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Inovația

factor al dezvoltării social-economice

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INDUSTRIA 4.0 CA SOLUȚIE DE CREȘTERE A PRODUCTIVITĂȚII MUNCII

INDUSTRY 4.0 AS A SOLUTION TO INCREASE THE LABOUR PRODUCTIVITY

Andrei POPA, ORCID: 0000-0003-2006-6923
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Andrei Popa, e-mail: 4andreipopa@gmail.com

Introduction

The "Industry 4.0" initiative, where digitization and automation of industrial processes are seen as solutions to boost sustainable industrial development, is based on the use of information technologies and artificial intelligence, thus replacing the exploitation of human resources in various technological segments and industrial operations, including those with increased risks to employee health and safety. In the context of a declining active population, national policymakers must find solutions to ensure the continuous and sustainable development of the Republic of Moldova's industry, and the purpose of our research was to argue the reason to implement systems and technologies designed in the "Industry 4.0" paradigm in the Republic of Moldova.

Material and methods

In order to find an answer to the problem and achieve the objective of the study, official statistical data (National Bureau of Statistics of the Republic of Moldova (NBS), UNECE Data Portal, National Employment Agency (ANOFM)) were studied, collected, selected and analyzed. We also studied the opinions of researchers and practitioners regarding the prospects for sustainable industrial development and the impact of "Industry 4.0" systems and technologies on labour productivity.

Results

In the Republic of Moldova, the value of manufactured industrial production, in current prices, in the period 2014-2022 increased from 43,54 billion lei in 2014 to 85,50 billion lei in 2022, representing a growth of about 196%. During this period a stable growth in average labour productivity, also expressed in current prices, is also observed. Although the data presented above shows us positive dynamics, the volume indices of industrial production compared to the previous year (previous year=100) shows us a different situation. Linear trends of "volume indices of industrial production" and "indices of average number of employees" in Moldova' industry (previous year =100%), reveal that both indicators have a decreasing trend.

Same, according to the "Labour Market Forecast for 2023 from the Employers' Perspective" developed by the National Employment Agency (ANOFM, 2023), in 2022, compared to 2021, there was a twofold increase in the number of economic agents who cited that *the lack of qualified personnel and the low number of staff are one of the main reasons for the failure to fill vacant positions and full-time positions*. The Forecast notes that the manufacturing industry has become the second industry most affected by the labour shortage (14%), after wholesale and retail trade. The shortage of skilled and unskilled labour is a structural problem of the economy of the Republic of Moldova and, in particular, of the domestic industry. In general, the increase in the total number of people employed in industry over the past ten years has been due to the develop-

ment of labor-intensive industries.

Based on the analyses and research carried out, we consider that as a solution to stimulate the productive forces in the Republic of Moldova can be the "Industry 4.0" paradigm, which refers to the technological transformation that society is experiencing in the 21st century (Ross & Maynard, 2021) and which involves a new approach to production based on the massive introduction of information technology into industry, large-scale automation business processes and the spread of artificial intelligence.

According to the paradigm, in the future, factories and plants will be able to improve and modernize themselves, that is, without or with minimal human involvement. Business processes, logistics, and production cycles will be constantly optimized autonomously. Predictive analytics will play a significant role in this process.

Based on the analysis of large amounts of data, it will be possible to predict the probability of a system element or an entire device breaking down, and replace the component before it completely fails. Also, the introduction of new technologies allows increasing productivity by optimizing the loading and operating modes of production equipment, optimizing logistics and supply chains, improving key product quality characteristics, more accurately forecasting demand, reducing the time of design and bringing products to market, and improving after-sales service.

Depending on the situation it is in, and the goals it pursues, each industrial enterprise have to adopt its own strategies for implementing the "Industry 4.0" concept. When making these decisions, it is necessary to evaluate and appreciate:

- strategic goals for the next few years;
- technologies and systems that have already been implemented and are operating at the enterprise;
- the efficiency of the technologies and systems that have already been implemented at the enterprise;
- steps (stages) to be performed for a successful transformation;
- the benefits that the enterprise wants to obtain.

In the same way, each enterprise must establish its strategic priorities and the sequence in which it will act.

As a result of such a strategic analysis, the enterprise will be able to formulate an operational digital transformation plan for all its structural units, indicating SMART (*Specific*, *Measurable*, *Achievable*, *Relevant*, *and Time-Bound*) goals.

Conclusions

The growth of the population's well-being is closely linked to the capacity of society to produce values that satisfy or contribute to the satisfaction of individual and collective needs. The industrial activity in the Republic of Moldova is carried out in the context of an ongoing demographic crisis and an increasing flow of emigrants. The implementation of technologies of the "Industry 4.0" paradigm is achieved through the optimization of production business processes. Same, "Industry 4.0" paradigm represents a new level of production organization and value chain management throughout the entire product life cycle, and aims to achieve increased productivity and increased worker safety through elimination of dangerous jobs.

Keywords: *labour productivity*, *Industry* 4.0, *transformation*, *automation*, *information technologies*

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ROLUL INTELIGENȚEI ARTIFICIALE ÎN REZOLVAREA PROVOCĂRILOR ECONOMICE CONTEMPORANE

THE ROLE OF ARTIFICIAL INTELLIGENCE IN SOLVING CONTEMPORARY ECONOMIC CHALLENGES

Liudmila ROȘCA-SADURSCHI, ORCID: 0000-0003-1358-0019
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Liudmila Roșca-Sadurschi, e-mail: liudmila.sadurschi@gmail.com

Introduction

Artificial intelligence (AI) has become a central element in modern economic systems, influencing various sectors globally. As economies face a range of contemporary challenges, including unemployment, inequality, and inefficiencies in resource distribution, AI offers potential solutions to these issues. It has the ability to optimize processes, enhance decision-making, and drive innovation. However, its integration into the economy also raises critical questions regarding workforce displacement, data privacy, and ethical concerns [1].

Material and Methods

This study adopts a comprehensive review methodology, analyzing the existing literature on AI's impact on economic development. Data from multiple reports, including those by the European Parliament, OECD(Science, Technology and Industry), Scoreboard, OMPI and the World Bank, are examined. The research focuses on the application of AI across various sectors, such as manufacturing, agriculture, healthcare, and finance, as well as its role in shaping policies and economic strategies. The study also incorporates findings from systematic reviews and case studies in emerging markets [4].

Results

The results demonstrate that AI significantly contributes to economic development by improving productivity, fostering innovation, and driving economic growth. AI-powered automation in industries like manufacturing and agriculture has reduced costs and enhanced operational efficiency. Moreover, AI applications in data analytics and decision-making processes have allowed for more accurate economic forecasting and better resource allocation [2]. However, AI adoption also presents challenges, including the risk of job displacement and increasing economic inequality. Emerging economies, in particular, face difficulties in fully capitalizing on AI's potential due to limited access to necessary technology and expertise [4].

Conclusions

AI holds substantial promise for addressing contemporary economic challenges, offering innovative solutions that can boost productivity and drive growth. However, to fully realize its benefits, careful management is required to mitigate its potential negative impacts, particularly on employment and income distribution. Policymakers and industry leaders must collaborate to ensure that AI technologies are deployed equitably, with a focus on sustainable and inclusive growth. There is also a need for comprehensive training programs and international cooperation to ensure that emerging economies are not left behind in the AI-driven economy [6].

Keywords: *Artificial Intelligence, economic challenges, automation, economic development, Industry 4.0, AI applications*

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PERSPECTIVE PENTRU AFACERILE DIN MOLDOVA ÎN CADRUL COOPERĂRII ÎN REGIUNEA DUNĂREANĂ

PROSPECTS FOR MOLDOVAN BUSINESSES WITHIN THE DANUBE REGION COOPERATION

Andrei POPA, ORCID: 0000-0003-2006-6923
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Andrei Popa, email: 4andreipopa@gmail.com

Introduction

Contemporary trends in the globalized economy call for the integration of small businesses with large ones (including multinational companies) in order to maximize the individual satisfaction of each customer. In the context of the EU cohesion and regional development policy, the European Commission promotes strategies that support the development of clusters – business groups that bring together different companies from value chains operating in several EU countries. For enterprises in the Republic of Moldova, a candidate country for accession to the European Union, cooperation and integration in value chains are a necessity to ensure their proper functioning and a way to ensure their sustainability.

Material and methods

In order to find an answer to the problem and achieve the objective of the study, official statistical data (National Bureau of Statistics of the Republic of Moldova (NBS) of the trade flows of the Republic of Moldova were studied, selected and analyzed. Same, a number of specialized studies and reports were analysed to identify several value chains that could be particularly relevant for further cooperation between the EU and Moldova in the Danube Region cooperation framework.

Results

The Republic of Moldova is closely connected to the international economic environment, and the fluctuations in the Gross Domestic Product confirm the influence of external factors on the economy of our country. Thus, the decrease in GDP in 2020 by 3.16% compared to 2019 is directly caused by the conditions in which the country's economy operated during the COVID-19 pandemic - quarantine, suspension, or limitation of activities with a large number of people in direct contact (in large and medium-sized enterprises, the HORECA sector, public institutions), difficulties in logistics and the international flow of goods, etc. The subsequent increase in GDP in current prices by +21.20% in 2021, +13.38% in 2022 and +9.44% in 2023) is largely due to the evolution of prices influenced by the increase in demand for raw materials and imported goods (caused by the pandemic crisis that continued in 2021), and subsequently by the war in Ukraine that affected the economic balance in our country, increasing the risks, uncertainty and costs related to national security. The main branches of creation of Moldovan GDP are industry (22%), trade (16%), construction (11%) and agriculture (10%).

In addition to the general reasons for this negative dynamics, mentioned above, we believe that entrepreneurs in the manufacturing industry do not fully exploit the opportunities of foreign trade and international relations. The dynamics of foreign trade of the Republic of Moldova is growing and reflects the fluctuations recorded in the period 2017-2023, related to the COVID-19 pandemic and the war in Ukraine. At the same time, the process of European integration has contributed to the development of trade, bringing trade with the countries of the European Union to the first place. The analysis of trade flows reveals several value chains that could be particularly relevant for further cooperation between the EU and Moldova. These value chains can be linked to the following six industrial ecosystems: agri-food, mobility-transport-automotive, digital, electronics, energy-intensive industries and healthcare.

In the Republic of Moldova, there are currently about 20 clusters operating in seven in-

dustrial ecosystems: Agri-food, Construction, Energy and renewable sources, Health, Mobility-transport-automotive, Textiles and Tourism. Accordingly, the overview of the most imported and exported goods between the EU and Moldova shows that the most relevant Moldovan trade relations and value chains can be connected to the EU's industrial production, grouped into regional clusters and macro-regions.

The economic area called the "Danube Region" is a macro-region stretching from Germany to Bulgaria and represents a group of large economies in the EU that have grown significantly over the past 30 years. As of 2022, the combined GDP of the EU Member States that make up the "Danube Region" macro-region is significant, reaching over EUR 2.8 trillion, and thus representing 17.6% of the total EU GDP. The macro-region's strategic location provides easy access to world markets, making it a hub for trade, as evidenced by its trade potential: the macro-region accounts for approximately one third of the EU's export and import potential, respectively.

The Republic of Moldova is part of the "Danube Region" macro-region and, due to its strategic position in the Danube Basin, is an important partner in the Danube macro-region. In addition to the Republic of Moldova, the Danube Region also includes nine EU Member States: Austria, Croatia, Slovakia, Bulgaria, Germany, Slovenia, the Czech Republic, Hungary, Romania, and four additional current or potential candidates for accession. EU accession: Bosnia and Herzegovina, Montenegro, Serbia and Ukraine.

