

Varazdin Development and Entrepreneurship Agency and University North
in cooperation with
Fluminense Federal University
Faculty of Management University of Warsaw
Faculty of Law, Economics and Social Sciences Sale - Mohammed V University in Rabat
ENCGT - Ecole Nationale de Commerce et de Gestion de Tanger - Abdelmalek Essaadi University
Polytechnic of Medimurje in Cakovec
University of Aveiro



Economic and Social Development

104th International Scientific Conference on Economic and Social Development

Book of Abstracts

Editors:

Marcelo Jasmim Meirino, Ivana Martincevic, Zvonko Merkas

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TEACHER'S COMPETENCES IN EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) ORIENTED BY VALUES: A SYSTEMATIC REVIEW OF LITERATURE

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ABSTRACT

The development and application of competences frameworks and models for education for sustainable development (ESD) have increased during the past several years. The competencies that students, the general public, and teachers need to develop are identified, examined, and evaluated using these models. In this study, we conduct a systematic literature review (SLR) about the frameworks and models that present teacher competences in ESD, focusing on values. Values for ESD can be considered as a set of ethical, moral, and cultural principles that underpin sustainable development and provide guidance for what's right or wrong, supported by norms and rules (UNESCO, 2014; UNESCO, 2020). We analyzed 13 papers out of an initial sample of 75 over the last five years. All the competences's indicators found in these materials were listed, summarized, and, through a content analysis, a list with the competences related to the concept of "values" for ESD was produced. This list of competencies can demonstrate what is expected of teachers in relation to their values for the promotion of ESD. Those models and frameworks analyzed aim to present a list of universal competences of values related to ESD, but they were predominantly produced in developed countries. For future research, it is therefore recommended to complement this framework by considering perspectives and educational contexts from around the world.

Keywords: *Competences, Education for Sustainable Development, Systematic Literature Review, Teacher, Value-oriented for ESD*

LITERATURE REVIEW: HYBRID WORK IN SUSTAINABLE ORGANIZATIONS

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ABSTRACT

Hybrid work models quickly became the most common work arrangement for many employees after the coronavirus pandemic. In recent decades, environmental, social, and governance (ESG) issues related to sustainability have also gained importance in science and management practices. Currently, companies worldwide are concerned about their financial performance and the environmental and social impacts of their operational activities. This study aims to identify, through a systematic literature review, the relationship between sustainable management and hybrid work. To achieve this goal, the study method used is a systematic literature review in international article databases (Scopus and Web of Science). The findings suggest the main themes related to hybrid work and sustainable management, including urban mobility, sustainability, gender equity, talent retention, health, medicine, hybrid work models, opportunities and challenges, construction, pollutant emissions, leadership, and technology. It was identified that the term hybrid work is often confused with other terms related to telecommuting, and there is a knowledge gap linking hybrid work and sustainable management to the Sustainable Development Goals (SDGs). Given the constant technological advancements, the transformation of the post-pandemic globalized society, and the emerging forms of work, more studies are needed to consolidate the terms and concepts related to hybrid work and to meet the premises of sustainable management. Additionally, support tools should be developed for governments, companies, institutions, and organizations. Thus, it will be possible to meet the demands of society, science, and businesses.

Keywords: *Flexible Work, Hybrid Work, SDG, Sustainability, Sustainable Governance*

THE RELATION BETWEEN QUALITY OF COMMUNICATION AND EMPLOYEE'S SATISFACTION

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ABSTRACT

Quality communication is one of key aspects in everyday human life and one of the key factors for maintaining quality private and business interpersonal relationships. Communication has an important role in business organizations, it enables better performance of tasks, leads to a sense of belonging to the organization and to building trust. Employee's job satisfaction is also due to the motivation that drives employees to perform work tasks as well as possible. In addition to rewards, motivation can also be in the form of a positive working atmosphere, which certainly affects job satisfaction. The research part of the work provides insight into the connection between the influence of communication and motivation on employee satisfaction in a construction company. In order to examine the impact of communication and motivation on employee satisfaction, research was conducted in the form of an online survey, The participants (N=74) are employees of the observed company. The questioner with 50 items was created for the purpose of this research. They gained insight into the elements of communication and motivation that have the greatest impact on employee job satisfaction. Results showed that employees prefer different frequency of using face to face and online communication with their supervisors compared whit the frequency that use for everyday business communication. Respondents reported that the higher level in tasks autonomy, higher level of education, price awarding, interpersonal relations and positive feedback provided by supervisors are positively related to the employee's motivation in performing activities. Results could be used for creating working environment that is positively related to the employee's motivation, work performance and employee's satisfaction.

