



THE ACADEMY OF APPLIED
TECHNICAL STUDIES
BELGRADE



INTERNATIONAL SCIENTIFIC
AND PROFESSIONAL CONFERENCE
POLITEHNIKA 2023

CONFERENCE PROCEEDINGS

Belgrade, 15th December 2023



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FOR THE PUBLISHER

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TECHNICAL PREPARATION AND COVER DESIGN

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**ENVIRONMENT AND
SUSTAINABLE DEVELOPMENT**

**OCCUPATIONAL HEALTH
AND SAFETY AND FIRE SAFETY**

SMART MANAGEMENT SYSTEMS

**GRAPHIC ENGINEERING
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FOREWORD

The International Scientific and Professional Conference POLITEHNIKA 2023 represents the seventh edition of the POLITEHNIKA scientific and professional events, occurring biannually since its inaugural event in 2011. POLITEHNIKA 2023 upholds a distinguished tradition and commitment to integrating higher education and practical application across a diverse spectrum of disciplines represented by defined thematic scopes.

Organized with the patronage of the Ministry of Education of the Republic of Serbia, the Ministry of Environmental Protection of the Republic of Serbia, the Ministry of European Integration of the Republic of Serbia, the Directorate for Occupational Safety and Health, the Office for Dual Education and National Qualifications Framework, the Conference of Academies of Applied Studies in Serbia, the Chamber of Commerce of Serbia, the Chamber of Commerce of Belgrade, the Institute for Standardization of Serbia, the Association of Belgrade Architects, the City of Požarevac and the Tourist Organization of the City of Požarevac, POLITEHNIKA 2023 stands as a collaborative platform at the intersection of academia, governmental institutions and industry.

This year heralds a notable progression with its international status and the incorporation of 10 conference scopes. Expanding beyond the thematic domains featured in previous events, the Conference now encompasses Environment and Sustainable Development, Occupational Safety and Health and Fire Safety, Smart Management Systems, Graphic Engineering, Design, Traffic Engineering, Biotechnology and Healthcare, Mechanical Engineering, Ecotourism and Rural development, and Mechatronics. By engaging experts, emerging professionals, and practitioners from these domains, the conference unifies fields of study programs of the Academy of Applied Technical Studies Belgrade. The thematic scopes, coupled with the structure of the compiled papers in this Proceedings, exhibit a rich diversity and multidisciplinary approach, fundamentally contributing to a holistic examination and resolution of societal and scientific challenges.

Comprising over 220 peer-reviewed contributions, the Proceedings represent a substantial intellectual asset, aligning with the conference's overarching objective of fostering the exchange of knowledge, research findings, and professional experiences among experts from industry, research institutions, and higher education establishments.

The Proceedings of the International Scientific and Professional Conference POLITEHNIKA 2023 serve as a comprehensive snapshot of the current landscape within the thematic realms of the conference, offering both insights and directives for ongoing scientific and professional development. Moreover, they proffer concrete solutions to practical challenges grounded in contemporary trends and pertinent insights.

The Academy of Applied Technical Studies Belgrade extends its sincere appreciation to all conference supporters whose financial contributions played a pivotal role in its successful realization. Special acknowledgment is reserved for the authors of the papers, whose diligence and eagerness to present their work to a wider audience, alongside the reviewers and members of the International Scientific Committee, Program Committee and Organizational Committee, have collectively contributed to the triumph of the International Scientific and Professional Conference POLITEHNIKA 2023.

Belgrade, December 2023
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ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

INVITED PAPERS

Srećko Stopić, PhD, Bernd Friedrich, PhD, Process Metallurgy and Metal Recycling, RWTH Aachen University, Germany

Advances in understanding of a role of unit metallurgical operations for recycling

Svetlana Grujić, PhD, Faculty of Technology and Metallurgy, University of Belgrade

Emerging pollutants in the environment: contamination of the Danube river basin in Serbia

Marija Nikolić, PhD, Faculty of Technology and Metallurgy, University of Belgrade

Biodegradable polyesters – from ecology to medicine

DESIGN

INVITED PAPER

Jelena Ristić Trajković, PhD, Faculty of Architecture, University of Belgrade

Society, Ecology and Design Education: Transformative Learning for Future Sustainable and Healthy Environments

MECHANICAL ENGINEERING

INVITED PAPERS

Tamara Bajc, PhD, Faculty of Mechanical Engineering, University of Belgrade

Energy savings and CO₂ emission reduction potential through the existing building renovation

Marko S. Jarić, PhD, Innovation Centre of Faculty of Mechanical Engineering in Belgrade

Analysis of remediation of horizontal cylindrical tank for oil storage

ECOTURISAM AND RURAL DEVELOPMENT

INVITED LECTURES

Marko Perić, PhD, Faculty of Tourism and Hospitality Management, University of Rijeka, Croatia

Challenges of sustainable tourism: Example of Croatia

Snežana Štetić, PhD, Balkan Network of Tourism Experts, Igor Trišić, PhD, Faculty of Geography, University of Belgrade

Selective forms of tourism and sustainable development of rural tourist destinations

INVITED PAPERS

Radomir Stojanović, PhD, Western Serbia Academy of Applied Studies

Education as a pillar of sustainable agritourism in Serbia

Jelena Premović, PhD, Faculty of Economics, University of Priština & Faculty of Economics and Engineering, University Business Academy in Novi Sad

Cultural heritage as a generator of sustainable development of tourism in local communities in the countries of the Western Balkans

Vladimir Živanović, Nevena Majstorović, Zlatibor Tourism Organization, Zlatibor

Analysis of the real number of tourist overnights based on the estimation of water consumption in Zlatibor

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INVITED PAPER

Andrea Matta, PhD, Dept. of Mechanical Engineering, Politecnico di Milano, Italy Mohsen Jafari, PhD, Dept. of Industrial and Systems Engineering, Rutgers University, USA