According to our analysis, in the "Danube Region" Moldovan clusters can operate in seven industrial ecosystems: Agri-Food, Construction, Energy and Renewables, Health, Mobility-Transport-Automotive, Textiles and Tourism.

Conclusions

Cluster organisations (associations) can play an important role in the organisation and development of regional supply chains. The most representative cluster activities include providing information (e.g. on market opportunities), facilitating networking (e.g. finding new partners/suppliers in other sectors and/or regions) or providing support (e.g. improving supplier skills).

Within the Danube Region Programme (DRP), Moldovan actors have the opportunity to work together with stakeholders from 13 other Danube Region countries on several interregional projects. Thus, by participating in INTERREG programmes and developing cooperation within the Danube Region clusters, Moldovan enterprises can gain new opportunities to integrate into the economic space of the community, thus ensuring increased resilience and capacity to meet current and future challenges.

Keywords: *manufacturing industry, clusters, regional cooperation*

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STRATEGIILE DE DEZVOLTARE A ANTREPRENORIATULUI FEMININ ÎN REPUBLICA MOLDOVA

DEVELOPMENT STRATEGIES FOR FEMALE ENTREPRENEURSHIP IN THE REPUBLIC OF MOLDOVA

Silvia IORDACHE, ORCID: 0000-0003-0239-0009
Academy of Economic Studies of Moldova, Chisinau, Republic of Moldova
*Corresponding author: Silvia Iordache, e-mail:iordache.silvia@ase.md

Introduction

Female entrepreneurship in Moldova has a significant impact on economic growth and social inclusion, yet women face challenges such as limited access to financial resources, insufficient entrepreneurial education, and gender discrimination. Data and analyzed projects highlight both the potential of female entrepreneurs and their needs to develop their businesses. Implemented strategies aim to support them, while proposed measures focus on strengthening efforts for the sustainable development of female entrepreneurship.

Material and methods

According to statistical data and observation methods, female entrepreneurship in Moldova has gained visibility and importance in recent years. More and more women are engaging in businesses and entrepreneurial initiatives, actively contributing to the country's economic growth. The number of female entrepreneurs is increasing, as they use their skills, knowledge, and passions to develop their own businesses. Approximately 34% of enterprises are owned or managed by women, yet they remain underrepresented in the business sector, accounting for only one-third of the total. Several institutions and organizations support female entrepreneurship through various programs that provide access to funding, counseling, training, and mentorship, facilitating the launch and growth of women-led businesses. Female entrepreneurs significantly contribute to job creation and the development of local communities. They promote innovation and create innovative products and services, becoming role models for other women and young people aspiring to entrepreneurship. Through their involvement in businesses and leadership roles, women contribute to promoting gender equality and diversity. They demonstrate that they can have a considerable impact in the business environment, overcoming gender stereotypes and contributing to a fairer and more inclusive business landscape. Strategies and support programs play a crucial role in the development of entrepreneurship, providing a well-structured framework for achieving business objectives, especially for SMEs. These programs facilitate access to resources and financing, including funds, grants, and loans, offering targeted support to women and young people who often face difficulties in securing the necessary capital. Additionally, the programs provide access to workspaces, equipment, and consultancy, as well as professional training courses to enhance entrepreneurial skills. These measures increase the long-term success rate of businesses, contributing to sustainable economic development.

Results

The study results have shown that female entrepreneurship in Moldova has significant growth potential, but women face obstacles such as lack of initial capital, insufficient financing, and limited time, which economically disadvantage them and reduce the size and profitability of their businesses. These challenges result in lower performance for micro and small businesses led by women, although in larger sectors and areas such as agriculture, hotels, or restaurants, gender performance differences almost disappear or even favor women. Difficulties in balancing professional and family life contribute to the lower representation of women with young children in entrepreneurship. However, with the support of effective policies and

initiatives, women can overcome these barriers, contributing to the development of a fair and prosperous business environment.

Conclusions

The development of female entrepreneurship in Moldova is essential for creating a sustainable and inclusive economy. Strategies such as access to education, financing, mentorship, favorable public policies, and innovation can significantly contribute to increasing the number of women launching and growing their own businesses. With continued support from the government, international organizations, and local communities, female entrepreneurship will become a key driver of economic and social development in Moldova.

Keywords: *female entrepreneurship, sustainable economy, inclusive economy, innovation, access to education, business growth, international organizations, government support., etc.*

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INOVAREA, ELEMENTE CHEIE ÎN CREȘTEREA PERFORMANȚELOR MANAGERIALE A MICILOR ANTREPRENORI

INNOVATION, KEY ELEMENT IN INCREASING THE MANAGERIAL PERFORMANCE OF SMALL ENTREPRENEURS

Slavic GÎRNEȚ, ORCID: 0000-0002-7628-0788
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Slavic Gîrneț, e-mail: girnet_slavic@yahoo.com

Introduction and Background

The development of human society in the century. XXI, is characterized by an uncontrolled fluctuation of factors of influence (financial crises, energy crises, war and military conflicts, pandemics and natural disasters tec.), fluctuation that conditions an unstable activity environment, difficult to predict and anticipate possible trends of manifestation. This creates a number of risks for the economic activity in the contemporary society, such as: - increasing the costs of raw materials, energy, fuel; reducing the purchasing capacities of the population; reducing the mobility of trade flows; increasing unemployment, inflation and reducing the well-being of individuals in society. In the contemporary period, with the evolution of the social system, in technical and informational aspect, a decisive influence on the result, efficiency of entrepreneurial activity is exerted by the activity or the process of innovation / invention, part of the entrepreneurial environment, which conditions the optimal management of both inputs and outputs from the enterprise.

Methodology

Scientific research is based on such methods as: tabular and graphical methods, scientific abstraction, historical and logical method, classification and comparison, analysis and synthesis, induction and deduction, forecasting and modelling of economic phenomena, etc.

Results

The activity of entrepreneurship in agriculture, it can be considered, dates back to May 29, 1991 [1], when the right of ownership of the land was introduced in the Constitution of the country, continuing with the approval of the Land Code on December 25, 1991. As a result of the intention to liquidate the historical debts of the collective agricultural enterprises of the former USSR, towards the state, about 1.6 billion lei [2], the procedure for privatization of the property of Sovkhoz and kolkhoz was submitted. During the years 1997-1998, the National Earth program was launched (March 1998), which resulted in [3]: - about 1034 collective households were privatized; 864 collective households were liquidated; 98.7% of the agricultural land was privatized; 98.7% of eligible individuals received land titles; about 707 thousand peasant households were established.

If as a result of the Earth program, about 707 thousand peasant households were established in the Republic of Moldova, then by 2020 their number was reduced to 171 thousand units, it is a reduction of about 76%, it is an indicator that largely demonstrates the real inefficiency of this program of privatization of the agricultural sector.

The inefficiency of the agricultural activities of the small households caused largely by the intentional misunderstanding of the principles of the market economy by the population, but especially by the people with public decision-making positions, created favorable conditions for the chaos and the current weak development of Agriculture. Moreover, at the basis of this situation is primarily the political factor and the weak capacity to organize public administrative structures with decision-making functions, whose activity is primarily oriented towards the realization of their own or party interests. There is no responsibility in the field of Planning, Use and management of public money, which conditions a total irresponsibility of public persons

and institutions in the field. All these conditions and conditioned the reduction of the number of households in rural areas from 707 thousand in 1998 to 171 thousand in 2020, as at present, in 2023 their number to reduce by 80%. In these conditions, an alternative for entrepreneurial economic activity is the innovation activity, carried out at different levels of economic activity. Conditional choice of: The growing shortage of local Labour, both in quantity and quality; The increase in the cost of labour use as a result of the increase in the cost of living; Very high cost (value) of the necessary techniques, equipment; The non-existence of sufficient internal financial sources to purchase the specific machinery from the manufacturers;

Conclusions

Under the above mentioned conditions, the entrepreneurial innovation activity represents a real and efficient means for the exit of small entrepreneurs from the risk situations created and for maintaining and increasing the entrepreneurial result, a specific precondition for entrepreneurial activity in the Republic of Moldova.

Keywords: *innovation*, *entrepreneurship*, *reforms*, *efficiency*, *crises.*

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STUDII PENTRU INTEGRAREA TEHNOLOGIILOR INFORMAȚIONALE ÎN PROCESE DE MANAGEMENT A ÎNTREPRINDERILOR DIN INDUSTRIA ALIMENTARĂ PENTRU DEZVOLTAREA SUSTENABILĂ A ACESTORA

STUDIES FOR THE INTEGRATION OF INFORMATION TECHNOLOGIES IN THE MANAGEMENT PROCESSES OF ENTERPRISES IN THE FOOD INDUSTRY FOR THEIR SUSTAINABLE DEVELOPMENT

Iurie RUMEUS, ORCID: 0000-0002-6392-7343
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Irina ȘCHIOPU, ORCID: 0000-0002-8790-3469
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Ilona POPOVICI, ORCID 0000-0003-2487-6413
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Irina VÎȘCU, ORCID 0000-0001-7375-4186
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Nicolae BALCĂNUȚĂ, ORCID 0000-0002-8850-374X
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Iurie Rumeus, email: rumeus.iurie@usch.md

Introduction

In the numerous research studies it was demonstrated that only through the continuous implementation of innovative solutions the sustainable economic development of an industrial enterprise can be ensured. Sustainability is very often associated with the digitalization of various processes within enterprises [1]. Information technologies allow to automate the collection and analysis of data obtained within a process, and at the same time, facilitate the interpretation of the provided information, which in turn allows to quickly make the right decision to effectively manage the company [2].

Methodology

Standard methods for economic research were used, such as: survey, poll, quantitative and qualitative data analysis. Google forms and Excel applications were used for data collection and processing.

Results: Following the survey conducted as part of this research, it was found that despite the advantages offered by integrating information technologies into management and production processes, these technologies are not fully used in food industry enterprises from Republic of Moldova. It was also determined that only certain types of applications are used to manage certain processes. Most often, food industry enterprises use applications/software programs for recording economic and financial activity (e.g. 1C: Accounting) and applications/software programs for processing texts and spreadsheets (e.g. MS Excel, Word and others). A large number of industry enterprises use online invoicing and document signing applications/software programs and online communication applications/software programs (e.g. email). A small part of enterprises use special applications/software programs (enterprise database, information system for process management) and no enterprise uses design applications/software programs (CAD (AutoCAD), CAM, CAE). The incomplete use of information technologies within food industry enterprises can be explained by the fact that in many companies, there are no positions for specialists in the field of information technology. Additionally, a large proportion of enterprises assess the level of knowledge of information technologies among administrative

staff as medium or low, which also hinders the integration of information technologies into various industrial processes.

Conclusions and Implications

The initiation of collaborative projects between universities and economic entities is essential for integrating information technologies in different processes. Universities can provide specialists and consulting in this field, which can contribute to increasing the efficiency of management and production activities. Through such collaboration, solutions and methods can be found to improve the processing of various data in enterprise activities.