Keywords: *Employee satisfaction, Communication, Motivation*

CITIES FACING TORRENTIAL RAINS: THE ECONOMIC AND PUBLIC MANAGEMENT IMPACTS OF PLUVIAL CLIMATE TRAGEDIES IN RECENT BRAZIL

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ABSTRACT

This research evaluates the economic and public management impacts of pluvial climatic tragedies in the Brazilian territory and their influences on the affected region's public budget. The most notorious recent cases of rainfall disasters involving the mountainous regions of Rio de Janeiro state and São Paulo northern coast state region were analyzed, both locations with a long susceptibility history to these tragedies and that make up the largest urbanized and inhabited region in Brazil, named as Rio-São Paulo megalopolis axis. This region was notable for the biggest climate tragedy in Brazil's history, in 2011 in the Rio state mountainous zone, and for the most recent climate tragedy occurred in 2023, in São Sebastião, São Paulo state north coast city. Based on bibliographical and documentary research this study evaluated comparatively the expenses involved in the reconstruction and urban reconstitution after the tragedies with the prevention public policies expenses. It is established the financial advantage of adopting public prevention policies. It is evident the costly and lofty government spending on reconstruction, mitigation, and contingency measures affects the entire public budget and creates a political culture of no-solution for a periodic and not recent problem that affects the whole region's development. The existence of a public budget destined for the cause but its non-use due to political questions and management failures negatively testify against the government's management about this subject. In summary, government management suffers from its omissions and mismanagement, making a recurrent and well-known problem onerous and potentially tragic, which could have been previously mitigated with the correct prevention policies and investments.

Keywords: *climatic pluvial tragedies, economic impacts, government management, prevention, public policies*

IDENTIFICATION OF RISKS AND OPPORTUNITIES INVOLVED IN THE PROCESS OF IMPLEMENTATION OF QUALITY MULTI-MODELS IN IT COMPANIES OF SMALL AND MEDIUM ENTERPRISES (SME) OF INFORMATION TECHNOLOGY

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ABSTRACT

Implementing multi-model quality management aims to improve internal processes to make the organizations more attractive and competitive in the global market. However, implementing quality multi-models in Brazilian small and medium-sized companies (SMEs) in the information technology (IT) area is challenging and involves many risks. Within this context, this work aims to present in a structured way the risks involved in implementing multi-quality models and the opportunities when one chooses to follow the guidelines, rules, and requirements of quality model certificates for IT SMEs. This research is based on exploratory bibliographic and research action in a medium-sized Brazilian Information Technology company that adopted some quality models to improve its processes. This way establishes a risks list, and map with opportunities to adopt these models. These findings seek to present to IT SMEs the main issues involved, in terms of risks and opportunities, to provide support so that these companies have material to decide whether or not they should adopt one or more quality models, evaluate whether this path adheres to the strategy of these companies and thus enables the best application of this investment, facilitate and better planning for the adoption of quality models, as well as reducing the implementation period when the implementation of one or more quality models is included in the strategy. It is worth highlighting that there are no references to risks and opportunities to implement quality multi-models. It is understood, therefore, that this work contributes to better support and boost IT SMEs.

