ANALYSIS OF WORLD EXPERIENCE IN AMBER EXTRACTION AND THE POSSIBILITIES FOR ITS IMPLEMENTATION IN UKRAINE'S CONDITIONS

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Analyzing global experiences in amber extraction and other natural resources is essential for identifying best practices that enhance extraction efficiency, reduce environmental impact, and ensure corporate social responsibility. In Ukraine, where amber holds strategic significance, it is important to compare local practices with international standards. This comparison will not only improve technological processes but also aid in the implementation of innovative solutions that can significantly modernize the existing industry. Ukraine has substantial deposits of amber, primarily concentrated in the Zhytomyr, Rivne, and Volyn regions. However, despite the availability of this natural resource, the country continues to face issues related to illegal extraction, poaching, and inadequate regulation in this area. At the core of these challenges lies pervasive global corruption affecting the industry. In recent years, Ukraine has gradually been influenced by global trends in the extraction and processing of natural resources, requiring adaptation to sustainable development demands, including the introduction of new technological solutions that allow for efficient resource use while preserving the environment and resource potential for future generations.

In light of this, it can be stated that Ukraine has significant potential for the implementation of new extraction technologies that align with global standards. For instance, selective extraction technologies minimize costs and environmental impact. The introduction of new ecological technologies, such as the use of drones for monitoring extraction areas, can substantially improve oversight of environmental consequences. Existing international practices, such as water reuse, can mitigate negative effects on the environment. Collaboration with international projects in natural resource management will help implement best practices. However, it is also essential to consider the challenges inherent in adopting new technical solutions. These challenges include high costs for technology and specialist training, the need to update legislation to support innovations, and raising awareness among entrepreneurs and government agencies about the benefits of new technologies. [1]

Thus, laser scanning can become a powerful tool in the amber extraction sector of Ukraine, ensuring accuracy, efficiency, and environmental safety. The successful implementation of this technology will require efforts from the government, industry,

and academic institutions, but the potential benefits vastly outweigh the costs. Remote sensing is a powerful tool for collecting, analyzing, and interpreting data about natural resources, including amber, directly from extraction sites. In Ukraine, where amber is highly significant as a resource, implementing remote sensing technologies could greatly improve extraction management and oversight of environmental impact.

Firstly, it should be noted that satellite technologies, particularly hyperspectral imaging, can detect specific mineral deposits characteristic of amber deposits. For example, the Landsat satellite provides data that helps researchers identify geological structures and locate amber deposits using analytical methods. Equally important is the use of drones equipped with high-quality cameras and sensors. These technologies enable topographic surveying and the creation of three-dimensional models of the terrain, allowing for accurate mapping of amber deposits and assessment of their condition. Geographic Information Systems (GIS) also play a vital role in integrating remote sensing data with other information systems. These technologies allow for spatial analysis, identifying patterns in extraction and their effects on ecosystems. Utilizing change analysis methods enables the monitoring of landscape transformations caused by amber extraction, which is crucial for understanding the consequences of this activity.

GIS and 3D modeling are two technological approaches that, when combined, become powerful tools for enhancing decision-making processes in various sectors, including mineral extraction. GIS provides a robust platform for spatial data analysis, while 3D modeling allows to visualize complex geological features and extraction sites. Together, they offer a comprehensive view of mining operations, facilitating more informed decision-making. Regarding ecology, the consequences of extraction activities are concerning. Amber extraction often involves the removal of large amounts of soil and vegetation, leading to soil erosion, disruptions in water drainage, and loss of biodiversity. Many mines are located in sensitive ecosystems that are habitat to rare and endangered species. Sustainable practices that prioritize land restoration and conservation can help mitigate the adverse effects of extraction.[2] For instance, responsible amber extractors can implement measures such as reforestation programs and environmental protection initiatives. These practices not only safeguard local wildlife but also contribute to the overall health of ecosystems. Additionally, sustainable extraction can minimize disturbances to so-called "amber forests," areas where fossilized resin accumulates, preserving geological heritage for future generations.

Enterprises should minimize their environmental impact through thorough assessments, monitoring, and mitigation measures. Companies are obliged to engage with local communities and consider their rights and interests in extraction activities. Ensuring the health and safety of both workers and residents of nearby communities is extremely important, supported by ongoing training and risk management programs. Economically responsible practices in the extractive sector should contribute to the development of local economies by creating jobs and ensuring fair working conditions. The social dimension of sustainability emphasizes the importance of community engagement and support. Extractive enterprises can yield significant economic benefits

for local populations through job creation and infrastructure development. However, without proper oversight and community involvement, these benefits may not be evenly distributed, and the long-term social fabric may be weakened.

The implementation of sustainable practices involves the active participation of local communities in decision-making and ensuring that they benefit from the extracted resources. This can include profit-sharing agreements, vocational training, or investments in local infrastructure. By prioritizing community well-being, extraction practices can contribute not only to economic growth but also to social justice. The current legal framework for amber extraction in Ukraine has some strengths but lacks specificity, control, and consideration of community interests to ensure sustainable practices. Effective legal and regulatory frameworks are necessary for the sustainable extraction of amber in Ukraine. Establishing specific regulations for amber extraction and developing specialized frameworks that focus on the processes of amber extraction—including extraction methods, land reclamation of "Klondike" and monitoring environmental impact—should be a priority. Improving the licensing process by introducing stringent criteria that evaluate the environmental impact and social responsibility of proposed extraction activities and increasing human resource options, as well as the technological capabilities of regulatory authorities to enhance enforcement against illegal extraction, including the use of satellite technologies, is essential.[3]

Creating tax incentives for companies that use environmentally friendly extraction technologies and developing certification programs for amber extracted through sustainable practices to attract environmentally conscious consumers, along with institutionalizing community consultation processes, is a priority project to allow local residents to voice their concerns and exert influence over extraction projects. Active collaboration with international experts, academic institutions, and private investors can significantly improve the situation in the sector. Utilizing global experience in natural resource management and applying foreign investment to implement new extraction technologies can also reduce environmental risks and increase the profitability of extracting the "sunstone." Thus, for the successful implementation of sustainable amber extraction in Ukraine, it is necessary to combine legal, economic, and environmental components into a unified strategy that will allow for the preservation of natural resources and ensure their rational use.

List of references:
1. McNeil, A. J. L., Khasnabis, D., & Best, R. (2015). Natural Resources and Environmental Justice: The Role of Geosciences. Wiley.
2. Coelho, Daniel C. R. L. H. (2020). Sustainable Development in Mineral Extraction. Springer.
3. Shtukina, A., & Golikova, I. (2021). "Impact of Illegal Amber Mining on Local Ecosystems in Ukraine." Environmental Science & Policy Journal, 114, 456-464.