Keywords: *economic development, enterprise activities, processing of data, applications, software programs.*

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SECȚIA II
ROLUL FINANȚELOR ȘI CONTABILITĂȚII ÎN ECONOMIA INOVAȚIONALĂ/ THE ROLE OF FINANCE AND ACCOUNTING IN THE INNOVATION ECONOMY/ РОЛЬ ФИНАНСОВ И БУХГАЛТЕРСКОГО УЧЕТА В ИННОВАЦИОННОЙ ЭКОНОМИКЕ

EVALUAREA RISCULUI DE FALIMENT AL ENTITĂȚILOR DIN SECTORUL AGRAR AL REPUBLICII MOLDOVA ÎN BAZA MODELULUI ANGHEL

EVALUATION OF THE BANKRUPTCY RISK OF AGRICULTURAL ENTITIES IN THE REPUBLIC OF MOLDOVA USING THE ANGHEL MODEL

Irina FUSARU, ORCID: 0009-0002-3309-0260
Moldova State University, Chisinau, Republic of Moldova,

Neli MUNTEAN, ORCID: 0000-0001-6385-2890
Technical University of Moldova, Chisinau, Republic of Moldova,
*Corresponding author: Irina Fusaru, e-mail: fusaru.irina@usm.md

Introduction and Background

The agricultural sector is a cornerstone of the Republic of Moldova's economy, serving as a vital pillar for both economic growth and social development. Despite its importance, this sector is confronted with numerous financial challenges, with bankruptcy risk representing a major concern for policymakers, business leaders, and stakeholders. Considering these challenges, assessing bankruptcy risk becomes crucial for identifying vulnerabilities and preventing financial collapse [1]. This study focuses on evaluating the applicability of the Anghel (2002) model in predicting the bankruptcy risk of agricultural entities in Moldova. The analysis includes eight companies: four facing insolvency and four in a stable financial position. All companies operate within the framework of the Classifier of Activities in the Economy of Moldova (CAEM-2), with their main activity in agriculture.

Methodology

The research employs a combination of literature analysis and dialectical methods, including deduction, induction, synthesis, and correlation, alongside comparative-critical and constructivist approaches. The Anghel model, developed for the Romanian economy, is adapted due to economic, structural, and climatic parallels between Romania and Moldova, making its indicators relevant for local analysis. Financial data from the period 2019-2023 were sourced from available financial statement of agrarian companies, providing a robust basis for identifying trends and financial performance fluctuations.

Results

The application of the Anghel model yielded results consistent with the actual financial conditions of the analyzed entities. For the four insolvent companies, scores were consistently below zero, confirming their bankruptcy status. In contrast, the financially stable companies achieved scores above 2.05, signaling a "non-bankruptcy situation" [2]. However, exceptions were noted in the case of one company in 2019 and another in 2020, where scores fell within the range [0; 2.05] - categorized as "the uncertainty zone". These borderline cases underscore the importance of further analysis to identify areas requiring intervention, such as cost structure optimization, cash flow management, and improved sales strategies.

Conclusions and Implications

The study concludes that the Anghel (2002) model is a reliable tool for assessing bankruptcy risk in Moldova's agricultural sector. By aligning with the actual financial states of the analyzed entities, the model demonstrates its adaptability and effectiveness in a Moldovan context. The findings emphasize the importance of continuous monitoring and risk assessment in agriculture, given the sector's susceptibility to economic fluctuations and external pressures. Furthermore, the study underscores the broader implications for stakeholders, including policymakers and financial institutions, by providing a framework for early intervention and informed decision-making.

Considering the results, this study advocates for integrating such predictive tools into regular financial assessments to ensure stability and resilience in the agricultural sector. The adaptability of the Anghel model to Moldova's context also opens avenues for further research, particularly in refining risk assessment frameworks to cater to sector-specific challenges.

Keywords: *Z-score function, bankruptcy risk, agricultural entities, evaluation.*

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ROLUL GESTIUNII RISCULUI FINANCIAR CA PUTERE FINANCIARĂ PENTRU STABILITATEA SECTORULUI AGRICOL

THE ROLE OF FINANCIAL RISK MANAGEMENT AS A FUNDING MECHANISM FOR THE STABILITY OF THE AGRICULTURAL SECTOR

Sofia DONEA, ORCID: 0000-0001-5479-3788
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Sofia Donea, e-mail: sofia.donea@feisa.usch.md

Introduction

The specific characteristics of the agricultural sector create a complex set of uncertainties in the production process — a situation that causes significant challenges for producers. These uncertainties persist in agriculture due to incomplete information, the inability to predict outcomes, or the consequences of certain actions — all of which generate risks. Risks in the agricultural sector threaten the stability of agricultural businesses. Achieving efficiency in agricultural operations requires the implementation of managerial strategies for financial risk management. Proper financial risk management supports the sustainability and financial strength of agricultural activities.

Material and methods

The study involves the generalization of approaches in the fields of accounting and finance from a management perspective. The methods applied are those specific to economic sciences. The methodological support includes practical works by experts in the field, relevant legislation, as well as practical experience and the development trends of agriculture in the Republic of Moldova.

Results

A company's financial position can be impacted by the type of operations it undertakes, which may generate various risks. It is crucial to highlight the connection or impact between different types of risks and financial risk to prioritize management actions. Financial risk management requires a comprehensive, well-documented information system in the company that complies with legal regulations. Financial statements serve as an essential informational foundation in this context and include:

- the balance sheet – offering a well-structured presentation of the company's assets and liabilities.
- the profit and loss statement – showing revenues and expenses by activity type, useful for determining profitability and efficiency indicators.
- the statement of changes in equity – providing insights into the added value of the business generated by its activities, categorized by equity components.
- the cash flow statement – detailing the movement of cash flows from operational transactions. This allows for analyzing whether there is enough cash to meet due obligations and helps evaluate liquidity and solvency indicators.
- notes to the financial statements – offering detailed explanations of the information presented in the preceding sections.

Financial risk management entails the efficient management of both equity and borrowed capital used to fund operational activities. Financial risk is assessed based on information selected for analysis, which varies depending on the maturity of financial obligations: short-term, medium-term, or long-term. The components of financial risk include cost elements, cash availability for timely receipts and payments, and maintaining the capacity to grow the company's assets. Since both equity and borrowed capital incur costs, it is crucial to accurately assess the financial position of the enterprise using specific, reliable indicators. Managerial strategies

often focus on increasing equity, as it reflects the efficiency of operational activities and supports long-term business performance.

Conclusions

Financial risk management involves employing appropriate tools for each operation, with the effectiveness of these tools being contingent upon the enterprise's specific financial situation. Accurate financial and accounting records, diversification of income sources, prioritization of other risk types, and the creation of reserves help maintain a favorable debt-to-equity balance for both creditors and investors. These measures enhance financial decision-making, facilitate access to diverse funding sources under favorable conditions, and improve the resilience and prosperity of agricultural enterprises, ensuring successful business operations.

Key words: *agricultural sector, uncertainty, financial risk.*

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ANALIZA CREDITELOR BANCARE ÎN REPUBLICA MOLDOVA

ANALYSIS OF BANK LOANS IN THE REPUBLIC OF MOLDOVA

Iulia VICOL, ORCID: 0000-0002-5675-9994
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Iulia Vicol, e-mail: iuliaboris@gmail.com

Introduction and Background

The banking system in the Republic of Moldova is a fairly well-integrated sector in the country's economy. In addition to collecting savings from the population and businesses, it also provides credit services.

Credit is a relationship of granting monetary means on loan, with the condition of their repayment and payment of the service rendered. In other words, lending relationships occur between people who trust each other. It is necessary to ensure that the borrowed money will be returned on time, accompanied by a reward negotiated and confirmed by both parties.

Methodology

To develop the research, specialized literature and scientific publications of local researchers were studied, and methods such as: analysis, synthesis, deduction, induction, explanation, description were also used.

Results

Enterprises, in their activity, often face the situation when they have a temporary insufficiency of their own financing resources. Under these conditions, entrepreneurs come to the conclusion that it is better to attract loans, in the form of bank credits, from financial institutions, which operate under the license issued by the Central Bank. In the Republic of Moldova, the role and functions of the central bank are performed by the National Bank of Moldova (NBM). In addition to the NBM, commercial banks also operate, which represent the basic link of the banking system.

Currently, there are 11 commercial banks operating in the Republic of Moldova, of which as of October 31, 2024, there are 540 branches and 8425 employees [1].

If we analyze the economic and financial activity of banks in the Republic of Moldova, the same period, then we can present information on the following indicators: share capital is 3,955.53 million lei; total equity - 21,679.21 million lei; balance of debt on loans (basic amount) - 75,800.48 million lei; balance of debt on non-performing loans (basic amount) - 3,581.67 million lei; total expired loans - 1,661.78 million lei; total loans granted to SMEs - 21,463.97 million lei; etc. [1].

The information regarding the structure of the loan portfolio in the banking sector of the Republic of Moldova, which we present in the table below, as of November 30, 2024, is also important:

Table 1. Structure of the bank loan portfolio, by branches, in the Republic of Moldova

No. d/o	Credit branch	Total number of loans granted	Total balance on the banking sector at the end of the month (MDL)
1	Loans granted to agriculture	219	4930929004
2	Loans to the food industry	51	4519328566
3	Loans granted in the construction sector	55	1737922959
4	Consumer loans	18,780	14518795479

5	Loans granted to the energy industry	13	1415945590
6	Loans granted to the productive industry	109	3001471541
7	Trade loans	406	16659840853
8	Loans granted to the non-banking financial environment	18	3015454618
9	Loans granted for the purchase/construction of real estate	800	17863603577
10	Loans granted in the field of transport, telecommunications and network development	106	2457883846
11	Loans granted to the service sector	112	2627256153

Source: prepared by the author based on statistical data from the National Bank of Moldova

Analyzing the data presented in Table 1, we can mention that most loans are granted for consumption, then loans granted for the purchase/construction of real estate, for trade, and the most disadvantaged branch is the energy industry.

Conclusions

Based on the above, we can mention that commercial banks in the Republic of Moldova offer entrepreneurs the opportunity to obtain bank loans for their development.

Keywords: *banking system, bank credit, consumer credit, commercial banks.*

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FINANCING THE ACTIVITIES OF INITIATIVE GROUPS AND THE ELECTORAL COMPANY

FINANȚARE ACTIVITĂȚILOR GRUPURILOR DE INIȚIATIVĂ ȘI A COMPANIEI ELECTORALE

Igor SOROCEANU, ORCID: 0000-0002-8719-0454
Universitatea de Stat din Moldova, Chișinău, Republica Moldova
*Autor corespondent: Igor Soroceanu, e-mail: soroceanuuuigor@gmail.com

Finanțarea activităților politice, incluzând grupurile de inițiativă și campaniile electorale, joacă un rol esențial în asigurarea funcționării eficiente și transparente a democrațiilor moderne. Grupurile de inițiativă sunt organizații care promovează anumite idei, cauze sau susțin candidați specifici, în timp ce campaniile electorale sunt desfășurate de partide politice și candidați pentru a atrage sprijinul electoratului. Ambele tipuri de activități necesită resurse financiare semnificative pentru a putea opera la capacitate maximă și a-și atinge obiectivele.

Sursele de finanțare pentru aceste activități sunt diverse și includ contribuții private, fonduri publice, evenimente de strângere de fonduri, granturi și subvenții, auto-finanțare și sprijin din partea partidelor politice. Fiecare sursă are propriile avantaje și dezavantaje, iar utilizarea lor este adesea reglementată de legi stricte pentru a preveni corupția și influența disproporționată a anumitor actori asupra procesului democratic.

Reglementările privind finanțarea politică variază de la o țară la alta, dar în general, acestea includ plafoane pentru donații, obligația de a raporta sursele de finanțare și cheltuielile, precum și interdicții pentru anumite tipuri de contribuții. Aceste măsuri sunt esențiale pentru a asigura transparența și echitatea în competiția politică, prevenind astfel abuzurile și menținând încrederea publicului în procesul electoral.

În acest context, este crucial să înțelegem cum funcționează finanțarea activităților politice și importanța reglementărilor care guvernează aceste procese. Aceasta nu doar că asigură un teren de joc echitabil pentru toți participanții, dar și contribuie la consolidarea democrației prin promovarea unui sistem politic transparent și responsabil. Astfel, studiul mecanismelor de finanțare și al impactului acestora asupra democrației devine nu doar relevant, ci și necesar pentru oricine este interesat de buna funcționare a societății.