Keywords: *Implementation, Multi-models quality, Opportunities, Risks, Small and medium-sized companies*

NEW BUSINESS MODELS IN SMES: CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

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ABSTRACT

Small and medium-sized enterprises (SMEs) represent the majority of companies worldwide, they are the main drivers of economic development, job creation and innovation. However they generate negative environmental impacts because they generally don't have sustainable practices in their processes, strategies or long-term vision, as they are considered expensive and difficult to adopt. Alignment with key elements to establish a strategic sustainability perspective is crucial. This includes encouraging and motivating to ensure top management support for sustainability, both in terms of product innovation and the effective integration of sustainable considerations, encompassing social dimensions throughout the entire lifecycle and delegating responsibilities, as well as employing tools to guide decision-making. Implementing sustainability in SMEs may seem challenging, but with a well-structured plan and consistent actions, it is possible to achieve positive results. This paper presents a case study of a Portuguese textile microenterprise, in which this concept is exemplified, that combines social innovation with environmental innovation through its sustainable practices. It also seeks to promote reflection on the social dimension of sustainability, which often receives less attention compared to the other two dimensions, economic and environmental, leading to a limited perception of the complexity of sustainability as a whole.

Keywords: *Case study, Microenterprises, Sustainability*

HEALTHCARE ORGANIZATIONAL CULTURE IN THE ENERGY SECTOR: SOCIAL INITIATIVES IN SUSTAINABILITY REPORTS

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ABSTRACT

Organizational culture assumes a role of extreme relevance in the context of companies operating in the energy sector, significantly influencing both their operational efficiency and their sustainability-related initiatives. Thus, this article aims to perform an analysis of the actions linked to the organizational culture of health in a given company in this sector. The objective of the study is to investigate the information pertinent to the theme of health, which was published in the social dimension of the sustainability reports, analyzing the period between 2018 and 2022. The sustainability reports issued by this organization have served as a primary source for understanding the values and objectives that guide its corporate culture. This qualitative research consisted of the careful analysis of this information, to identify and understand the culture expressed through the actions and symbols described in these documents. The methodology used was content analysis, an instrument used to identify values, beliefs, and practices related to health, as well as aspects correlated with sustainability. The approach to the actions that permeate the organizational culture of health in companies in the energy sector is of unquestionable importance, given the significant repercussions of this theme on the health of workers, the surrounding communities, and the environment. Understanding the approach and communication plays a key role in assessing your commitment to aspects associated with life and well-being. The results presented provided opportunities for (re)organization, (re)alignment, and revision of its strategic guidelines and, consequently, of its health practices, in the search for more effective and more integrated actions. In addition, the research can be used as a reference point by other companies in the sector that seek to improve their approaches to health and sustainability.

Keywords: *Organizational Culture, ESG, Health*

PROPOSAL OF ACTIONS TO LEVERAGE THE PERFORMANCE OF STUDENTS IN THE NATIONAL HIGH SCHOOL EXAM: ANALYSIS IN A FEDERAL PUBLIC SCHOOL IN RIO DE JANEIRO

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ABSTRACT

The National High School Examination (ENEM) became the main access to college education in Brazil, and its results are used as a requirement for participation in a lot of programs offered by the Federal Government such as: FIES, Sciences without Frontiers, SISU, SISUTEC, among others. Given this, the students finishing high school, specially the ones coming from public school, are required to take the test with the obligation to achieve a good performance, if they intend to continue their academic life or to participate in the offered programs. Therefore, the objective of this study was to identify the main difficulties faced by the high school student in the performance of the test, through a diagnosis made at a Federal Public School located in Rio de Janeiro, in order to propose actions that can improve the student's performance in the ENEM. For this, a bibliographical research was carried out, based on theoretical themes such as the High School reformulation, ENEM, influence factors on student's performances, among others. It is a qualitative study with bibliographic, documentary and field researches as much as direct, applied and participant observation. The field survey was performed using the questionnaire technique, applied to all teachers and students of the 3rd year of High School in two Campuses of the Institution, aiming at the analysis of the influence variables such as: the student's knowledge about the exam and offered programs through their results, gender, origin, school environment, family environment, encouragement given to student by teachers and school, the student's understanding of the theoretically proposed interdisciplinary character in elaborating ENEM's issues. The results of this study demonstrated that the High School students are facing challenges that begin with the lack of Vocational Guidance in schools. These youngsters feel lost and have difficulty choosing the career they intend to follow. That is a fact that contributes to the student's struggle, they start feeling anxious, withdrawn, sad and unmotivated. The study showed that the student's greatest difficulty in the test is not necessarily the lack of content received at the school, but the lack of knowledge applying what they have learned by solving the ENEM issues, which are based on a specific approach. It was also found that a large part of the students is still unaware of most of the programs offered by the Federal Government through ENEM results, including the SISU main gateway for Federal Public Universities, pointing out that there is an urgent need to divulge the programs and their proposals to the basic education institutions of the country.