Towards a theory of digital twins: fundamental definition

TABLE OF CONTENTS

SCOPE 1. ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

Srećko Stopić, Bernd Friedrich <i>Advances in understanding of a role of unit metallurgical operations for recycling</i>	26
Svetlana Grujić <i>Emerging pollutants in the environment: contamination of the Danube river basin in Serbia</i>	32
Marija Nikolić <i>Biodegradable polyesters – from ecology to medicine</i>	38
Alessandro Gasparetto, Stefano Grimaz <i>The ESPeRT project: a “polytechnic” strategic plan focused on sustainability</i>	44
Ana Stojković, Miodrag Stanisavljević, Ivan Krstić, Nenad Krstić, Dragan Đorđević <i>Physical-chemical characterization of waste glass of general use</i>	50
Ljiljana Tolić Stojadinović, Svetlana Grujić, Nikolina Antić, Tatjana Đurkić <i>Impact of wastewater antibiotics on river water quality in Belgrade area</i>	54
Nataša Karić, Marija Vukčević, Marina Maletić, Mirjana Ristić, Aleksandra Perić Grujić, Katarina Trivunac <i>Removal of organic and inorganic pollutants from aqueous solutions using starch-diatomaceous earth adsorbent</i>	60
Nataša Karić, Marina Maletić, Sara Živojinović, Marija Vukčević, Milena Milošević, Katarina Trivunac, Aleksandra Perić Grujić <i>Alkali modification of fly ash for adsorption of selected dyes</i>	66
Katarina Popović, Davor Antanasijević, Jelena Antanasijević, Viktor Pocajt <i>Carbon footprint of bio-based and recycled plastic materials</i>	71
Katarina Popović, Davor Antanasijević, Jelena Antanasijević, Viktor Pocajt <i>Application of machine learning for the simulations and modeling in environmental science</i>	77
Jasmina Bašić, Danijela Pecarski, Dragana Dragaš Milovanović, Slavica Krsmanović, Daka Tešić <i>Air quality according PM concentration in the city of Belgrade in September 2023</i>	83
Jelena Vesković, Milica Lučić, Slavica Ražić, Ivana Deršek-Timotić, Andrijana Miletić, Maja Đolić, Antonije Onjia <i>Multivariate analysis of the Morava river plain groundwater</i>	89
Eleonora Gvozdić, Ivana Matić Bujagić, Tatjana Đurkić, Svetlana Grujić <i>Ecological risk assessment of aspartame and neotame in river sediments</i>	95
Mirjana Ocokoljić, Djurdja Petrov <i>Impact of urban heat island on butterfly-bush (<i>buddleja davidii franch.</i>)</i>	100
Mirjana Ocokoljić, Djurdja Petrov, Dragan Vujičić <i>Effects of urbanisation on <i>simplicarpos orbiculatus moench</i> in the green infrastructure of Belgrade</i>	106
Anja Bubik, Katrin Školnik Škrabe <i>Chemical variability of personal care and cosmetic products</i>	112
Miloš Tošović <i>Technical-technological disasters, risk assessment and environmental security</i>	118

Radule Tošović	124
<i>Economic considerations of the relationship of national income, mineral reserves and environmental accounting</i>	
Slavica Krsmanović, Danijela Pecarski, Jasmina Bašić	130
<i>Quality of swimming pool water and hygiene</i>	
Jelena D. Lukić, Latinka J. Slavković-Beškoski, Katarina V. Trivunac, Antonije E. Onjia	134
<i>Analysis of heavy metal(loid)s in coal fly ash leachate by inductively coupled plasma optical emission spectrometry</i>	
Andrijana Miletić, Antonije Onjia	139
<i>Analysis of carbon monoxide in ambient air using passive sensors</i>	
Ivana Trajković, Milica Sentić, Slobodan Cvetković, Andrijana Miletić, Antonije Onjia	145
<i>Analysis of BTEX in sediments by purge-and-trap gas chromatography-mass spectrometry</i>	
Saša Marković, Darja Žarković	150
<i>Economic instruments in the function of environmental protection</i>	
Jelena Milosavljević, Snežana Šerbula, Tanja Kalinović, Jelena Kalinović, Ana Radojević	156
<i>Overview of air pollution in the city of Bor during the period of 2020–2022</i>	
Milan Trumić, Vladimir Nikolić, Mirjana Marić, Jelena Janković	162
<i>Mining solid waste around Bor, yesterday, today, tomorrow</i>	
Danijela M. Jašin, Ljubica Lazić Vulićević, Valentina Mladenović, Aleksandar Rajić	167
<i>The solution for reusing non-recyclable plastic-based materials</i>	
Filip Živković, Milica Stojković, Maja Đolić, Mirjana Čujić	173
<i>Elemental analysis of rare earth elements in coal fly ash from thermal power plants in the Republic of Serbia</i>	
Darja Žarković, Saša Marković	177
<i>Sustainable production in cardboard industry</i>	
Marija Prosheva, Jadranka Blazhevskaja Gilev	182
<i>Sensors for ammonia detection based on carbon nanofiller</i>	
Marija Prosheva, Jadranka Blazhevskaja Gilev	188
<i>Investigation of the UV stability of lignin/polymer composites</i>	
Ana Momčilović, Marta Trninić	193
<i>A comprehensive analysis: offshore renewable energy methodologies, benefits, and limitations</i>	
Danijela Đurić Mijović, Danijela Milanović, Jelena Savić, Miloš Nedeljković, Dušan Randelović	199
<i>Wind comfort design based on building position</i>	
Zaga Trišović, Tomislav Trišović, Ana Virginia Socalici, Corneliu Banesa Birtok	204
<i>Innovative system for electrochemical active chlorine production in coaxial and cabinet-type reactors</i>	
Đorđe Karić, Aleksandra Sretenović-Dobrić	209
<i>Analysis of energy-saving measures in residential buildings connected to district heating systems using information technology</i>	
Bosiljka Srebro, Stefan Milojević, Miljan Adamović	214
<i>Environmental accounting education for sustainable development: a comprehensive overview</i>	
Vladana Đurđević, Aleksandra Janićijević, Dominik Brkić, Ana Popović, Marina Stamenović, Aleksandra Božić	219
<i>Validation of the ICP-OES method for determining the elemental composition of water</i>	
Vladana Đurđević, Jelena Pavlović, Bojan Obradović, Ana Popović, Marina Stamenović, Aleksandra Božić	225
<i>Proficiency testing as a tool for quality control of laboratory test results in environmental pollution analysis</i>	

Radmila Marković, Zoran Stevanović, Zoran Štirbanović, Vojka Gardić, Renata Kovačević, Vesna Marjanović, Jelena Petrović <i>Monitoring of the surface water quality in copper mining and metallurgy operation areas in Bor</i>	231
Biljana Angjusheva, Ildiko Merta, Emilja Fidancevski <i>Sustainable synergy: alkali-activated coal fly ash and CDW in sustainable construction</i>	237
Vaishnavi Inamdar, Ana Popović <i>Global ESG perspectives and the changing world of 2023: a sustainability odyssey</i>	242
Nikola Stojković, Dominik Brkić, Svetlana Čupić, Aleksandra Božić, Sladjana Glišić, Vladana Đurđević <i>Determination of polychlorinated biphenyls in waste oil</i>	247
Dejan Vasić, Vladana Đurđević, Marina Stamenović, Aleksandra Božić, Aleksandra Janićijević, Dominik Brkić <i>Determination of PAHS in medical waste</i>	252
Vesna Alivojvodić, Aleksandra Vučinić <i>EU taxonomy as a framework for a functioning circular economy</i>	256
Milica Marković, Ana Momčilović, Maja Stanković <i>Environmental concerns of lithium battery disposal</i>	261