Este de menționat faptul că, finanțarea activității grupurilor de inițiativă și a campaniilor electorale este un aspect crucial al procesului democratic, cu implicații profunde asupra integrității și egalității acestuia. Prin aplicarea principiilor de transparență, echitate, responsabilitate și independență, societățile pot asigura că procesul electoral rămâne echitabil, în care cetățenii sunt bine informați și toți participanții politici au șanse egale de a concura.

Transparența în finanțarea politică este esențială pentru prevenirea corupției și influențelor disproporționate, asigurând că cetățenii pot urmări și evalua sursele de finanțare ale partidelor și candidaților. Echitatea în distribuirea resurselor financiare și accesul la finanțare publică ajută la contracararea inegalităților și asigură că toți candidații au oportunități egale de a-și prezenta viziunile politice.

Responsabilitatea în gestionarea fondurilor de campanie este crucială pentru menținerea încrederii publicului în procesul electoral și pentru prevenirea abuzurilor. Implementarea unor sancțiuni stricte pentru încălcările regulilor de finanțare și asigurarea auditurilor independente contribuie la promovarea responsabilității și transparenței.

Cuvinte cheie: *transparență, echitate, reglementări, democrație, responsabilitate.*

SECȚIA III
CREATIVITATE ȘI INOVAȚIE ÎN DOMENIUL EDUCAȚIEI ȘI AL ȘTIINȚELOR SOCIALE/ CREATIVITY AND INNOVATION IN THE FIELD OF EDUCATION AND SOCIAL SCIENCES/ ТВОРЧЕСТВО И ИННОВАЦИИ В ОБЛАСТИ ОБРАЗОВАНИЯ И СОЦИАЛЬНЫХ НАУК

MODELAREA VIITORULUI ÎNVĂȚĂMÂNTULUI AUTO ÎN MOLDOVA: PROVOCĂRI, PROBLEME ȘI OPORTUNITĂȚI

SHAPING THE FUTURE OF AUTOMOTIVE EDUCATION IN MOLDOVA: CHALLENGES, ISSUES, AND OPPORTUNITIES

Ioana VINTILOIU, ORCID: 0000-0002-4256-4539
Fritz Dräxlmaier GmbH & Co. KG, Germany

Liliana CECLU, ORCID: 0000-0001-5500-7785
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Liudmila ROȘCA-SADURSCHI, ORCID: 0000-0003-1358-0019
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Marina BUNEA, ORCID: 0000-0002-7792-6907
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Liliana Ceclu, e-mail: liliana.ceclu@feisa.usch.md

The automotive industry is undergoing a transformative evolution driven by technological advancements, sustainability imperatives, and shifting market demands. This research explores the critical role of higher education in preparing the next generation of professionals to meet these challenges, with a specific focus on shaping the future of automotive education in Moldova. Titled „Shaping the Future of Automotive Education in Moldova: Challenges, Issues, and Opportunities," the study examines the current state of automotive education in the country, identifies key challenges and issues, and highlights emerging opportunities for innovation and growth.

The research begins by contextualizing the global trends impacting the automotive sector, including the rise of electric vehicles (EVs), autonomous driving technologies, and the integration of artificial intelligence (AI) and the Internet of Things (IoT) in vehicle design and manufacturing. It emphasizes the need for Moldovan higher education institutions (HEIs) to align their curricula and training programs with these advancements to ensure graduates are equipped with relevant skills and knowledge.

A mixed-methods approach is employed, combining qualitative interviews with industry experts, educators, and students, as well as quantitative analysis of enrollment trends, graduate employment outcomes, and industry needs. The study identifies several challenges facing automotive education in Moldova, including outdated curricula, limited access to modern training facilities, and a gap between academic offerings and industry requirements. Additionally, financial constraints and a lack of collaboration between HEIs and the automotive sector are noted as significant barriers to progress.

Despite these challenges, the research uncovers numerous opportunities for innovation and improvement. It highlights the potential for integrating emerging technologies such as EV engineering, AI, and IoT into automotive education programs. The study also emphasizes the

importance of fostering stronger partnerships between HEIs, industry stakeholders, and government agencies to create internship programs, research collaborations, and funding initiatives that support curriculum modernization and infrastructure development.

The research proposes a comprehensive framework for advancing automotive education in Moldova. This framework includes recommendations for curriculum redesign, investment in state-of-the-art training facilities, and the establishment of industry-academic partnerships. It also advocates for the inclusion of sustainability and green technologies in automotive education to align with global trends and environmental goals.

In conclusion, the study underscores the critical role of automotive education in driving Moldova's economic development and technological advancement. By addressing existing challenges and leveraging emerging opportunities, Moldovan HEIs can position themselves as key contributors to the future of the automotive industry, both locally and globally. The findings of this research provide actionable insights for educators, policymakers, and industry leaders seeking to shape a more innovative and sustainable future for automotive education in Moldova.

Keywords: *Automotive education, Moldova, challenges and opportunities, curriculum innovation, industry-Academia collaboration.*

Acknowledgements

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INTERACTIVITATE ȘI ÎNVĂȚARE: EXPERIENȚE DIGITALE ÎN STUDIUL LIMBII ȘI LITERATURII RUSE

INTERACTIVITY AND LEARNING: DIGITAL EXPERIENCES IN RUSSIAN LANGUAGE AND LITERATURE STUDIES

Diana BÎCLEA, ORCID: 0000-0001-5737-2209
Lucian Blaga University of Sibiu, Department for Teacher Training, Sibiu, România
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Olga POSTAVICENCO
Secondary school S. Rahmaninov, Cahul, Republica Moldova
*Corresponding author: Diana Bîclea, email: biclea.d@gmail.com

Introduction and Background

In the digital age, interaction with technology has become an essential part of our lives. Digital tools can significantly improve students' motivation, engagement, and performance [1]. These findings highlight the transformative potential of digital technologies in teaching Russian as a mother tongue and open new avenues for future research in the field, with significant implications for both teaching practices and the development of new digital tools and resources tailored to the specific needs of foreign language learning [2]. Our research explores how interactive digital experiences can revolutionize the learning process of Russian language and literature, focusing on the question: How can digital technologies be used to create more engaging and effective learning environments that stimulate both language acquisition and the development of literary skills?

Methodology

A qualitative approach was adopted, based on the analysis of textual and visual data obtained through participant observation and recordings of students' digital activities. This approach allowed us to identify specific tools that can be adapted to the school curriculum, to select strategies that lead to the achievement of objectives through the use of digital tools, and to gain a deeper understanding of the phenomenon studied.

Results

Participant observations revealed that the integration of digital tools into the Russian language teaching process stimulated a significant increase in student engagement. They showed increased enthusiasm for interactive activities, which led to improved motivation and performance in oral and written communication tasks. It was also found that the use of digital technologies facilitated collaboration among students and created a more dynamic and relevant learning environment for contemporary reality. Used tools included: Google Classroom learning platforms; interactive tests in Google Forms and LearningApps; interactive worksheets with PDFescape and Liveworksheets; mobile applications like Mind Maps for developing critical thinking; YouTube video resources; interactive presentations in Canva. There is a reciprocal interaction between the study of the Russian language, the digital tools applied, and the impact on Russian language learning (Fig. 1).

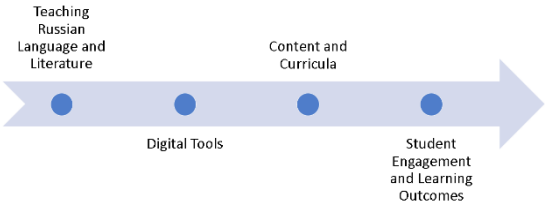

Figure 1. Interaction between digital technologies and the study of Russian language and literature

Conclusions and Implications

Conclusions and implications: We conclude that digital tools can be a powerful catalyst for innovation in teaching Russian as a native language. The results of this study have significant implications for both practice and research. We encourage teachers to explore and experiment with various digital tools, and researchers to continue investigating ways to optimize the use of technology in teaching Russian as a foreign language.

Keywords: *digital experiences, interactivity, study, language learning.*

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INTEGRAREA METODEI PBL ÎN PREDAREA DISCIPLINELOR DIN DOMENIUL I NFORMATICII

INTEGRATING THE PBL METHOD IN THE TEACHING OF COMPUTER SCIENCE COURSES

Ilona POPOVICI, ORCID: 0000-0003-2487-6413
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Irina VÎȘCU, ORCID: 0000-0001-7375-4186
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Ilona Popovici, email: ilonapopovici8@gmail.com

Introduction and Background

In an era of accelerated digitization, traditional teaching methods no longer fully meet the needs of future generations of IT professionals. Preparing modern IT specialists requires more than the transmission of theoretical knowledge. Today's challenges require the development of practical skills and the ability to solve real-world problems applicable in diverse contexts. The Problem-Based Learning (PBL) method, centered on active learning by solving authentic problems, has proven to be an effective approach for developing these competences. This research aims to integrate the PBL method into the teaching of Web Application Development, exploring how this approach can meet both the educational and practical needs of the IT industry. The specific objective of the study is to investigate to what extent the PBL method enhances the learning process, increases student engagement and contributes to the development of digital solutions relevant to the local business environment. The study also aims to assess the impact of this method on the relationship between academia and business in the southern region of the Republic of Moldova.

Methodology

The PBL method is based on authentic problem-centered learning, stimulating critical thinking an collaboration. In the Web Application Development university course, students carried out a questionnaire applied to four local enterprises, identifying their specific web application needs. Concrete problems were analyzed and students were organized into four teams, each developing a web application tailored to the identified requirements. The process included all stages of the software development cycle, from requirements analysis through to deployment and testing, providing a genuine hands-on experience.

Results

The results demonstrated a significant improvement in students' technical skills and teamwork competences. The four applications developed were praised by businesses for their relevance and functionality, reflecting a solid understanding of end-user needs. The PBL method also stimulated collaboration, time management, decision-making, effective communication, creativity and a critical approach to problems, with students identifying innovative solutions to the challenges they encountered. Students reported a high level of satisfaction with the learning process, noting that involvement in real-life projects motivated them to deepen their knowledge and overcome the challenges they encountered. The partner companies appreciated the professionalism of the teams and the relevance of the solutions offered, expressing their interest in continuing their collaboration with the university and thus confirming the practical applicability of the results obtained.

Conclusions and Implications

The study emphasizes the potential of the PBL method to improve the quality of computer science learning by connecting the educational process to market requirements. The implementation of this method can contribute to the training of specialists better prepared and better adapted to the realities of the digital economy. Future research can extend this approach to other technical disciplines, strengthening the link between academia and the professional world.

***Keywords*:** *web application development, innovative educational methods, practical learning, technical skills, IT education, academic-industry collaboration.*

ÎNCURAJAREA IMPLICĂRII STUDENȚILOR PRIN METODE MODERNE DE ÎNVĂȚARE ACTIVĂ

ENCOURAGING STUDENT ENGAGEMENT THROUGH MODERN ACTIVE LEARNING METHODS

Irina VÎȘCU, ORCID: 0000-0001-7375-4186
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Ilona POPOVICI, ORCID: 0000-0003-2487-6413
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Irina Vîșcu, email: irina.viscu@feisa.usch.md

Introduction and Background

In a dynamic world deeply influenced by technological change, university education faces significant challenges. Students are no longer mere passive recipients of knowledge, but active actors in the learning process, requiring an interactive, adaptable and stimulating environment. In this context, active learning is an essential educational paradigm that values the direct involvement of students in critical thinking, problem-solving and collaborative processes.

Modern active learning methods, such as project-based learning, inquiry learning, the use of simulations and the integration of digital technologies, contribute to creating an educational environment in which students are motivated to actively participate. These approaches not only improve academic performance, but also develop skills essential for professional success, such as effective communication, adaptability and team spirit.