Keywords: *National High School Examination, Performance, Challenges, University education entry*

MODEL OF ADVISING DEPENDING ON THE PRODUCTION INTENSITY AND THE FORM OF AGRICULTURAL ENTITY

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ABSTRACT

Eastern Croatia is the most important agricultural region in the Republic of Croatia in terms of agricultural area and production. Recently, agriculture faced significant changes — integration of new digital technologies and adaptation to more sustainable agricultural production and challenges — climate changes, depopulation, etc. Consequently, there is an increased need for advising farmers in terms of applying new techniques, mechanization and equipment in agriculture and generally all aspects of digitalization in agriculture. The aim of this paper is to provide proper kind of advisory (extension) service in the form of verbal model according to the organizational form of agricultural entities and intensity of agricultural production, which is shown on the example of Eastern Croatia. Among 5 counties of Eastern Croatia, Osijek-Baranja County is the most intense in terms of agricultural area and livestock units. The most important organizational forms in Croatia are family farms (154,697), self-supply farms (10,250), trade associations (3,039), trading crafts (2,299) and agricultural cooperatives (355). In Eastern Croatia, the situation is similar. Chronological display of the development of Advisory Service in Croatia is presented herein, as well as the scope of its activities and methods. Based on the presented results, it was concluded that integrated advice, means of mass distribution and online services are suitable for all forms of entities and levels of farming intensity. Whether individual or group counseling is the most suitable method depends on the entity complexity and intensification level. For the simpler forms of entities and lower levels of intensity, group counseling method is more suitable because it encourages dialogue and decreased isolation of farmers, while being a more rational method for the advisors, but at the same time requires a high level of skills. For the more complex organizational forms of entities with higher level of intensification, individual advising is more suitable because it requires more advisory time per farm and a higher level of adaptation to individual needs.

Keywords: *advising, agricultural producers, production organizations, production intensity*

PLUVIOMETRIC TRAGEDIES IN BRAZIL AND LOCAL ECONOMIC IMPACTS – AN ANALYSIS OF LOCAL TOURISM

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ABSTRACT

Brazilian tourism is closely linked to natural and environmental conditions. This is evidenced by the exploration of coastal regions and the vertiginous growth of ecotourism, both responsible for most national tourist destinations. Therefore, tourism is an economic sector highly sensitive to climate change and its natural consequences. This research evaluates the economic impacts generated in the tourist sector of Brazilian locations affected by climatic disasters associated with intense rainfalls, floods, and landslides. Notorious recent cases of rainfall disasters were analyzed involving the mountainous regions of Rio de Janeiro state, São Paulo northern coast state, and south Bahia state. All these regions are notorious for their tourist vocation and sought-after destinations for leisure travelers. We also analyze tourist losses in infrastructure terms and the affectability of possible interest destinations. Based on bibliographical and documentary research, it was possible to perceive that psychological trauma also emerges as a potentiator for the subsequent tragedy of economic damages among the structural impacts and financial losses. The tourist management of locations susceptible to such phenomena must pay double attention to these risks of possible financial losses and humans. Tourism is negatively impacted by such weather events, which for certain locations, highly dependent on this sector, can result in a higher local social-financial aggravation. A partial solution or mitigation for this issue involves joint action by public and private management, investments, and effective policies to contain damage and prior preparation for possible disasters.