STUDENTS PAPER

Miloš Kovačević, Nataša Radić <i>Air pollution caused by modern-day armed conflict</i>	266
Danijela Jeremić, Daniela Ristić <i>Influence of “Stubo-Rovni” dam on climate change in the city of Valjevo</i>	272

SCOPE 2. OCCUPATIONAL HEALTH AND SAFETY AND FIRE SAFETY

Marta Trninić <i>Application of 3D random e-glass fiber composites in construction hardhat design</i>	278
Drago Pupavac, Ljudevit Krpan, Josip Knežević <i>Cost-benefit analysis in employee health and safety protection</i>	284
Svetozar Sofijanić, Vladan Pantović, Željko Ognjanović <i>Centralized information system for monitoring workplace injuries</i>	290
Dragan Živanić, Nikola Ilanković <i>Safety concerning cableways</i>	296
Dragan Živanić, Nikola Ilanković <i>Basic safety measures for chain conveyors</i>	302
Nataša Ćirović, Ana Petrović, Marija Burilo <i>Testing of microclimate and physical harms in the sawmills</i>	308
Ana Petrović, Nataša Ćirović <i>Noise level investigation in production process</i>	314
Vesna Marjanović, Jelena Jelisić <i>Comparative analysis of risk assessment in the field of construction</i>	320
Saša Kuzmanović <i>Analysis of assessed professional risks at the workplace of forklift drivers in the Logo company with comparative risk assessment methodologies and reference to the current law</i>	325

Marija Mićanović, Tanja Radović <i>Implementation of strategies for the development of critical thinking in English language teaching among the students of the Occupational safety and health study program at the Academy of applied technical studies Belgrade</i>	331
Tanja Radović, Marija Mićanović <i>Business communication obstacles in English language in occupational health and safety education</i>	335
Radenko Rajić, Ivan Arandjelović, Nikola Tanasić <i>A novel tabular method for estimation of waterflow rate at the hydrant nozzle</i>	338
Goran Đorđević, Martina Petković, Ljubinko Rakonjac, Marko Tomić, Anita Klikovac <i>Selection and use of mechanized equipment for extinguishing forest fires in order to increase efficiency - methodological approach</i>	342
Darko Marković, Nebojša Ćurčić <i>Prevention of occupational risks in transport and installation of concrete prestressed T-girders on project Iverak-Lajkovac</i>	350

STUDENTS PAPER

Milena Andrejević <i>“Near miss” events in the TPS Zemun reconstruction project: a research and analysis</i>	357
Maja Đikić, Novak Milošević <i>Research and analysis of professional stress issues among employees in security roles</i>	363
Lazar Milićević, Novak Milošević <i>The impact analysis of stress accumulated outside the workplace on the occupational safety and health of employees in Institute of Nuclear Sciences „VINČA”</i>	368
Jelena Tintor, Jasmina Rajić, Igor Babić <i>Researching the harmful effects of cooling liquid on employees</i>	374
Jelena Tintor, Jasmina Rajić, Igor Babić <i>Employee safety during plastic deformation metal processing</i>	380
Milica Marković <i>Chemical hazards in horticulture from the aspect of occupational safety and health</i>	385
Marijana Drakulić <i>Potentially explosive atmospheres in flour production</i>	391

SCOPE 3. SMART MANAGEMENT SYSTEMS

Radoslav Raković <i>Information security management standard and personal data protection – practical experiences</i>	398
Miloš Jelić, Ana Aksentijević Jelić <i>Deficiencies and advancement in organizational strategic decision - making</i>	404
Igor Milić <i>Civil protection management model at the local government level</i>	410
Dragan Zlatković, Kostadinka Stojanović, Mirjana Tomić, Nebojša Denić <i>Artificial Intelligence as support for quality 4.0: a review of current applications and future directions</i>	415
Koviljka Banjević, Jovana Femić <i>Adult education in Serbia and countries in the region</i>	421

Dragana Gardašević, Dragana Rošulj, Mina Radišić, Koviljka Banjević <i>Application of the Pareto analysis in quality control</i>	428
Aleksandra Nastasić, Dragana Rošulj, Koviljka Banjević, Aleksandra Pavlović <i>The influence of digital transformation on customer perception</i>	433
Ana Maksimović <i>The effectiveness of environmental social and governance due diligence in driving sustainable outcomes in the outdoor apparel industry</i>	439
Aleksandra Pavlović, Aleksandra Nastasić, Andrea Ivanišević <i>QMS and EMS implementation in Serbian organizations – a driving factor for sustainable development</i>	445
Ana Maksimović <i>Socially responsible chains: investigating the social implications of supply chain due diligence in corporate sustainability</i>	453
Aleksandra Pavlović, Aleksandra Nastasić, Predrag Drobnjak, Ana Langović Milićević, Andrea Ivanišević, Ivana Katić <i>PPP projects and economic growth in Serbia</i>	459
Marija Marčetić, Danijela Misoloska, Bojan Kocić <i>The threats and opportunities in modern forwarding business</i>	467
Jelena Pavlović, Dragica Stanković <i>Contemporary approach to leadership, management, knowledge and innovation</i>	472
Marko Pavlović, Ana Petrović, Đorđe Pavlović <i>Study on the attitudes of electronic banking users in Serbia</i>	477
Jelena Pavlović, Dragica Stanković <i>New technologies, labor market and human resources</i>	484
Zorica Baroš <i>The impact of the kelvin redefinition within the SI System on the improvement of temperature measurement technologies</i>	490
Ana Đokić, Hana Stefanović <i>Analysis and visualisation of COVID 19 data set in Python programming language</i>	496
Sanja Pavlović, Dejan Crnoglavac, Aleksandar Starčević <i>Examining the role of drones as educational tools: an practical teaching example in enhancing learning experiences in STEM education</i>	501
Đorđe Dihovični, Dragan Kreculj, Nada Ratković Kovačević <i>Experiences in teaching and mastering materials in WEB applications in vocational education</i>	507
Marko Pavlović, Ana Petrović, Đorđe Pavlović <i>E-learning: study on students' opinions</i>	513

SCOPE 4. GRAPHIC ENGINEERING

Aleksa Milovanović, Tomáš Babinský, Aleksandar Sedmak, Miloš Milošević <i>Printing parameter impact on PLA material fracture toughness results</i>	520
Bojan Banjanin, Neda Milić Keresteš, Jelena Kerac, Rastko Milošević, Savka Adamović <i>Applications of real-time rendering game engine in education through practices and initiatives</i>	526
Slađana Glišić, Predrag Živković, Aleksandra Janićijević <i>Examination of the possibility of dyeing printing papers with plant extracts</i>	532