Methodology

Encouraging student engagement through modern active learning methods involves adopting strategies that emphasize students' active participation in the learning process, stimulating critical thinking, creativity and collaboration. Among the most effective methods is project-based learning, in which students work to develop solutions to complex problems, applying the knowledge they have acquired in a practical context. Analyzing real cases or simulations allows them to apply theory to real-world situations, and problem-based learning gives them the opportunity to solve challenges without pre-determined solutions, which encourages the development of autonomy and research skills.

Collaboration in groups is another key method, promoting interaction and exchange of ideas between students, leading to a more dynamic learning process. Gamification elements, which integrate techniques from games to make learning more engaging and motivating, are increasingly used to stimulate competitiveness and engagement. Continuous feedback plays a central role, giving students constant opportunities to improve their performance and adjust learning strategies.

Flipped classroom approaches transform the traditional structure of learning, where students prepare at home with theoretical materials and lesson time is used for interactive and collaborative activities.

Results

Active learning methods facilitate the maintenance of students' attention and interest, as they are centred on interactive and stimulating activities. As a result, students become more motivated to actively participate in lessons, to collaborate and to take an active role in their own learning.

Conclusions and Implications

In conclusion, the implementation of active learning methods is not only an effective means of enhancing the learning process, but also an investment in the development of essential skills for future professional success. This approach contributes to the formation of well-prepared professionals equipped to navigate the complexities of an evolving societal landscape.

Keywords: *active learning methods, collaborative learning, case-based learning, feedback, flipped classroom, students*

ROLUL EDUCAȚIEI FORMALE ȘI NON-FORMALE ÎN DEZVOLTAREA COMPETENȚELOR PENTRU CARIERĂ

ROLE OF FORMAL AND NON-FORMAL EDUCATION IN DEVELOPING CAREER COMPETENCIES

Maxim ILICCIEV, ORCID: 0000-0001-6645-306X
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Natalia MIHĂILESCU, ORCID: 0000-0002-3587-9110
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Maxim Ilicciev, email: maxim.ilicciev@fsup.usch.md

Introduction and Background

In a world characterized by rapid technological advancements and dynamic economic transformations, education emerges as a cornerstone for equipping individuals with the competencies needed to thrive in modern careers. Formal education, delivered through structured academic programs, lays a foundation of theoretical knowledge and analytical skills. It provides learners with standardized curricula and recognized certifications, ensuring a clear academic trajectory and professional credibility.

Non-formal education, on the other hand, complements formal systems by offering flexible, skill-oriented learning opportunities outside traditional frameworks. Through workshops, mentoring, volunteering, and online courses, non-formal education facilitates hands-on learning experiences, addressing practical competencies like communication, teamwork, and adaptability. This blend of formal and non-formal education is particularly relevant in today's fast-changing job market, where employers prioritize both technical knowledge and soft skills.

The current study investigates how these two educational approaches intersect to cultivate career-related competencies. It explores their respective contributions and the synergy achieved when they are combined. Emphasis is placed on the adaptability and resilience gained through non-formal learning pathways, which enable individuals to respond effectively to emerging challenges in the workforce. By examining this intersection, the research highlights the importance of integrating multiple learning modalities to prepare individuals not just for jobs, but for lifelong career development and success.

Methodology

The study employed a mixed-methods approach, combining quantitative surveys applied to a sample of 200 participants (students, teachers, and employers) with qualitative interviews conducted with 20 professionals involved in career development programs. Data analysis included thematic coding and statistical tests to identify patterns in the relationship between educational approaches and skill acquisition.

Results

The study results emphasize that formal education mainly contributes to the development of theoretical knowledge and cognitive competencies. Conversely, non-formal education has proven to be more effective in developing practical skills such as communication, teamwork, and problem-solving. Over 85% of participants stated that integrating both forms of education had a significant impact on their employability and professional growth. Moreover, qualitative analysis revealed that non-formal programs complement formal education through applied learning experiences. Participants highlighted the importance of adaptability and critical thinking acquired through these experiences, which are essential for managing career transitions. Quantitative data showed a 30% higher employment rate among those who combined formal and non-formal educational experiences compared to those who relied solely on formal edu-

cation. These findings highlight the need to implement diverse educational formats to meet the dynamic requirements of the labor market. Additionally, non-formal education was observed to support confidence building and the development of interpersonal skills, which are crucial for adapting to new work environments.

Conclusions and Implications

The integration of formal and non-formal education proves to be an essential strategy for fully preparing future professionals. Stakeholders in education should prioritize teacher training and encourage collaboration between educational institutions and community organizations to facilitate access to non-formal programs. Furthermore, investments in teacher training and curriculum alignment with labor market demands are crucial. Future research should focus on identifying scalable models for implementing this type of learning, analyzing long-term impacts and cost-effectiveness. Addressing barriers such as financial constraints or geographic limitations will help increase accessibility and equity in education. Additionally, developing adaptable educational policies can promote the integration of diverse educational formats, ensuring continuous and flexible workforce preparation for future demands.

Keywords: *career competencies, formal education, non-formal education, lifelong learning, skills development.*

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INOVAȚIE PENTRU UN VIITOR DURABIL PRIN TRANSFORMARE VERDE ȘI DIGITALĂ ÎN ÎNVĂȚĂMÂNTUL SUPERIOR

INNOVATING FOR A SUSTAINABLE FUTURE THROUGH GREEN AND DIGITAL TRANSFORMATION IN HIGHER EDUCATION

Liliana CECLU, ORCID ID: 0000-0001-5500-7785
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Elena MANDAJI, ORCID ID: 0000-0003-0924-4602
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Ina FILIPOV, ORCID ID: 0000-0002-8524-6784
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Iurie RUMEUS, ORCID ID: 0000-0002-6392-7343
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Valentina CORNEA, ORCID ID: 0000-0001-6469-1283
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova

Sergiu CORNEA, ORCID ID: 0000-0002-0888-5902
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Liliana Ceclu, e-mail: liliana.ceclu@feisa.usch.md

The global challenges of climate change, resource depletion, and environmental degradation have necessitated a paradigm shift towards sustainability across all sectors, including higher education. This research explores the intersection of sustainability, digital innovation, and educational transformation as a pathway to fostering a more sustainable future, with a specific focus on higher education in the Republic of Moldova. It investigates how Moldovan higher education institutions (HEIs) can leverage green and digital transformation strategies to align their operations, curricula, and research with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 13 (Climate Action).

The study begins by contextualizing the urgent need for sustainability in higher education, emphasizing the role of HEIs as key drivers of societal change. It highlights the dual potential of green transformation—focused on reducing environmental footprints and promoting eco-friendly practices—and digital transformation—centered on integrating advanced technologies such as artificial intelligence, big data, and the Internet of Things (IoT) to enhance efficiency and innovation. The convergence of these two transformations is posited as a critical enabler for achieving sustainability goals in academia, particularly in the context of Moldova's evolving educational landscape.

A mixed-methods approach is employed, combining qualitative case studies of pioneering HEIs with quantitative analysis of sustainability metrics. The research identifies best practices in green and digital transformation, such as the adoption of renewable energy systems, smart campus initiatives, and the integration of sustainability-focused curricula. Case studies from universities in Moldova demonstrate how digital tools can optimize resource management, reduce carbon emissions, and enhance student engagement in sustainability initiatives. For instance, the use of IoT-enabled sensors for energy monitoring and AI-driven platforms for personalized learning on sustainability topics are highlighted as innovative solutions tailored to the Moldovan context.

The study also examines the challenges associated with implementing green and digital transformation in Moldovan HEIs. These include financial constraints, limited technological infrastructure, resistance to change, and the need for interdisciplinary collaboration. The research underscores the importance of leadership commitment, stakeholder engagement, and policy support in overcoming these barriers. It further discusses the role of public-private partnerships in scaling up sustainable innovations and fostering knowledge exchange between academia, industry, and government within Moldova.

One of the key contributions of the research is its proposed framework for integrating green and digital transformation in Moldovan higher education. This framework emphasizes a holistic approach, encompassing governance, infrastructure, education, research, and community engagement. It advocates for the development of "smart sustainable campuses" that serve as living labs for testing and scaling innovative solutions. The framework also highlights the importance of embedding sustainability into the core mission of Moldovan HEIs, ensuring that all stakeholders—students, faculty, staff, and administrators—are actively involved in the transformation process.

The study concludes by outlining future research directions, including the need for longitudinal studies to assess the long-term impact of green and digital transformation initiatives in Moldova and the exploration of cultural and regional differences in implementing these strategies. It calls for a collaborative effort involving Moldovan HEIs, international partners, and local communities to share knowledge, resources, and best practices, enabling Moldovan universities to become catalysts for sustainable development.

In summary, this research provides a comprehensive analysis of how green and digital transformation can drive sustainability in Moldovan higher education. It offers practical insights and an actionable framework for HEIs in Moldova seeking to innovate for a sustainable future, emphasizing the critical role of technology, collaboration, and leadership in achieving this goal.

Keywords: *Sustainability, digital transformation, green transformation, Higher Education, Sustainable Development Goals (SDGs).*

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SECȚIA IV
ȘTIINȚE INGINEREȘTI ȘI CERCETĂRI APLICATIVE/
ENGINEERING SCIENCES AND APPLIED RESEARCH/
ТЕХНИЧЕСКИЕ НАУКИ И ПРИКЛАДНЫЕ ИССЛЕДОВАНИЯ

BUNE PRACTICI PRIVIND REDUCEREA AMPRENTEI DE CARBON ÎN DOMENIUL OPERĂRII PORTUARE

ANALYSIS OF THE APPLICABILITY OF BEST PRACTICES FOR REDUCING THE CARBON FOOTPRINT IN THE PORT OF CONSTANTA

Costel STANCA, ORCID: 0009-0009-8063-6722
Constanta Maritime University, Constanta, Romania

Andreea MOLDOVEANU, ORCID: 0009-0005-6326-282X
Constanta Maritime University, Navigation and Waterborne Transport Faculty, Constanta, Romania
*Corresponding author: Costel Stanca, e-mail: costel.stanca@cmu-edu.eu

Introduction and Background

The current efforts to reduce the carbon footprint in the port sector have intensified due to the adoption of legislative measures and the increasing societal concern about climate change.

A relevant category of port services that contribute to the port's carbon footprint are marine technical services (towage and pilotage).

Concerns regarding the reduction of the carbon footprint in European ports include numerous projects including the Greenport Alliance Project, in which partners have identified good practices and analyzed their applicability

Methodology:

The work is based on the collection and analysis of the available relevant information resulting from the literature review and that collected by the partners within the Greenport Project.

A questionnaire was subsequently developed to which all relevant stakeholders were invited to respond.

The evaluation of the applicability of the good practices that were discussed includes a multi-criteria analysis that takes into account the effectiveness, the contribution to the result, the economic sustainability, the social impact and the availability of funds for implementation.

Results

The initial review looked at existing vessel service operating practices and included three categories: Emission reduction, Operational efficiency enhancements, Engagement and professional development.

A number of 13 practices with a high level of implementation resulted.

Later, they were investigated by practices with a higher level of effectiveness and with a more pronounced character of innovation, but which require investments.

Propeller Boss Cap Fins (PBCF) - enhance propulsive efficiency by capturing energy from the hub vortex created behind a propeller. This innovation reduces fuel oil consumption by weakening the hub vortex, making PBCF the first energy-saving device specifically designed for this purpose.

Conclusions and Implications

The conclusion of the research showed that the best practice identified in the European countries that were the object of the study is Propeller Boss Cap Fins.

Its applicability for the towing and pilotage services provided in the Port of Constanța is confirmed by the relevant stakeholders.

However, the implementation of this practice is significantly related to the support offered by the state and European funds to encourage and assist providers at least for the initial investments.