Keywords: *climatic pluvial tragedies, economic impacts, management, prevention, tourism*

WHERE IS THE THEORETICAL BASIS FOR THE PROPOSAL OF BLOCKCHAIN TECHNOLOGY IN SUSTAINABLE SUPPLY CHAIN MANAGEMENT? A SYSTEMATIC REVIEW

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ABSTRACT

The advancement of studies and practices on the impact of blockchain technology on the supply chain has been increasing scientific interest. The global push for better sustainability management conditions in the supply chain, ESG, life cycle, and competitive advantage has also been investigated. Just like other technologies in industry 5.0, AI, IoT, and Big Data, among others, Blockchain also aroused the interest of researchers, largely due to its promise in solving challenges posed to the supply chain, such as traceability, transparency, auditability, security, greater efficiency, among other objectives focused on sustainability. This context made the literature expand, increasing the discussion about causal relationships between these objects of investigation. However, this nexus, built between blockchain and the supply chain, has been gaining relevance in the scientific discussion, due to the way in which the existence of this causality emerged and because the research is based on practical motivations, with different lines of thought and with no consistent theoretical basis. The purpose of this work aims, through a systematic literature review, to comprehensively investigate how the research on blockchain applied to the sustainable supply chain has been constructed. The originality of this proposal lies in its results, which present the state-of-the-art theories developed for this field of research and how the lack of a consistent theoretical basis has hampered the advancement of studies on blockchain in the supply chain. The main points between the causal relationships, characteristics, and determinations of these objects of study are discussed, which, in some cases, concluded the possibility of more efficient sustainable management. We finish by highlighting contributions to the literature by surveying existing theories and lines of thought, and also by suggesting future work on blockchain governance applied to the supply chain.

Keywords: *Blockchain Technology, Supply Chain, Sustainability, Industry 5.0*

DIGITAL TRANSFORMATION OF CINEMA IN THE 21ST CENTURY AND ITS IMPACT

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ABSTRACT

Digital technology in the 21st century changed the cinema in every aspect, from filming with digital cameras, digital distribution and screenings in cinemas, platforms for home screenings to digital marketing via social networks. In this paper we try to determine the impact of digitalization on cinema, from economical, ecological and social perspective. Cheap HD digital cameras enabled the democratization of filmmaking, while drones helped independent filmmakers to film spectacular scenery without enormous budgets. However, the cost of digital cinema is not necessarily less than the 35mm film; indeed, it is sometimes greater in many aspects. The Academy of Motion Picture Arts and Sciences found the cost of long-term storage of 4K digital masters to be higher up to 11 times that of the cost of storing 35mm film masters. Also, digital storage media are not completely reliable and stored media can be lost. The digitalization of cinemas was a costly process that favored multiplexes over traditional one-screen cinemas, especially the smaller and art ones, as multiplex cinemas use only one operator for a large number of cinema halls. Streaming platforms brought a much wider choice of films to users, but only for a limited time, and the Blu-Rays still remain the most reliable way to collect movies. From the ecological point of view, streaming media's carbon footprint, were estimated in 2019 to be 1 percent of global greenhouse gas emissions, and this figure is rising at a high rate as more people around the world stream more media at higher bandwidth, especially during and after the COVID-19 pandemic. This paper will present not only the history of this processes, but also collect, summarize, analyze and comment the latest research data from various reliable sources.

Keywords: *Cinema, Digital technology, Film*

SUSTAINABLE DEVELOPMENT STRATEGY OF HEALTH TOURISM: THE CASE OF VRNJACKA BANJA

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ABSTRACT

This study focused on sustainable health tourism of Vrnjacka banja in order to identify potential problems and resources to improve its strategic position. Analysis of case study consisted of evaluation of factors defined by UNWTO methodology, content analysis of meta data as well as Development Strategy of Vrnjacka banja Municipality. The results showed that main problems are infrastructure, ecology, and privatization. In this paper, author provided guidelines for strategic development of Vrnjacka banja.

Keywords: *Strategy, sustainable development, health tourism, Vrnjacka banja, Serbia*

KAIZEN COSTING: A CASE STUDY IN A CONSTRUCTION COMPANY

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ABSTRACT

This research is conducted with the primary objective of assessing the effectiveness of implementing Kaizen Costing to achieve cost reduction within a civil construction company across four distinct projects. The methodology employed encompasses an exploratory approach based on in-depth case study analysis. The application of Kaizen Costing has been found to make significant contributions to cost-saving efforts. Notably, the approach has resulted in a remarkable reduction of up to 10% in expenses within one of the construction projects. As such, this research objective plays a crucial role in enhancing the overall performance of the company under investigation. Moreover, it serves as a valuable reference for similar cases, ultimately promoting increased productivity and improved cost management.