SCOPE 5. DESIGN

Jelena Ristić Trajković <i>Society, Ecology and Design Education: Transformative Learning for Future Sustainable and Healthy Environments</i>	539
Biljana Pejić, Bojana Škorc <i>The effects of style on an aesthetic assessment of design</i>	545
Biljana Pejić, Bojana Škorc <i>Familiarity as aesthetic category in design</i>	551
Dragica Nikodinović <i>Analogous principle as an added value in graphic design in the post-industrial era</i>	557
Dušanka Komnenić <i>Design as a form of communication, deconstructive approach to design</i>	563
Duško Trifunović, Anamarija Vartebedijan <i>Graphic design by Miodrag Vartebedijan Varta, Vatra's graphic mark in Yugoslavian and world design</i>	567
Emmanouil Tzimitzimis, Alexandros Papoutsis, Nikolaos Koumartzis, Konstantinos Tsongas, Dimitrios Tzetzis <i>Utilizing parametric computer-aided design and modal analysis for the redesigning of Anglo-Saxon medieval lyres</i>	573
Emmanouil Tzimitzimis, Dimitrios Sagris, Constantinos David, Dimitrios Tzetzis <i>Evaluating the influence of infill pattern and density in fused filament fabrication 3D printing technology through multimedia data analysis business communication</i>	579
Ivana Desnica <i>Leather recycling in the context of Haute Couture</i>	585
Jelena Jocić, Maida Gruden <i>Design and education: traditional and online environment</i>	590
Jelena Zdravković <i>Design fashion and the industry: The context of the emergence of fashion and ready-to-wear clothing production</i>	596
Katarina Nikolić, Danica Glodović, Aljoša Ninković <i>Design, ideology and propaganda</i>	602
Ljubomir Maširević <i>The social significance of video games</i>	607
Maja Milinić Bogdanović <i>Interdisciplinaryness of sustainable design</i>	613
Marija Mićanović, Tanja Radović <i>Motivation for English language learning among the students of the design study programs at the Academy of Applied Technical Studies Belgrade</i>	619
Natalija Gaković <i>Does Frank Lloyd Wright's Fallingwater House represent a precursor to sustainable design?</i>	623
Natalija Gaković <i>Children without parental care in social protection institutions – Park of support design</i>	628
Natalija Đukić <i>Analysis of the spatial organization of a modern apartment in Belgrade, case study New Dorcol</i>	634

Predrag Maksić <i>Design to the measure of marketing</i>	639
Sandra DePalo <i>The experiance and percepton of the light colour in the spatial contex</i>	644
Suzana Polić <i>Techno - praxeological opinions about design: views from perspective of protection of cultural heritage</i>	650
Suzana Polić <i>Visuality, method and Laban's orthography: one parallel</i>	656
Željko Zdravković <i>Bioart and our creative biotechnological future</i>	662

STUDENTS PAPERS

Jelica Živković <i>Use of gold color in interior design</i>	668
Sara Todorović <i>Use of coper color in interior design</i>	674

SCOPE 6. TRAFFIC ENGINEERING

Dejan Jovanov, Daniel Pavleski, Kosta Jovanov <i>Road safety management capacity review – use of Tailor-made checklists</i>	680
Željko Ranković, Nemanja Deretić, Aleksandra Obradović <i>Consequences of traffic accidents in the Republic of Serbia in the period from 2013 to 2022 with proposed measures to reduce fatal consequences</i>	686
Aleksandra Obradović, Dalibor Pešić, Željko Ranković <i>Statistical analysis of traffic accidents on state roads in the work zone on the territory of the Republic of Serbia for the period from 2014 to 2021</i>	692
Lazar Kocić, Aleksandra Obradović <i>Analysis of safety of cyclists in traffic in the city of Smederevo from 2018 to 2022</i>	697
Biljana Ranković Plazinić, Aleksandra Obradović <i>The length of dilemma zone at signalized intersections</i>	702
Kristina Milić <i>Role of the rescue coordination centre in land in case of aircraft accidents</i>	708
Dejan Kožović, Dragan Đurđević <i>Trends of artificial intelligence in aviation: cyber security of ADS-B system</i>	713
Saša Marković, Svetozar Sofijanić <i>The importance of low-cost and differentiation strategies for the business of traffic companies</i>	719
Svetlana Živanović <i>Analysis of the competitiveness of logistics providers in the area of the Western Balkan countries</i>	725
Svetlana Živanović, Gordana Radivojević, Milorad Kilibarda <i>Selection of logistics provider in the field of e-commerce</i>	730
Class “Tecnico Superiore della Logistica per la GDO” biennio 2022-24, ITS Logistica Puglia Bari, Michele Minenna, Nataša Gojković Bukvić <i>Market research aimed towards the analysis of the possibility of launching an operational Start up in the field of LCL (Less Than Container Load) transport at the ports of Bari and/or Taranto (Italy)</i>	736

Miloš Nikolić, Ivana Jovanović, Milica Šelmić 742
A survey on the vehicle routing problem with occasional drivers and its variants

Marina Milovanović Arandelović 748
Application of probability and stochastic analysis to traffic improvement

STUDENT PAPER

Jelena Vajović, Marina Stevanović 754
Improvement of traffic safety on the chosen intersection in the town of Pancevo

SCOPE 7. BIOTECHNOLOGY AND HEALTHCARE

Tatjana Sekulić, Zlata Živković, Marija Perkunić 761
Biological control as an evolving technology in pest management

Zlata Živković, Goran Nestorović, Milan Vasić, Darko Stojićević, Tatjana Sekulić, Markola Saulić 767
Smart farming and long-term sustainability

Zlata Živković 772
Varroa destructor, the parasitic mite of Apis mellifera: a review

Dorin Dumitru Camen, Mădălina Elena Dumitrașc, Maria Mihaela Moatăr 777
Research on the photosynthesis rate in the species Salvia Officinalis in vitro and in vivo

Aleksandar Stevanović, Vera Popović, Milica Jevtić, Jelena Bošković 783
Application of new technologies for adaptation to climate changes in agricultural production

Aleksandar Stevanović, Goran Nestorović, Vera Popović 789
Information systems in organic agriculture - a review

Vladanka Stupar, Darko Stojićević, Aleksandar Stevanović 795
Raising the vineyard - pruning and agrotechnical measures: a review

Markola Saulić, Darko Stojićević 801
Crop modelling: a new tools for crop production

Darko Stojićević, Markola Saulić 805
Basic concepts of ANN model and its application in agricultural research

Milica Blažić 810
Applications of molecular markers in animal genetics and breeding: a review

Milica Blažić, Markola Saulić, Vladanka Stupar 816
Precision agriculture technologies and methodologies used to crop yield prediction – a review

Vladanka Stupar, Darko Stojićević, Aleksandar Stevanović, Milan Vasić 822
Implementation of robotic technologies on apple pruning: a review.