***Keywords*:** *alternative fuels*, *climate change*, *decarbonization*, *port operation*, *Propeller Boss Cap Fins.*

Acknowledgments

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REVOLUȚIA AGRICULTURII DIGITALE: CONVERGENȚA INTELIGENȚEI ARTIFICIALE, INTERNETULUI LUCRURILOR (IOT) ȘI BIOTEHNOLOGIILOR PENTRU CREAREA UNEI AGRICULTURI SUSTENABILE ȘI INTELIGENTE

THE DIGITAL AGRICULTURE REVOLUTION: THE CONVERGENCE OF ARTIFICIAL INTELLIGENCE, THE INTERNET OF THINGS (IOT) AND BIOTECHNOLOGIES TO CREATE SUSTAINABLE AND SMART AGRICULTURE

George TOADER, ORCID: 0000-0002-1379-9531
Suceava Agricultural Research-Development Station, Suceava, Romania

Cătălin-Ioan ENEA, ORCID: 0009-0002-3364-7196
Suceava Agricultural Research-Development Station, Suceava, Romania

Leonard ILIE, ORCID: 0009-0000-8424-0535
University of Agronomic Sciences and Veterinary Medicine of Bucharest, Bucharest, Romania
*Corresponding author: George Toader, toadergeorge92@gmail.com

The digital transformation of agriculture, fueled by the convergence of Artificial Intelligence (AI), the Internet of Things (IoT), and Biotechnology, is poised to reshape the future of food production and sustainability. This paper explores how these cutting-edge technologies are revolutionizing agricultural practices, enabling smarter, more sustainable farming methods. AI-driven analytics and machine learning models are being utilized to optimize crop management, predict climate impacts, and enhance decision-making processes.

IoT devices, through sensors and connectivity, enable real-time monitoring of soil health, weather patterns, and plant growth, facilitating precision farming and resource efficiency. Meanwhile, biotechnology innovations are fostering the development of genetically modified crops that are more resistant to pests, diseases, and climate stress, thereby ensuring food security in the face of growing global challenges.

The integration of these technologies not only improves agricultural productivity but also addresses environmental concerns, such as reducing water usage, minimizing chemical inputs, and mitigating the effects of climate change. By examining the synergy between AI, IoT, and biotechnology, this paper highlights their potential to create a sustainable and intelligent agricultural system that can meet the demands of a rapidly growing global population while safeguarding natural resources for future generations. The paper also discusses the challenges and opportunities in the widespread adoption of these technologies and the role of policy, infrastructure, and education in facilitating this digital agriculture revolution.

Introduction and Background

The digital revolution is transforming agriculture through the integration of Artificial Intelligence (AI), the Internet of Things (IoT), and Biotechnology [Miller, R., & Patel, S., 2021]. These technologies enable farmers to optimize resources, increase productivity, and tackle global challenges like climate change and food security.

AI and IoT allow for real-time monitoring and data-driven decision-making, while biotechnology fosters the development of resilient crops [Johnson, L., & Davis, M, 2023]. Together, they pave the way for a smarter, more sustainable agricultural system that meets the needs of a growing global population while minimizing environmental impact [Smith, J., & Zhang, Y., 2022].

Methodology

This paper employs a qualitative approach, reviewing existing literature and case studies to analyze the integration of AI, IoT, and Biotechnology in agriculture. It examines technolog-

ical advancements, their applications in farming practices, and their impact on sustainability and productivity. Additionally, key challenges and opportunities are identified through expert reports and industry trends to provide a comprehensive understanding of the digital agriculture revolution.

Results

The integration of AI, IoT, and Biotechnology has significantly enhanced agricultural efficiency, precision, and sustainability. Key outcomes include improved crop yields, optimized resource use, and better resilience to climate change. These technologies have also reduced environmental impacts, such as water and chemical usage, while contributing to global food security. However, challenges remain in terms of adoption, infrastructure, and policy support.

Conclusions and Implications

The convergence of AI, IoT, and Biotechnology is transforming agriculture into a more sustainable and efficient sector. These technologies offer solutions to global challenges like food security and climate change. However, successful implementation requires addressing barriers such as infrastructure, policy, and education. Continued innovation and supportive frameworks will be essential for realizing the full potential of digital agriculture.

Keywords: *agricultural innovation, agricultural technology, crop management, digital transformation, smart agriculture systems.*

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IMPACTUL LUCRĂRILOR METODICO-ȘTIINȚIFICE ÎN DEZVOLTAREA COMPETENȚELOR PROFESIONALE ALE TINERILOR CARE STUDIAZĂ SPECIALITĂȚILE INGINEREȘTI

THE IMPACT OF METHODICAL-SCIENTIFIC WORKS IN THE DEVELOPMENT OF PROFESSIONAL COMPETENCES OF YOUTH STUDYING ENGINEERING SPECIALTIES

Victor POPESCU, ORCID ID 0000-0002-4634-2255
Technical University of Moldova, Chisinau, Republic of Moldova
*Corresponding author: Victor POPESCU, victor.popescu@ie.utm.md

Introduction and Background

In the development professional skills for students and pupils, researchers in the field have been always looking for effective means. So far, various solutions have been proposed, but none of them has proved to be perfect, as each has its advantages and disadvantages. For a youth studying engineering specialties, the problem of personal development is much broader, due to the specific characteristics of the future profession, which requires the development of a number of specific skills. In the basis of the mentioned above, the aim of this paper is to estimate the impact of new methodical-scientific works on the development of professional competences of young people studying engineering specialties.

Methodology

In achieving the proposed goal the following were realized: Analysis of the actual problems concerning the development of professional skills of youth studying in engineering specialties; Identification of the modern concept of personal development of this category of subjects; Proposal of adequate means for the development of professional skills; Assessment of the initial level of personal development of youth in the first years of study; Implementation of the proposed means of development of professional competences in accordance with innovative technologies; Processing and validation of experimental results; Formulation of general conclusions and practical recommendations. The research was realized at: the Faculty of Industrial Mechanical Engineering and Transport (FIMET) of the Technical University of Moldova (TUM), during the academic year 2023-2024; the Center of Excellence in Transport (CET), during the academic year 2023-2024; the Faculty of Agricultural Engineering and Auto Transport (FAEAT) of the State Agrarian University of Moldova (SAUM), during the academic year 2021-2022. The study involved 169 youth: 57 students from FIMET, TUM; 63 pupils from CET; 49 students from FAEAT, SAUM. The study was based on the following works: Electrotechnics and automation of technological processes; Computerized systems of control and management of technological processes; Rural electrification and electric actions; Applied electrotechnics; Reliability management of electricity distribution systems, etc.

Results

Modern technological solutions, which have emerged in response to actual needs, make a veritable contribution to the improvement of the educational system and, in particular, to the personal development of youth. The development of the professional skills of youth studying in engineering specialties is a **ample** and complex process, determined in particular by the interaction of field-specific factors and especially by the imposition of the development of corresponding professional skills for the solution of the complex of problems occurring in professional activity, arising in step with the technical-scientific progress and the rapid development of technology, particularly in the context of actual policies on the environment, digitalization, automation, energy efficiency, cost reduction, work productivity, creation of optimal conditions for professional activity, scientific research, livelihood, leisure, etc. The results obtained

from the study, based on the application of the proposed means, have confirmed that these works have an essential impact on the personal development of youth.

Conclusions and Implications

Proposed means for developing the professional skills of youth studying engineering specialties have been checked and validated in the experiments realized, and the results showed that the applied works have a significant impact on the personal development of these youth. The practical recomandations about the use of the means proposed in the technical courses taught were elaborate.

Keywords: *personal development, methodical-scientific works, professional skills, students, pupils, level of technical creativity, new technological solutions.*

CARACTERISTICI CALITATIVE ALE UNUI DESERT FUNCȚIONAL DIN BRÂNZĂ DE VACI

QUALITATIVE CHARACTERISTICS OF A FUNCTIONAL COTTAGE CHEESE DESSERT

Olga RUSEVA, ORCID: 0009-0001-6662-5201
Technical University of Moldova, Chisinau, Republic of Moldova

Olga DESEATNICOVA, ORCID: 0000-0003-4801-8173
Technical University of Moldova, Chisinau, Republic of Moldova

Natalia SUHODOL, ORCID: 0000-0002-5609-5139
Technical University of Moldova, Chisinau, Republic of Moldova

Eugenia COVALIOV, ORCID: 0000-0003-4574-2959
Technical University of Moldova, Chisinau, Republic of Moldova

Violina POPOVICI, ORCID: 0000-0001-5393-1181
Technical University of Moldova, Chisinau, Republic of Moldova

Vladislav RESITCA, ORCID: 0000-0002-6063-1731
Technical University of Moldova, Chisinau, Republic of Moldova
*Corresponding author: Olga Ruseva, e-mail: olga.ruseva@doctorat.utm.md

Introduction and Background

Functional cottage cheese desserts combine the nutritional richness of cottage cheese with functional ingredients to enhance health benefits. The base composition includes 10.5% protein, 7.2% fat, 6.9% carbohydrates, and an energy value of 135.78 kcal/100 g. Using powdered by-products from fruit pomace—obtained during juice or wine production—such as red grape skins, apple, pear, and quince, enriches the dessert's taste and nutritional value. This sustainable approach applies circular economy principles, reducing waste and valorizing agricultural by-products.

Methodology

The mousse was prepared by hydrating gelatin, mixing it with a sugar solution heated to 103-107°C, and tempering it to 30-35°C. Cottage cheese purée and vanilla sugar were added, homogenized, and foamed for uniformity. During homogenization, fruit pomace powders were incorporated at 2.5%, 5.0%, 7.5%, and 10% of the total mass. Standardized methods were used to evaluate physicochemical properties and sensory quality.

Results

Incorporating powders derived from fruit pomace (red grape skins, apples, pears, and quinces) enhanced the nutritional profile and sensory qualities of the cottage cheese mousse. The mousse with apple powder exhibited a moisture content of 66.0±0.2%, titratable acidity of 185°, fat content of 7.7±0.1%, sugar content of 7.0±0.1%, polyphenol content of 100.73 mg/L, and antioxidant activity of 7.2%. The mousse with powdered pear displayed a moisture content of 65.0±0.2%, titratable acidity of 160°, fat content of 7.5±0.1%, sugar content of 6.9±0.1%, polyphenol content of 99.45 mg/L, and antioxidant activity of 18.8%. The mousse containing quince powder had a moisture content of 69.0±0.2%, titratable acidity of 175°, fat content of 7.3±0.1%, sugar content of 6.9±0.1%, polyphenol content of 101.19 mg/L, and antioxidant activity of 13.9%. Similarly, the mousse with grape skin powder showed a moisture content of 67.0±0.2%, titratable acidity of 190°, fat content of 7.2±0.1%, sugar content of 6.9±0.1%, polyphenol content of

108.84 mg/L, and antioxidant activity of 15.1%.

Conclusions and Implications

The incorporation of fruit pomace powders significantly influenced the dessert's color, aroma, and taste, depending on the type and concentration of vegetable additives. Mousses with 5% and 7.5% powder additions demonstrated the most favorable sensory and physico-chemical characteristics. Although mousses with 10% powder had a less attractive color, they maintained satisfactory taste and texture qualities. This study highlights the potential of using fruit pomace, a sustainable by-product of juice and wine production, to develop high-quality functional desserts.