Keywords: *Kaizen Costing, Construction Company, Case study*

DIGITALIZATION, WOMEN ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT GOALS: THE BULGARIAN CASE

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ABSTRACT

The focus of the paper is on the relationship between digitalization, female entrepreneurship and sustainable development. Its aim is to outline the role and contribution of female entrepreneurship, in particular digital female entrepreneurship in Bulgaria, to the implementation of the Sustainable Development Goals. It examines the specifics of digital entrepreneurship and how it contributes to the achievement of sustainable development goals. Special attention is paid to female entrepreneurship, including in Bulgaria. To achieve the goal of the research, a three-step technology is applied. It is based on a set of indicators such as the number of newly born enterprises, the number of closed enterprises, self-employed persons with and without employees, the level of Total early-stage Entrepreneurial Activity, description of characteristics of women entrepreneurship and a study of the profile of Bulgarian digital startups founded by women or by women and men. The results show that there is a difference in entrepreneurial activity between women and men, which is below the average for the European Union. The main characteristics of female entrepreneurs in Bulgaria are also presented. The share of female digital entrepreneurship is not large, but it contributes to the achievement of the goals for Sustainable Development. This is evidenced by the subject of their activity focused on areas such as education, health, sustainable and environmentally friendly production and consumption, providing work for vulnerable groups, digital marketing and online commerce. The main conclusion is that theoretical studies and empirical evidence clearly highlight the contribution of women (digital) entrepreneurship to achieving a more sustainable, more socially and environmentally oriented economy.

Keywords: *Female entrepreneurship, Digital entrepreneurship, Sustainable development goals, Startups*

A MODEL OF CHANGE MANAGEMENT FOR THE FILM INDUSTRY IN THE CONTEXT OF CONTINGENCIES

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ABSTRACT

The purpose of this paper is to offer a model for change management for the film industry in the context of contingency. The model was developed based on theoretical analysis and discussion of most referenced models in change management, as well as the literature on contingency. Subsequent discussion of its applicability to the film industry is presented and resulted in a proposed model for this industry composed by four key steps: Situational awareness, Decision-making, Communication, and Monitoring.

Keywords: *Change management, Film industry, Contingency, Communication, Monitoring*

FOSTERING ORGANISATIONAL EXCELLENCE: ANALYZING THE INTERPLAY BETWEEN INVOLVEMENT IN CONTINUOUS IMPROVEMENT AND ORGANIZATIONAL SOCIAL CAPITAL

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ABSTRACT

Organisational culture plays a crucial role in active participation in continuous improvement and innovation. A culture that values the active involvement of professionals in these areas, fosters an environment that encourages them to acquire new skills and knowledge, as well as to promote innovation in processes and working methods. It also has a significant impact on the way they perceive their roles, interact with each other and approach their work. This topic becomes particularly relevant in the context of teaching and education. In this context, the use of information and communication technologies is inevitable, culminating in the need to use innovative training and learning methods. This reorganisation of education systems implies a shared commitment to continuous improvement of teaching and learning, requiring a collective effort from all those involved. This study focuses on the work context of education (n=233 professionals from public and private schools), exploring the relationship between the culture of involvement in continuous improvement (at process and/or individual level), with the organization's social capital, leadership relations, as well as the individual-work interface (assessed using COPSOQ III). The results show a symbiotic relationship between the organisational culture of involvement and the dimensions assessed, particularly social capital. In conclusion, social capital is an organizational strength that is highly mediated by the culture of employee involvement in continuous improvement at multiple levels. Understanding its synergy provides valuable information for organizations that want to focus on innovation and continuous improvement.