Milica Jevtic, Vladanka Stupar, Milica Blažić 828
Precision agriculture in vegetable farming

Milica Jevtić, Goran Nestorović, Milan Vasić, Darko Stojićević 833
The agricultural smart systems

Milan Vasić, Zlata Živković, Goran Nestorović, Darko Stojićević 838
Drive units in robots for controlled pesticide application

Dubravka Mandušić, Lucija Blašković 844
Deep learning in fruit detection

Dobriła Randelović, Svetlana Bogdanović, Ivana Zlatković, Dragana Stanisavljević <i>Chemical properties and microbiological quality control of frozen plum fruit</i>	847
Aleksandra Stojićević, Tatjana Marinković, Aleksandar Stevanović, Miloš Purić <i>Application of medicinal herbs and spices as a food additive – challenges and limitations</i>	852
Milica Sentić, Ivana Trajković, Ivana Deršek-Timotić, Slobodan Cvetković, Zoran Stojanović, Antonije Onjia <i>Polycyclic aromatic hydrocarbons in medicinal herbs: analytical method development</i>	856
Jana Klopcevska, Zoran Kavrakovski, Marija Srbinoska, Vesna Rafajlovska <i>Nanoemulsions of pumpkin seed oil with turmeric extract</i>	861
Jana Klopcevska, Zoran Kavrakovski, Marija Srbinoska, Vesna Rafajlovska <i>Formulations of carboxymethyl cellulose-based emulgels with turmeric extract</i>	867
Maja Nujkić, Žaklina Tasić, Sonja Stanković, Dragana Medić, Snežana Milić, Vladan Nedelkovski <i>Potential application of mullein leaf as biosorbent for efficient biosorption of Cu(II) ions from synthetic solutions</i>	873
Višnja Sikimić, Slavica Čabrilo, Nada Jelić <i>Possibilities of production of a new functional product - mayonnaise with reduced fat content</i>	878
Miloš Purić, Aleksandra Stojićević <i>Utilization of apple pomace to obtain functional bakery and confectionery products</i>	884
Slavica Čabrilo, Višnja Sikimić, Miloš Purić <i>Alternative packaging in wine packaging technology</i>	889
Jasmina Rajić, Tanja Petrović, Dragana Mihajlović <i>Potential migration of phthalates from different polymers into food</i>	894
Marko Jauković, Tatjana Marinković, Aleksandar Stevanović, Svetozar Sofijanić <i>Food labelling – monitoring of allergen info in bakery retail stores</i>	900
Veroslava Kocić, Dušica Ćirković, Dragana Stanisavljević, Dobriła Randelović, Milica Stojanović, Jelica Lazić Saković, Aleksandar Veličković <i>The Influence of Raw Materials and the Production Process on the Quality of Rosé Wine</i>	904
Danka Mitrović, Nikolina Živković, Jelena Pavlović, Marko Jauković <i>Occurrence of ochratoxin a in wine in Serbia in 2022</i>	910
Anja Vuksan, Jelena Pavlović, Marina Stamenović, Marko Jauković <i>Aflatoxin M1 levels in milk in Serbia in 2022</i>	914
Danijela Pecarski, Dubravka Marinović, Dragana Dragaš Milovanović, Svetlana Karić <i>Adverse effects of pesticides on public health</i>	918
Milica Lučić, Ivana Sredović Ignjatović, Steva Lević, Jelena Lukić, Antonije Onjia <i>Exposure to potentially toxic elements due to consumption of Capsicum annuum in different parts of Serbia</i>	924
Milica Ivanović, Gordana Stefanović, Aleksandra Janković, Sandra Stanković <i>Identification of the optimal co-substrate for co-composting with grape pomace by using multiple criteria analysis</i>	930
Dragan Marinkovic, Tatjana Marinkovic, Aleksandra Jelic <i>Perspectives and challenges in cognitive enhancement based on the neurotechnology approach</i>	936
Snežana Knežević, Tamara Gajić, Dragan Vukolić, Miloš Zrnić, Slavica Đorđević <i>Prescribing wellness in primary care: integrating health and healthcare</i>	942
Snežana Knežević, Tamara Gajić, Dragan Vukolić, Miloš Zrnić, Slavica Đorđević <i>Lifestyle medicine: empowering health through behavior modifications</i>	948

Aleksandra Vracaric, Zeljko Karganovic, Slavka Mitricevic, Ivanka Djuricic <i>Complications of pertussis infection in neonate: a case report</i>	954
Vuk Aleksić, Radmila Aleksić <i>Sport related injuries in Brazilian jiu jitsu</i>	957

SCOPE 8. MECHANICAL ENGINEERING

Tamara Bajc <i>Energy savings and CO₂ emission reduction potential through the existing building renovation</i>	964
Marko S. Jarić <i>Analysis of remediation of horizontal cylindrical tank for oil storage</i>	970
Kuznetsov Yu. A., Kolomeichenko A.V., Logachev V. N., Kravchenko I. N., Kalashnikova L.V., Dobychin A.YYakovlev D.D., Gribakin A.A. <i>Study of porosity and oil capacity of coatings formed by electric arc metallization method</i>	978
Aggoune Mohammed-Salah, Bensedira Nouredine, Milles Abdessmad <i>Effect of the voltage and the magnetic field variations on the velocity field in a MH pump – simulation and experimental analysis</i>	983
Milan Milutinović, Goran Vasilić <i>The effects of tool wear on cutting forces during the turning operation of workpiece with coatings</i>	989
Đorđe Đurđević, Andrijana Đurđević, Nina Anđelić, Katarina Antić <i>Dynamic calculation of friction stir welding tools using the finite element method</i>	997
Dragana Velimirović, Milan Marković, Milan Velimirović <i>Critical review on the safety barriers from the structural and deformation parameters aspects</i>	1002
Elisaveta Doncheva, Aleksandra Krstevska, Marjan Djidrov, Filip Zdraveski, Trajche Velkovski <i>Wire-arc additive manufacturing: recent developments and potential</i>	1010
Andrijana Đurđević, Ljubiša Bučanović, Đorđe Djurdjević, Aleksandar Živković, Aleksandar Sedmak, Đorđe Dihovični <i>Production of a lap joint using friction stir welding and microhardness measurement using the Leeb method</i>	1016
Danijela Živojinović, Aleksandra Božović <i>Comparative analysis of the manufacturing time of a part on a CNC lathe obtained by calculation and simulation of machining using the CAD/CAM software system</i>	1021
Aleksandra Mitrović, Ivan Banjac <i>Optimization of FGD process in TPP Kostolac 'B'</i>	1026
Milan Marković, Dragana Velimirović, Andrijana Đurđević <i>Mathematical model of car rotating during overtaking in a left roadway curve</i>	1032
Misković Žarko, Zoran Stamenić, Jovana Antić, Radivoje Mitrović <i>The latest standards of rolling bearing testing</i>	1039
Murat Ispir, Ilker Goktepel, Muharrem H. Akso <i>Solar-powered farming: evaluating the viability of PV water pumping in Turkish agriculture</i>	1045
Bojan Ivljanin, Andrijana Đurđević, Đorđe Đurđević, Nada Ratković Kovačević <i>The phenomena of rigid and reverse waterhammer and their influence on maintenance of hydropower plants with Kaplan turbines</i>	1052
Miloš Mihailović, Miloš Božić, Tomislav Simonović, Aleksandra Božović <i>The influence of insulation thickness on investment and operational costs in heating systems with a heat pump in Serbia</i>	1058

