEERING PROCESS IN A THERMAL POWER PLANT UGLJEVIK

Stevan Petrović[1], Živoslav Adamović[1], Veljko Vuković[1], Zoran Stjepanović[1], Goran Topić[2]

[1]European University Brčko distrikt, Bijeljinska bb, 76100 Brčko, Bosnia and Herzegovina, petrovic.stevan.73@gmail.com
[2]Elnos Group HQ, Petra Kočića 49, 78 000 Banja Luka, Bosnia and Herzegovina

ABSTRACT

Business Process Reengineering (BPR) represents a new business concept or philosophy that emerged in the 1990s. The central focus of reengineering philosophy is on processes, referring to process design. The reengineering revolution had two main themes: the first was organizing around processes, and the second was organizing processes in a superior way.

Keywords: Benchmarking, reengineering, Ugljevik thermal power plant

EU MONETARY POLICY – CURRENT STATE AND PERSPECTIVES

Dijana Grahovac, Radmila Čičković

University of Business Studies, Jovana Dučić 23a, 78000 Banja Luka, Bosnia and Herzegovina
jonidg11@yahoo.com, cickovic.radmila@gmail.com

ABSTRACT

The monetary policy of the European Union is one of the key instruments for achieving macroeconomic stability, sustainable economic growth, and maintaining price stability within the euro area member states. This paper analyzes the institutional framework of the European Union's monetary policy, with particular emphasis on the role of the European Central Bank, its objectives, instruments, and operational mechanisms. Special attention is given to the challenges that monetary policy has faced in recent years, including the consequences of the global financial crisis, the COVID-19 pandemic, inflationary pressures caused by disruptions in supply chains, and geopolitical uncertainties. The aim of the research is to examine the current state of the European Union's monetary policy, assess its effectiveness in achieving its established objectives, and identify the key perspectives for its future development. The study applies descriptive and comparative analysis methods, as well as an analysis of relevant statistical indicators and official documents of the European Central Bank.

Keywords: Monetary policy, European Union, European Central Bank, euro area, inflation, financial stability.