Keywords: *cottage cheese*, *functional desert*, *polyphenol content*, *mousse desert*, *antioxidant activity.*

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ELIMINAREA ACIDULUI GALIC DIN APELE UZATE INDUSTRIALE FOLOSIND PROCESE AVANSATE DE OXIDARE

REMOVAL OF GALLIC ACID FROM INDUSTRIAL WASTEWATER USING ADVANCED OXIDATION PROCESSES

Larisa MOCANU, ORCID: 0000-0003-3306-5292
Moldova State University, Chisinau, Republic of Moldova

Maria GONTA, ORCID: 0000-0003-3476-0967
Moldova State University, Chisinau, Republic of Moldova
*Corresponding author: Larisa Mocanu, e-mail: lmdordea@gmail.com

The presence of gallic acid in industrial wastewater poses significant environmental challenges due to its recalcitrant nature and potential toxicity. Advanced Oxidation Processes (AOPs) have emerged as effective methods for degrading such organic pollutants. This study evaluates the efficiency of AOPs, particularly Fenton and photocatalytic methods, in removing gallic acid from wastewater. Results indicate that optimized AOPs achieved a removal efficiency exceeding 95% under specific conditions. These findings highlight the potential of AOPs for wastewater treatment, contributing to sustainable environmental managment.

Introduction and Background

Industrial wastewater often contains persistent organic pollutants, including gallic acid, which derive from industries such as pharmaceuticals, textiles, and food processing. The removal of gallic acid is crucial due to its potential environmental toxicity and contribution to chemical oxygen demand (COD) in wastewater. Advanced Oxidation Processes (AOPs) offer a promising solution, leveraging reactive oxygen species to degrade complex organic molecules. This study investigates the efficiency of AOPs, specifically Fenton and photocatalytic methods, for the removal of gallic acid from wastewater, aligning with the broader objective of advancing sustainable industrial practices.

Methodology

The study employed a combination of Fenton and photocatalytic AOPs to treat synthetic wastewater spiked with gallic acid. Fenton oxidation experiments were conducted using optimized concentrations of hydrogen peroxide and ferrous ions, while photocatalysis utilized titanium dioxide (TiO_2) under UV light. Gallic acid degradation was monitored through spectrophotometric analysis, measuring residual concentration over time, and COD reduction was also assessed to evaluate overall treatment efficiency.

Results

The Fenton process demonstrated a gallic acid removal efficiency of 92% under optimal conditions (H_2O_2:Fe^{2+} molar ratio of 4:1, pH 3, and reaction time of 60 minutes). Photocatalysis further enhanced degradation, achieving 95% removal when applied after Fenton pretreatment, attributed to the synergistic effect of reactive oxygen species. COD reduction reached 85%, indicating significant mineralization of organic content. The combined AOPs proved effective across a range of gallic acid concentrations, with minimal sludge generation, underscoring their potential scalability for industrial applications.

Conclusions and Implications

This study demonstrates that AOPs, particularly the Fenton-photocatalytic combination, are highly effective in removing gallic acid from industrial wastewater. The findings provide a foundation for adopting AOPs as a sustainable treatment method, reducing the environmental

impact of industrial effluents. Future research could focus on scaling these methods and exploring their application to diverse industrial pollutants, aligning with the goals of sustainable development and socio-economic innovation highlighted in the *Conferința Științifică Națională "Inovația: factor al dezvoltării social-economice"*.

Keywords: *gallic acid, industrial wastewater, advanced oxidation processes, Fenton method, photocatalysis, environmental sustainability.*

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PRODUCEREA DE β-GLUCAN DIN DROJDIILE VINURILOR LOCALE PRODUSE CU UTILIZAREA DIFERITOR TEHNOLOGII

PRODUCTION OF β-GLUCAN FROM YEAST LEES OF LOCAL WINES PRODUCED USING DIFFERENT TECHNOLOGIES

Alina BOISTEAN, ORCID ID 0000-0002-5374-5853
Technical University of Moldova, Chisinau, Republic of Moldova

Aurica CHIRSANOVA, ORCID ID 0000-0002-1172-9900
Technical University of Moldova, Chisinau, Republic of Moldova

Ana CHIORU, ORCID ID 0009-0001-1363-5887
Technical University of Moldova, Chisinau, Republic of Moldova
*Corresponding author: Alina Boistean, email alina.boistean@toap.utm.md

In recent years, researchers have increasingly focused on β-glucans, particularly exploring potential sources and finding ways to repurpose agro-food waste. In this regard, the Republic of Moldova, as an agrarian nation, offers a diverse range of agro-food residues suitable for utilization. β-glucans are bioactive substances known for their diverse biological activities, such as anticancer, anti-inflammatory, antioxidant, and immune-modulating effects. Due to its unique physical properties, including solubility, viscosity, and gelation, β-glucans are finding growing applications in the food, pharmaceutical, and cosmetic industries [1]. β-glucan has successfully been extracted from brewery spent yeast by-products and is proposed for use as an ingredient, additive, animal feed supplement, and fish immunostimulant. Yeast from wine lees of winery waste has not been yet exploited for β-glucan production. In the wine industry, the sludge left after alcoholic fermentation contains a substantial amount of spent yeast, which can be transformed into value-added products like β-glucans using suitable biotechnological methods. Nowadays, this waste is most often disposed of improperly, harming the environment [2]. In this study, yeast lees of four types of indigenous wines obtained from Moldovan wineries were used and using different technologies. In general, the extraction of β-glucans is classified into chemical (acid-base), physical (sonication and high pressure) and enzymatic. In this study, we use two extraction methods (alcali-acid and autolysis combined with ultrasound) and compare whether the extraction method has a greater influence on the yield and quality of β-glucans or the type of residual yeasts used. Also, different ultrasonic conditions were tested in the extraction method of β-glucans. The physicochemical and nutritional parameters of the obtained β-glucans were identified and analyzed to understand whether they were of interest for further valorization and identification, based on their characteristics, of the most important areas of possible use. The results show that vinification processes significantly affect the composition and quality of the wine lees, and both the extraction methodology and the origin of the yeast affect the yield and nature of the β-glucans obtained. The results of the analyses show that the residual yeast lees is rich in protein (41.12 ± 0.87 to 75.98 ± 0.23%), phenolic substances (142.19 ± 0.77 to 3350.17 ± 2.42 mg GAE/kg) and has almost the same dry matter, ash and carbohydrate values for all types of yeast sediment. Alternatively, the choice of yeast lees and winemaking techniques plays a significant role in determining the efficiency and extent of β-glucan extraction. It was proved that the first autolysis method used provided a higher yield of β-glucan compared to the second acid-base method. These insights are critical for optimizing β-glucan extraction processes, supporting sustainability efforts and waste valorization in the wine industry. Efficient extraction of β-glucans from natural sources like wine lees offers a promising path toward their industrial application as valuable functional compounds.

Keywords: *alkali-acidic extraction, winery sustainability, yeast waste biomass, yeast β-glucans.*

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APLICAREA ULTRASUNETELOR PENTRU REDUCEREA RUGOZITIILOR SUPRAFEȚELOR METALICE OBȚINUTE DE ESA

APPLICATION OF ULTRASOUND TO REDUCE THE ROUGHNESS OF METAL SURFACES OBTAINED BY ESA

Pavel PERETEATCU, ORCID ID: 0000-0002-1190-4772
Alecu Russo Balti State University, Balti, Moldova

Alexandr OJEGOV, ORCID ID: 0000-0002-8052-241X
Alecu Russo Balti State University, Balti, Moldova

Cornel CRACAN, ORCID ID: 0009-0008-0985-4615
Alecu Russo Balti State University, Balti, Moldova
*Corresponding author: Pavel Pereteatcu, pereteatcupavel@yahoo.com

Introduction and Background

It is known that the processing of metal surfaces by electro-spark alloying (ESA) produces surface layers with superior mechanical and wear properties [1] comparing to those of the base material, but the processed surface has an increased roughness, which can lead to inconsistency with the operating requirements of the parts, especially those that are in contact. One possibility to reduce the roughness of the surface processed by ESA is to choose soft energy regimes for finishing machining passes [2], another one is processing with a graphite tool-electrode [3]. In order to reduce the roughness of surfaces processed by ESA subsequent processing by plastic deformation of the surface by applying ultrasound is proposed in this paper.

Methodology

Boxes and cylindrical bars made of normalized steel 45 and steel 3 were used as workpieces. Bars with a circular section with a diameter of 3 mm made of hard alloys VK6 and T15K6 was chosen as the tool-electrode for the processing by ESA. Flat and circular surfaces of the workpieces were investigated. Elitron-22 set-up was used for ESA. PMS15A-18 set-up was used for the subsequent processing of the surfaces by plastic deformation applying ultrasound with conical concentrator and spherical head (Figure 1). The measurement of the surface roughness of the samples was carried out by using the Mitutoyo SJ-411 tester.

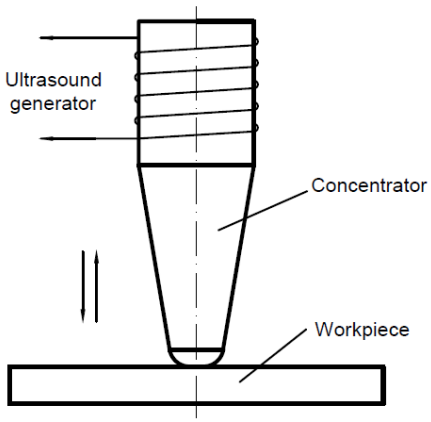

Figure 1. Scheme of ultrasound surface processing

Results

Following the application of ultrasonic processing of the investigated surfaces after ESA

(deposition of hard alloys on steels) a decrease in the average roughness by about 2.5 times was detected (from Ra12.8 (~Rz50) to Ra4.9 (~Rz20)). Besides the increase of the surface quality, its hardening also occurs through plastic deformation.

Conclusions and Implications

Subsequent ultrasonic processing of the surfaces of parts after ESA leads to a decrease in their roughness by about 2.5 times. Additional restructuring and hardening of the surface layer is attested. Parts with processed surfaces and reduced roughness broaden their area of application in machine building technology.

Keywords: *strata, plastic deformation, deposition, steel, hard alloy.*

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MOTIVUL FRAUDELOR ALIMENTARE, CAUZA CRIZEI EONOMICE DE DURATĂ

THE REASON FOR THE FOOD FRAUD, THE CAUSE OF THE LASTING ECONOMIC CRISIS

Iulia MAFTEI
"Dunărea de Jos" University of Galati, Galati, Romania

Florin Marian BUHOCIU
"Dunărea de Jos" University of Galati, Galati, Romania

Maricica STOICA, ORCID: 0000-0001-7315-1860
"Dunărea de Jos" University of Galati, Galati, Romania
*Corresponding author: Iulia Maftei, e-mail: iulia6362@gmail.com

Introduction and Background

In the food industry, a long time ago, but to date, it poses a risk due to food fraud, but also at the level of economic crisis. Food business operators are required to carry out a food fraud vulnerability assessment to meet the requirements of the GFSI.

Food fraud poses a risk to the food industry and food business operators are required to carry out a food fraud vulnerability assessment to meet the requirements of the GFSI. There is currently no globally recognized standardized process for mitigating food fraud, and some food business operators have found that meeting the requirements can be challenging.

This paper summarizes the main aspects of food fraud, publicly existing as a learning tool for companies. Consumers are suffering instead. These are the issues addressed in the context.

This work is being discussed at a global level, which can lead to the consensus process such as those carried out under the suspicions of the Codex Alimentarius Commission.

Methodology

This document was written in the format of a guidance document, and is generally non-prescriptive with respect to the details of implementation;

Results

Description of existing food fraud vulnerability assessment ,tools and Resources. This effort would not be successful unless it was widely supported by all stakeholders, willing to supply a wide range of food fraud relevant data from existing databases, laboratories, food industries, and governments and their associated testing and surveillance programs.

Conclusions

Development of a globally-recognized vulnerability assessment approach would support food regulators in their efforts to offer guidance to the regulated sector, should their regulatory policy around fraud evolve towards mandating such measures. However, successful development of a flexible and adaptable approach would also be dependent upon active participation by food industry groups.