Aleksandar Petkovic, Jovan Ilic, Ivan Bozic <i>Headwater level governing at small hydropower plants with open channel conveying system</i>	1063
Nenad Mitrovic, Zorana Golubovic, Aleksandra Mitrovic, Milan Travica, Isaak Trajkovic, Milos Milosevic, Aleksandar Petrovic <i>Application of 2D digital image correlation method on three-point bending in material testing</i>	1068
Dorđe Dihovični, Nada Ratković Kovačević, Andrijana Đurđević <i>Application of smart production systems in vocational education</i>	1072
Elisaveta Doncheva, Aleksandra Krstevska, Martin Petreski, Nikola Avramov, Jelena Djokikj <i>A study on the environmental and health impact of hazardous substances during welding</i>	1078
Stojko Biočanin, Milica Timotijević <i>Analysis of research on optimization models and algorithms for planning preventive maintenance of machine systems</i>	1084
Ana Maksimovic, Bojana Zečevic, Ljubica Milovic, Vujadin Aleksic <i>Experimental investigation on the use of JIC for a HSLA Steel Welded Joint</i>	1092
Dragan Šaler, Milan Grujić <i>Landing optimization of a small sounding rocket</i>	1097
Milanka Plavsic, Milenko Plavsic <i>System scaling renormalization problems in bio-thermodynamics: I) Yeast cell colony size scaling, as an opportune model</i>	1103
Aleksa Maljević, Milan Ignjatović <i>Influence of laminate stacking and fiber volume fraction on natural frequencies of composite kevlar 49 aramid – 3501 – 6 epoxy plates</i>	1109
Milivoje Filipović, Ivan Arandelović <i>Fire resistance of boiler room the building structure</i>	1115
Bojana Zečević, Ana Maksimović, Ljubica Milović, Vujadin Aleksić, Srdjan Bulatović <i>Effects of temperature on fatigue crack growth rate of a low carbon microalloyed steel</i>	1121
Goran Nestorović, Dragan Kreculj, Milan Vasić <i>Large-scale three-dimensional printers in Industry 4.0</i>	1125
Milan Travica, Nenad Mitrović, Aleksandar Petrović <i>Strain behavior analysis of steel S235JRH ring specimens</i>	1131
Nataša Trišović, Wei Li, Marko Gavrilović, Corneliu Banesa Birtok, Ognjen Ristić, Milica Milić, Radoslav Radulović, Zaga Trišović, Ana Virginia Socalici <i>Effects of changing design parameters</i>	1135
Stojko Biočanin, Milica Timotijević <i>Selected achievements in the research of the diagnostics of the lack of combustion in the engine and changes in the instantaneous angular velocity of the crankshaft</i>	1142
Neda M. Sokolović, Ivana Gavrilović-Grmuša, Nenad Šekularac <i>Panel shear properties of carbon fiber reinforced LVL board</i>	1149
Vule Reljić, Dragan Šešlija, Vladimir Jurošević, Valentina Mladenović <i>The influence of refrigerated dryers on the compressed air quality</i>	1155
Ivana Jevtić, Obrad Drakulović, Goran Mladenović, Miloš Milošević <i>Types of bee drinkers</i>	1161
Tamara Tešić, Milica Rančić, Danica Bajuk Bogdanović, Ivana Gavrilović Grmuša <i>Effect of tannin on increasing UF adhesive performance</i>	1165

SCOPE 9. ECOTOURISM AND RURAL DEVELOPMENT

Radomir Stojanović <i>Education as a pillar of sustainable agritourism in Serbia</i>	1172
Jelena Premović <i>Cultural heritage as a generator of sustainable development of tourism in local communities in the countries of the Western Balkans</i>	1177
Vladimir Živanović, Nevena Majstorović <i>Analysis of the real number of tourist overnights based on the estimation of water consumption in Zlatibor</i>	1182
Radomir Stojanović, Branko Radeljić <i>Safety and security standards and procedures of modern hotels</i>	1188
Slobodanka Stankov, Branko Radeljić <i>Guided tour as a type of animation in cultural tourism</i>	1194
Miloš Spasojević, Marija Popović, Jasmina Đurašković <i>Incentives for agriculture in the city of Belgrade</i>	1200
Jelena Basarić, Andrijana Golac Čubrilo <i>The role and significance of cultural-historical heritage in the development of cultural tourism – example of the Mileševa monastery</i>	1205
Zlata Živković, Markola Saulić, Vladanka Stupar, Ben Mladenović, Dragan Šaler <i>The potential for rural development in the Braničevo district through the tourist sights</i>	1212
Marija Perić, Ben Mladenović <i>Protection, development and management in a protected natural asset - analysis of the Petnička cave</i>	1218
Marija Perkunić, Tatjana Sekulić, Markola Saulić, Vladanka Stupar <i>The faunal diversity of memorial park Čačalica</i>	1224

STUDENT PAPER

Sara Ilanković <i>Cultural heritage of Italy</i>	1230
Sara Ilanković <i>Italian cinematography</i>	1235

SCOPE 10. MECHATRONICS

Andrea Matta, Mohsen Jafari <i>Towards a theory of digital twins: fundamental definitions</i>	1240
Đorđe Dihovični <i>An analysis of a process of decentralized control of a robot powered by a direct current motor</i>	1246
Milan Vasić, Mirko Blagojević, Goran Nestorović <i>Primary criteria for selecting gearboxes for axes of 6-axis industrial robots</i>	1250
Dragan Kreculj, Đorđe Dihovični, Nada Ratković Kovačević, Siniša Minić, Sanja Jevtić <i>MQTT protocol in the IoT</i>	1255