Keywords: *Organizational Social Capital, Continuous improvement, Quality, Innovation, Education professionals*

COST-EFFECTIVENESS OF APPLICATION OF MICROBIAL BIOAGENTS AS A SUBSTITUTE FOR MINERAL P FERTILIZERS ON ACID SOILS

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ABSTRACT

The importance of soil fertility and its elasticity is increasingly highlighted in view of the significant limitations of crop cultivation due to climate change and soil degradation. Unfortunately, in the last few years in the Republic of Croatia, the share of acidic arable soils and soils with a low content of SOM and plant-available phosphorus is worrying, but the use of microbial bioagents with the aim of increasing the availability of P in agricultural soils is very promising. The aim of this paper was to determine the profitability of using microbial bioagents on acidic soils with different levels of available P in order to determine the possibility of reducing mineral fertilization without reducing yields and without increasing production costs. For that purpose, a model was created for calculating the costs of mineral fertilizers and

microbial bioagents (MB) in the cultivation of corn and wheat. The required fertilization was calculated for 14,646 soil samples with a total of 44,604 ha of arable land based on the results of agrochemical soil analyses. Three models were used: a basic model with an analysis of the required P mobilization without including the potential benefit of N fixation, a model with an assumed reduction of the N fertilization of 5%, and a model with an assumed reduction of N fertilization of 10%. Models show that the application of MB in corn and wheat cultivation can be already profitable with N fixation which reduces N fertilization by 10-20% without affecting P mobilization. With the expected effect on P mobilization and reducing the need for P fertilization, the 5% reduction of N fertilization is already profitable with mobilization of 5–15 kg P, as well as 10% reduction in N fertilization with mobilization of 0–10 kg P ha⁻¹. Including the expected effect on potassium and micronutrients, the model could prove the cost-effectiveness of using MB with an even smaller effect on N fixation and P mobilization.

Keywords: *acid soils, available phosphorus, fertilization, microbial bioagents, poor soils*

DECISION-MAKING WITH MULTICRITERIA METHODS: A COMPARATIVE STUDY BASED ON REAL DATA

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ABSTRACT

The variety of existing multicriteria methods and their characteristics are illustrated and systematized, for example, in the work of Wątróbski et al. (2019) and Guarini et al. (2018). Although scientific and applied research in this field has provided a broad framework for the different methods, from an empirical point of view, the selection of multicriteria methods continues to prioritize theoretical and practical simplicity. It has been found that different

methods are used for similar decision problems (Wątróbski et al., 2019), and depending on the decision context, the technical assumptions of existing methods are often adjusted (Dias et al., 2018; Marttunen et al., 2017; Wang et al., 2009), leading to difficulties in comparing the results obtained and revealing a mismatch between theory and the underlying needs of real decision contexts. Even if different methods lead to the same classification of alternatives, this does not necessarily determine the merit or robustness of any method (Saaty, 2013). But more than apprehending the assumptions and technical formalisms associated with each method, it is desirable to complement the body of knowledge in this domain, whose content is fundamentally technical, with other descriptive analytical references with on key decision-making aspects. This framework should support the understanding on how and why different methods produce divergent results for some alternatives and to what extent this information can be useful to determine the suitability of the method in view of the characteristics and objectives of the decision context. This work analyzes this issue based on data collected in real decision-making contexts, where collective decision-making exercises were carried out to differentiate and establish priorities between alternatives. The methodological approach followed consisted in comparing four multi-criteria analysis methods, which appear in the literature as the most used (AHP, TOPSIS, SAW and WPM). The analysis and discussion developed goes beyond the technical aspect that can be associated with other studies, which have neglected the importance of analyzing the alternatives in an integrated way, as well as they are characterized and how are selected due to the differentiated results that each method allows. This work enables comparing the final rankings and discuss the consistency of the results, considering: i) the decision matrix, where each alternative is linked to the criteria; and ii) the preference structure based on the weights collectively assigned to the criteria.