Keywords: *International food standards, vulnerability assessment, food fraud, economic crisis*

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UTILIZAREA INOVATOARE A EXTRACTELOR DE PLANTE CA INHIBITORI VERZI PENTRU PROTECȚIA DURABILĂ A METALELOR

THE INNOVATIVE USE OF PLANT EXTRACT AS GREEN INHIBITORS FOR SUSTAINABLE METAL PROTECTION

Alexandra CICANCI, ORCID: 0000-0002-6968-9016
Cahul State University "Bogdan Petriceicu Hasdeu", Cahul, Republic of Moldova
*Corresponding author: Alexandra Cicanci, alexandra.cicanci@feisa.usch.md

Introduction

Currently, various resources are being intensively extracted worldwide, many of which are non-renewable, such as metals. Whereas metals represent an important asset for sustainable development, continued population growth and the current acceleration of changes in the energy field generates increasing concerns about their availability for actual and future generations. At the same time, it is alarming that objects, metal installations in industries, are permanently subjected to the corrosion process and, as a consequence, irreversible changes occur in their structure, leading to their complete destruction, thus huge economic losses occur. Therefore, the corrosion of metals presents an extremely important contemporary technical-scientific problem, the solution of which is related to the excessive use of toxic inhibitors, which leads to environmental pollution.

The aim of this study is to research and establish the inhibitory activity of plant extracts obtained from plantain and nettle for their further use as inhibitor compositions against metal corrosion in an acidic environment, as well as determining their effectiveness and comparing them with an existing inhibitor. The research objectives consisted in the studying the problem of metal corrosion and existing methods of protection, analysis and synthesis of scientific approaches in the field of "green" chemistry on the subject of plant inhibitors, identifying the effectiveness of using plantain and nettle extracts as corrosion inhibitors in an aggressive environment, comparing the developed inhibitor with the one already used in production.

Material and methods

Aqueous extracts obtained from plantain leaves (*Plantago major* L.) and nettle leaves (*Urtica dioica* L.) by infusing plant materials; the aggressive substance, for which a sulfuric acid solution with a concentration of 20% was used, as a control – a solution of sulfuric acid diluted with distilled water; corrosion losses were evaluated by the gravimetric method, based on the weight loss of the sample in the corrosion process [1, p.277].

Results

It was found that compositions based on plant extracts have a positive effect on the corrosion process. The inhibitor composition based on the addition of plantain extract showed to be more effective in the first 7 days of the corrosion process, its degree of protection being very high (96.7 %) and the inhibition coefficient 30.2 times compared to the corrosive medium without inhibitor. Through further research, over the next 3 weeks, the degree of protection of the nettle inhibitor passed to the plantain inhibitor, remaining effective throughout the research (fig.1).

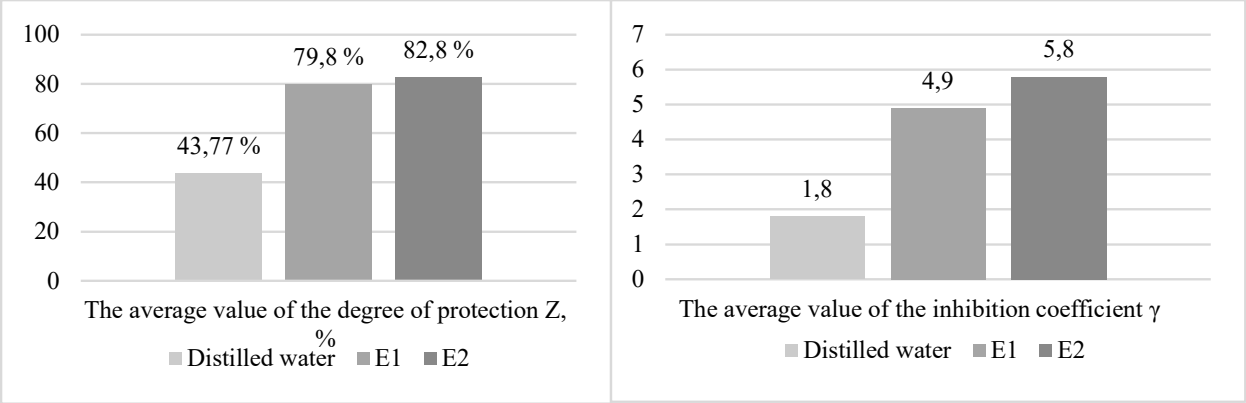

Fig. 1. The average values of the degree of protection and the inhibition coefficient

Conclusions

Through experience was demonstrated the effectiveness of natural inhibitors elaborated on the basis of plant extracts from plantain and nettle. At the same time, it has been found that the inhibitor from the nettle, used in the acid environment, has a more pronounced anticorrosive effect compared to the control sample and the inhibitor from the plantain. This "green" inhibitor has a high protective effect (82.8%), being at the same time available and environmentally harmless.

Keywords: *inhibitor, corrosion, natural inhibitors, the effectiveness of inhibition.*

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EFECTUL FĂINII DE NUCĂ (*JUGLANS REGIA* L.) ASUPRA CALITĂȚII BISCUIȚILOR

THE EFFECT OF WALNUT MEAL (*JUGLANS REGIA* L.) ON BISCUIT QUALITY

Olga BOESTEAN, ORCID: 0000-0002-0390-3550
Technical University of Moldova, Chisinau, Republic of Moldova

Vladimir FEDOROV, ORCID: 0009-0005-4537-0034
Transnistrian State University, branch city of Rybnitsa

Iuliana SANDU, ORCID 0000-0003-1266-3154
Technical University of Moldova, Chisinau, Republic of Moldova

Aliona GHENDOV-MOSANU, ORCID: 0000-0001-5214-3562
Technical University of Moldova, Chisinau, Republic of Moldova
*Corresponding author: Olga Boeștean, e-mail: olga.boestean@tpa.utm.md

Vegetable meals, by-products of the extraction of oils from seeds, play a crucial role in animal nutrition and the food industry [1]. Walnut meal is a concentrate of proteins and carbohydrates. In walnut meal, the amino acids are represented by valine (43-55%), isoleucine (20-41%), phenylalanine (19-78%) and leucine (15-17%). [1]. Also, 100 g of walnut meal contains the daily dose of vitamin B6 (26%), vitamin B1 (23%), folic acid (25%), magnesium (39%), phosphorus (34%), copper (79%) and a full daily dose of manganese [1]. The specialized literature attests that walnut meal is a valuable source of polyphenols and other components that have antioxidant activity [1]. Walnut meal with a relevant chemical composition can be widely used to obtain food products with high nutritional value and to manufacture functional products [2]. In this context, it was of interest to study the influence of walnut meal flour (WMF) (*Juglans regia* L.) in the manufacture of biscuits and its effect on sensory and physico-chemical quality, CIELab parameters and microbiological stability during storage.

When preparing experimental biscuit samples, the wheat flour mass was partially replaced with WMF in a proportion of 1-7%. The sensory and physicochemical quality of wheat flour and WMF was analyzed. The physicochemical characteristics of WMF described the following values: moisture content – 9.95%, ash content – 3.87%, lipid content – 11.44% and protein content – 28.77%.

During experimental research, the physical properties of the prepared biscuits were determined: mass - 14.97 g, diameter - 69.00 mm, density - 0.56-0.62 g/cm^3. The quality and microbiological stability of the biscuits was evaluated during a storage period of 35 days. Research conducted on the first day demonstrated that the moisture content of biscuits with the addition of WMF from 1% to 7% varied from 7.22% to 5.79%, the decrease of which was an advantage, since the shelf life increased. The water activity in the biscuits varied within the limits of 0.456 ÷ 0.211 c.u., reducing moisture losses and decreasing the elasticity of the finished product. The alkalinity of the biscuits was below 2 degrees, falling within the pre-established limit [3]. From the analysis of the chromatic parameters, the brightness values demonstrated a slight upward trend. Following the sensory analysis, the highest value was attested to the smell, because the WMF intensified the nutty smell. Also, a higher score was observed for fragility, this fact was due to the use of butter in the manufacturing recipe. The taste attested high values, but at the limit of accessibility. According to the quality indices obtained, the biscuits with WMF can be considered safe products for consumption, which retain their quality indices for a storage period of 35 days under prescribed storage conditions and can be recommended in the diet of various consumer groups.

Acknowledgments

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EVALUAREA IMPLICAȚIILOR ASUPRA SĂNĂTĂȚII ALE NANOPARTICULELOR DE OXIZI METALICI DIN AMBALAJELE ALIMENTARE ACTIVE

ASSESSING THE HEALTH IMPLICATIONS OF METAL OXIDE NANOPARTICLES IN ACTIVE FOOD PACKAGING

Dimitrie STOICA, ORCID: 0000-0001-5495-7076
"Dunărea de Jos" University of Galati, Galati, Romania

Angela Stela IVAN, ORCID: 0000-0002-1448-5921
"Dunărea de Jos" University of Galati, Galati, Romania

Maricica STOICA, ORCID: 0000-0001-7315-1860
"Dunărea de Jos" University of Galati, Galati, Romania
*Corresponding author: Maricica Stoica, Maricica.Stoica@ugal.ro

Polymer-based food packaging plays a significant role in the food protection. However, it seriously threatens the worldwide ecological sustainability. In line with this, innovative active packaging could be a suitable solution. Active packaging is designed to adsorb/release substances from/into the packaged foods or the packaging headspace to provide fresher and safer-like foods with a longer shelf life. There are three main categories of active packaging systems: adsorbing/absorbing systems (e.g. biopolymers, clays, enzymes), releasing systems (e.g. antimicrobials; antioxidants; enzymes) and nonmigrating systems (e.g. metal oxide nanofillers as impactful antimicrobials, completely encapsulated in the polymer/biopolymer matrix, their migration into food being not allowed) [1]. However, in some circumstances (abrasion, senescence of the packaging matrix, etc.), the polymer/biopolymer-based matrix is able to release metal oxide nanofillers into foods, depending on certain factors (food chemical nature, food processing, storage conditions, etc.). Once released into the food, metal oxide nanofillers pass through the human gastrointestinal tract (via the oral route, Figure 1), and, from there, can readily enter human cells [2].

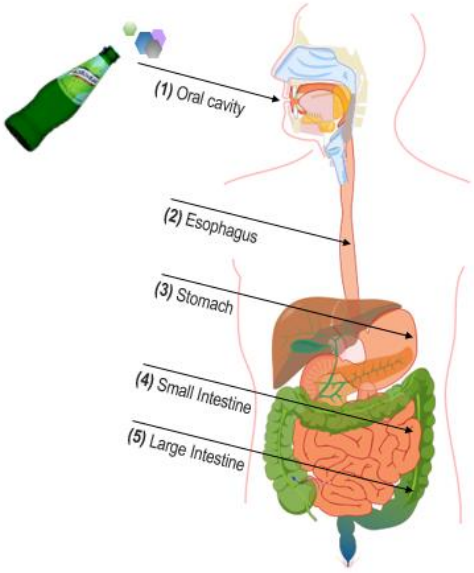

Figure 1. The ingestion pathway of metal oxide nanofillers into the human gastrointestinal tract [2]

The metal oxide nanoparticles can be significantly bioaccumulated in various organs

(brain, intestines, kidneys, liver, spleen), and may exert potential toxicity on human health. Whether they are recognized by the immune system or not, the nanofillers influence the human immune system through different immune reactions (e.g. inflammatory/anti-inflammatory responses) [2]. This paper does not conclude that metal oxide nanoparticles should not be used, it emphasizes the need for cautious use of metal oxide nanoparticles in food packaging due to potential adverse effects on human health.

Keywords: *fresher foods, healthier foods, impactful antimicrobials nanofillers, migration into food not allowed.*

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