Srđan Barzut <i>The post-quantum cryptography and challenges in network security and Industry 4.0</i>	1261
Nebojša Andrijević, Vladan Radivojević, Duško Radaković, Dragan Milovanović, Suad Suljović <i>Conceptual model of a system for optimizing the temperature and humidity of honeybee hives using artificial intelligence</i>	1266
Goran Nestorović, Vladimir Petrović, Nebojša Andrijević, Nenad Petrović, Suad Suljović <i>The channel capacity of wireless communication system with L-branch SC combining in rayleigh short term fading and co-channel interference</i>	1270
Dragan Milovanović, Srđan Đorđević, Đorđe Miladinović, Nenad Petrović, Radiša Stefanović, Suad Suljović <i>The outage probability in system limited by Nakagami fading and co-channel interference for classification-based QoS estimation</i>	1276
Dragoslav Perić, Slobodan Obradović, Mirjana Nešić, Dragana Đurić <i>Computer devices and the Serbian language - interface and application</i>	1282



INFORMATION SYSTEMS IN ORGANIC AGRICULTURE – A REVIEW

Aleksandar Stevanović¹, The Academy of Applied Technical Studies Belgrade

Goran Nestorović², The Academy of Applied Technical Studies Belgrade

Vera Popović³, Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia

Abstract: *Organic agriculture is becoming an increasingly significant component of the global food system, with a focus on environmental sustainability and product quality. Information systems and technologies play a crucial role in supporting organic production, environmental conservation, and the production of safe and healthy safe food. The application of precision agriculture, utilizing cutting-edge technological systems, enables pest and disease monitoring and management, efficient water and energy management, digital product identification, the use of Geographic Information Systems (GIS) for crop planning, and blockchain technology for supply chain transparency. Through these applications, information systems and technologies significantly contribute to reducing the negative environmental impacts of agriculture, increasing productivity, and ensuring healthy safe food with greater nutritional benefits in organic farming. This symbiosis of science and technology in organic agriculture helps create more sustainable agricultural systems that can meet the needs of current and future generations.*

Keywords: organic agriculture, information systems, environmental sustainability, healthy food

1. INTRODUCTION

The dynamics of global population growth and the need to ensure a larger quantity of high-quality food, combined with the imperative of preserving the environment and resources, are key factors shaping the development of technologies in the field of organic agriculture. Organic agriculture is a holistic production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity [1-10]. Faced with the challenges of the modern era, the agricultural sector must address a dual task: increasing productivity and ensuring long-term sustainability. It is evident that Information Technology (IT) plays a pivotal role in enhancing productivity in organic agriculture, with the ultimate goal of benefiting agricultural producers [11-15]. Specifically, the application of precision agriculture, using cutting-edge satellite-guided and automated technology systems, along with Geographic Information Systems (GIS), significantly contributes to yield improvement. Simultaneously, these technological advances promote efficient resource utilization, thereby reducing negative environmental impacts. In this light, the integration of new technologies into organic agriculture becomes essential for enhancing the production of safe and healthy safe food and represents the potential for sustainable sector development.

Contemporary trends in information technology development offer organic agriculture a unique opportunity to improve its operations, increase production efficiency, and minimize the negative impact on the environment. Given the specific requirements for producing environmentally friendly

¹astevanovic@atssb.edu.rs

²gnestorovic@atssb.edu.rs

³vera.popovic@ifvcns.ns.ac.rs

products to meet the global demand for organic agricultural products, the main direction of its development lies in the introduction of innovative methods and technologies into the production process.

Despite global challenges in the agricultural sector, the prospects for organic production development through digitization are promising. The use of information systems in organic agriculture is driven by the need to increase its efficiency and manageability, improve product quality, and align with the requirements of organic agriculture standards in the green economy. They enable the automation of many routine processes and informed decision-making [16].

2. APPLICATION OF INFORMATION TECHNOLOGY FOR EFFICIENT RESOURCE AND PROCESS MANAGEMENT IN ORGANIC AGRICULTURE

Organic agriculture represents a specific branch of agricultural production that requires a special management system to ensure sustainable and environmentally-friendly production. The implementation of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems can significantly enhance the efficiency of managing all aspects of organic agriculture, including the management of material and financial resources. One of the key systems for managing organic agriculture is FarmERP. This system encompasses a range of functions crucial for organic farms, including yield tracking and analysis for various crops. These systems allow farmers to gain a better understanding of yield dynamics and make informed decisions. Additionally, FarmERP includes crop planning systems, taking into account crop rotation and their mutual location, which is crucial for preserving soil health. Furthermore, the system provides soil condition monitoring and offers agronomic recommendations for the care of different crops, considering optimal sowing times and agronomic operations. FarmERP also includes cost tracking systems, essential for monitoring the costs of major material resources such as seeds, fertilizers, and fuel. FarmLogs is another important cost management tool in organic agriculture. This system allows tracking all costs associated with organic production, including fertilizers, seeds, labor, fuel, and other factors. It also enables monitoring of soil conditions, such as pH values, moisture, and nutrient levels. Based on this data, FarmLogs provides recommendations based on successful agronomic practices, taking into account natural, climate, and weather conditions, as well as crop characteristics. ERP systems like SAP ERP provide a comprehensive solution for automating business processes in organic production. These systems enable the planning of agricultural tasks and resources, efficient management of business operations, and the optimization of the overall business of organic farms. Additionally, the information system FarmOS supports farmers in managing organic production. This system includes crop and crop rotation planning, weather monitoring, financial accounting, and nutrient management. FarmOS also allows tracking mineral and organic fertilizers, organizing pest control, and provides documentation necessary for compliance with organic agriculture standards. The implementation of ERP and CRM systems, such as FarmERP, FarmLogs, SAP ERP, FarmOS, and others, plays a crucial role in optimizing organic agriculture management. These systems provide better control over all aspects of production, help reduce costs, improve product quality, and contribute to the sustainability of organic agriculture [17-19].