Keywords: *decision support, multicriteria, public policy*

THE POTENTIAL OF CROATIANS SOIL FOR NITROGEN MINERALIZATION FROM SOIL ORGANIC MATTER

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ABSTRACT

Nitrogen (N) is an essential element for life and it is one the most limiting factors for sustainable and profitable agricultural production. Its widely noted fact in enhancing crops yield and quality led to excessive use of nitrogen fertilizers worldwide, which affected soil degradation and environmental quality. High prices of mineral fertilizers forced farmers to optimize fertilization and look for alternative sources of N in order to ensure yields and quality. An often forgotten source of N is its mineralization from soil organic matter, an unstoppable process led by soil microorganisms breaking down soil organic matter (SOM). During the year 2021 about 27,716 soil samples were analyzed in Croatia. On one hand the results showed that the SOM content in about 58.2% of soils was higher then 2%, but, on the other hand, about 49.9% soils were acidic or even very acidic, while a high proportion, 50.7% of soils were poor in phosphorus (P). Given that N mineralization depends on a large number of factors, primarily the content of soil organic matter, then texture, soil pH, temperature and moisture, Croatian soils indicate a respectable potential for N mineralization and a strong need for methods/models to predict N mineralization from SOM. Rebalancing N recommendations in order to reduce N fertilizers would result in multiple environmental (reduced soil acidification, less N leaching, less gas emissions) and financial benefits. Also, saved money could be allocated in order to increase plant available P in soils and to apply bioagents containing N-fixing and P-solubilizing microorganisms which would ensure additional N and P for plant uptake, as well as intensify N mineralization from SOM.

Keywords: *Mineralization, Nitrogen, Soil organic matter*

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AGRICULTURAL SMALL AND MEDIUM-SIZED ENTERPRISES COPING WITH THE EFFECTS OF CLIMATE CHANGE

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ABSTRACT

Beginning of the 20th century intensification of agriculture began, which was especially noted after the Second World War. Intensification of agriculture meant the separation of agricultural systems from the natural ecosystems. In order to replace all the benefits of natural systems, vast fields of agriculture required artificial human input of energy in order for such systems to prevail. These inputs refer to fertilizers and plant protection, which today are considered to be the highest cost of food production. Such, intensified agricultural systems managed to produce higher yields but with higher inputs (costs). Intensification of agriculture achieved higher yields but caused negative effects on the environment, especially soil degradation, causing depletion of organic matter and biodiversity in the soil. In addition, recent climate changes and weather extremes have shown that these intensified systems are very easily subject to stress conditions caused by climate extremes. Small and medium enterprises (SME), that have built their business in agriculture, are highly affected by soil degradation and these weather extremes. One way to reduce their costs and secure steady yearly yields and profit is to apply agricultural practices based on the principles of natural systems that conventional agriculture has abandoned so many years ago. Recently there has been a shift in agriculture towards sustainable practices not only to produce healthy organic food but also to create systems that require less human input and are more resistant to stress conditions. In order to improve soil condition there is a need to shift from using mineral fertilizers and chemical pesticides. Instead of using mineral fertilizers, there is an option of using bioagents whose utilization has been growing in the last few years. Improving soil health by using bioagents can also improve crop resistance. Additionally, SMEs can use management practices, such as intercropping crops with trees (alley cropping), that can mitigate the negative effects of extreme weather conditions. All of these principles are much easier to implement for SMEs than for large companies whose production is based on large areas and large numbers of machinery.

Keywords: *climate change, soil degradation, sustainable agriculture, SME*

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SOIL SUITABILITY ASSESSMENT FOR AGRICULTURAL PRODUCTION AND LAND EVALUATION AS A DECISION MAKING TOOL

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ABSTRACT

Soil suitability assessment for agricultural production and land evaluation is a critical decision making tool for farmers, land managers, and policymakers. This process involves the systematic evaluation of soil properties and characteristics to determine the suitability of land for various types of crops and agricultural practices. The key steps and considerations in this process is to collect detailed information about the soil, including its physical, chemical and biological properties. This data can be obtained through soil surveys, laboratory tests and field observations which help in categorizing the soil into groups or classes. It is also necessary to consider factors like climate, topography, water availability and socio economic considerations that can influence the suitability of the land for agriculture. These factors can greatly impact the overall suitability of the land for agricultural use. Based on the assessment results informed decisions can be made regarding land use and agricultural practices such, as selecting crops implementing land management techniques and allocating resources accordingly. Soil suitability assessment and land evaluation are essential tools for optimizing agricultural production, conserving natural resources, and promoting sustainable land use practices. These assessments help in making informed decisions to ensure that land is used in a way to maximize productivity while minimiz negative environmental impacts.

Keywords: *data collection, soil classification, evaluation criteria*

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