3. ADVANCED INFORMATION SYSTEMS FOR ENSURING COMPLIANCE WITH ORGANIC AGRICULTURE STANDARDS

In the modern context, the use of information systems has become a key component in achieving compliance with stringent organic agriculture standards. These standards encompass various aspects, including the production, labeling, and certification of organic products, as well as requirements for ecological and socially sustainable agricultural practices. In this context, digital solutions play a crucial role in facilitating the compliance process for farmers and providing them with tools to monitor and document all relevant aspects. Information systems enable farmers to

track all stages of organic product production, starting from agricultural activities such as the use of fertilizers, pesticides, and cultivation techniques that comply with organic standards. They allow for efficient monitoring of the flow of raw materials and products throughout the supply chain, contributing to transparency and the reliability of the organic chain. One of the key aspects of information systems for compliance with organic agriculture standards is simplifying the certification process. These systems enable farmers to collect, organize, and store all the necessary information and documentation required for certification. This includes data on inputs used, tracking production processes, and records of previous annual production cycles. All this information streamlines the certification process and facilitates effective communication with certification bodies. Additionally, information systems provide farmers with tools to monitor compliance with environmental and social standards [20-24].

4. IMPLEMENTATION OF SCIENTIFIC INFORMATION SYSTEMS FOR MONITORING AND MANAGING RISKS IN ORGANIC AGRICULTURE

Scientific-level information systems provide essential tools for monitoring and managing risks in the context of organic agriculture. These systems enable farmers to effectively track variables such as climate change, plant and animal diseases, as well as soil and water quality. Through this comprehensive data analysis, farmers can identify potential risks and take appropriate measures to minimize crop losses and enhance product quality. Information systems for risk monitoring and management in organic agriculture can include various components, including meteorological stations to monitor weather conditions, automated irrigation systems to reduce moisture-related risks, disease control information systems, and market analytics tools to optimize resources and reduce market risks. Integrating these information systems into a unified platform allows farmers to efficiently collect, analyze, and predict risks, enabling them to make strategic decisions to improve the sustainability and stability of organic agriculture [25, 26].

5. INFORMATION SYSTEMS ENABLING STATISTICAL DATA MANAGEMENT AND BIG DATA ANALYSIS

This process encompasses all relevant aspects of agricultural production and is based on the application of precision agriculture systems, including the use of GPS technology, field sensors, technology-equipped machinery, storage, and satellite imagery. Integrated systems for monitoring the health and movement of animals, as well as physiological parameters, are also included. This comprehensive set of data includes a significant amount of unstructured information that is crucial for making informed decisions and optimizing agricultural processes. An example of such a system is AgSquared, a software platform that is entirely based on cloud technologies. This platform enables collaboration among various stakeholders in the agro-industry, including managers, agronomists, tractor operators, and farm workers. This approach provides constant access to key information, allowing for improvements in productivity, profitability, sustainability, and efficiency at any time and in any location within the agricultural sector. [27].

6. LAND MONITORING INFORMATION SYSTEMS

Land monitoring information systems are crucial in modern agriculture. They enable precise monitoring of soil fertility and quality, helping farmers choose suitable crops and apply optimal cultivation methods. The use of digital technologies enhances the productivity and sustainability of agricultural systems while preserving the natural balance. These systems allow for precise control of nutrients in the soil, reducing the use of fertilizers. They also improve product quality and reduce the risk of diseases and drought. Digital land monitoring systems provide rapid information on soil health, aiding in crop protection. These systems also support organic agriculture and the preservation of the natural balance by measuring various soil parameters [27].

7. INFORMATION SYSTEMS FOR PLANT CONDITION MONITORING

Organic agriculture requires the monitoring and control of plant conditions to achieve healthy growth and a good yield. Information systems play a crucial role in this process. The system for monitoring and controlling soil moisture uses sensors to measure moisture and provides irrigation recommendations. Additionally, a system for monitoring soil nutrients is important for the sustainable use of nutrients. These systems monitor the content of nitrogen, phosphorus, potassium, and other elements, recommending doses of organic fertilizers. Information systems are also used for early detection of pests and diseases through sensors, including infrared cameras or pest detectors. This allows for rapid interventions without the need for pesticides. Data collected from these systems are processed and sent to farmers, enabling them to optimize processes and improve productivity in organic agriculture. Overall, information systems enable the early detection of problems in organic agriculture, thereby improving yields and product quality [28].

8. INFORMATION SYSTEMS FOR ANIMAL CONDITION MONITORING

In organic agriculture, information systems for monitoring animal conditions play a crucial role. These systems encompass various technological solutions for precise monitoring and management of animal health and movement. One of the key technologies is the RFID identification system, which uses microchips embedded in animals. These microchips enable tracking animal movement and essential health parameters such as body temperature and pulse. Such monitoring allows farmers to effectively track each animal, which is essential for reproduction and rapid response to health issues. In addition, there are systems for monitoring animal health status, which serve to prevent diseases and the spread of infections among animals. These systems use databases of diseases and data analysis tools. Furthermore, feed control systems play an important role in ensuring proper animal nutrition while adhering to organic agriculture standards. These systems monitor and manage food and additives usage. There are also systems for monitoring physiological parameters such as hormone levels, pheromones, and body temperature. These data are crucial for determining the optimal breeding times and the overall health of animals in organic agriculture. All of these information systems enable farmers to efficiently manage farms, reduce negative environmental impacts, and adhere to organic agriculture standards [29].

9. COMMUNICATION INFORMATION SYSTEMS

Organic agriculture is a certified system, well controlled by authorities, so it would a strategy for gathering and analyses of data could be of great value to reinforce the implementation of organic agriculture as a health indicator, in any country or region, where organic agriculture certification already exists. Information systems play a crucial role in improving communication among various stakeholders in organic agriculture, including farmers, consumers, and other interested parties. These systems contribute to building more reliable and transparent relationships among participants in the organic market. By using information systems, farmers are facilitated in tracking changing market demands and consumer needs, allowing for production adaptation. Additionally, information systems provide consumers with access to essential information about the origin and quality of products, which fosters greater trust in organic products. Transparency in the supply chain becomes crucial for consumers and is achieved through the use of modern information technologies. Information systems enhance communication and collaboration among all stakeholders in the organic market, ensuring better sustainability and product quality, while also promoting transparency and trust in organic agriculture [30].

10. CONCLUSION

The integration of information technology (IT) into organic agriculture brings about profound transformations and a range of key elements that shape this change. On one hand, there is the potential for significant improvement in the production of organic food and environmental preservation. On the other hand, there are certain challenges that require careful consideration. The advantages of this integration include increased productivity, reduced negative environmental impacts, the production of high-quality food, and better farm management. These factors contribute to increased profitability and long-term sustainability of organic agriculture. The challenges that accompany this change include high initial costs for implementing IT systems, the need for farmer training, regular system maintenance, and data privacy and security concerns. These challenges can be barriers, especially for smaller farms and rural areas. In essence, the integration of IT into organic agriculture has the potential to significantly enhance this branch of agriculture, but it requires careful planning and management to maximize the benefits and minimize the drawbacks. This process represents a critical point for the long-term development of organic agriculture in line with the requirements of modern society and environmental preservation.

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