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# Embracing innovation for a future-ready wine industry: insights from Moldova's AI-powered pilot project

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**Abstract.** In 2023–2024, the Republic of Moldova launched its first AI-powered wine pilot, integrating artificial intelligence into the vitivinicultural value chain. The initiative was built on Moldova's dual strengths: a deep-rooted winemaking tradition and a rapidly expanding digital economy. Through a multi-actor collaboration involving public institutions, academia, and the private sector, the project tested AI's potential across harvest prediction, fermentation monitoring, blending design, and branding. The pilot utilized over 120 expert documents, seven years of IoT vineyard data, and GPT-based large language models. AI recommendations were grounded in local context and validated by winemakers. Two wines—one red and one white—were produced exclusively from indigenous grapes, with AI contributing to compositional logic and storytelling. The project culminated in an international campaign that drew over 1,900 global media mentions and more than 1.3 billion impressions. Beyond technical success, the pilot demonstrated how emerging technologies can enhance tradition-bound sectors through structured experimentation, sectoral alignment, and digital storytelling. Moldova's AI Wine Pilot offers a replicable blueprint for small wine economies seeking to build competitive advantage through innovation, while reinforcing the country's positioning as both a terroir-driven producer and an agile digital innovator.

## 1. Contextual foundations: Moldova's Dual Strength in Wine and Digital Innovation

The Republic of Moldova, a country known for its ancient winemaking heritage, is today emerging as a dual-force nation: a wine country and a growing digital economy. The wine sector remains one of the pillars of the national economy, accounting for approximately 3% of GDP, 7% of country's exports, and engaging over 150,000 people along the value chain. Moldova cultivates more than 110,000 hectares of vineyards and is the global leader in vineyard surface per capita. Parallel to this, Moldova has developed a robust ICT sector, where digital services account for over 10% of total exports, positioning the country among the top exporters of IT services in Eastern Europe. The coexistence of these two strategic sectors: wine and tech, has opened new pathways for innovation-driven growth and sustainable economic transformation.

In 2023, building on these national strengths, Moldova launched its first AI-powered pilot project in winemaking, aiming to integrate digital tools across the vitivinicultural value chain. The initiative reflects a growing global trend: the use of artificial intelligence, IoT, sensorisation, and blockchain to optimize vineyard performance, fermentation, traceability, and consumer engagement. Around the world, wineries are increasingly adopting predictive algorithms, smart tractors, and AI-driven wine recommendation systems. In parallel, Moldova is actively cross-pollinating its wine and tech sectors through various innovation-led projects—ranging from the use of drone-based spectral imaging to identify vine disease patterns and scale phytosanitary responses, to the deployment of precision weather stations across vineyards for real-time microclimate data modeling. The country has also piloted AI systems for winemaking, blending, and product design, created a national AgriTech innovation arena, and is experimenting with immersive digital marketing tools to reimagine wine storytelling and consumer interaction.

According to the OIV Digital Transformation Report (2021), digitalisation is expected to significantly impact the vine and wine sector over the next decade, with over 85% of experts identifying improved traceability, productivity, and data-driven decisions as key benefits.

This transformation is not isolated. The Republic of Moldova's National Digital Transformation Strategy (2023–2030) positions the country as a hub for emerging technologies, while the Agricultural and Rural Development Strategy (2023–2028) promotes smart viticulture and data-based sustainability interventions. In parallel, the country's draft Program for the Development of the Vine and Wine Sector (2025–2029) emphasizes the transition toward value-added production, innovation, and increased resilience, advocating the use of digital technologies, precision tools, and smart marketing approaches to elevate Moldova's wine sector[1].

Implemented in 2023–2024, amid the global surge in the development and accessibility of artificial intelligence technologies, the AI Wine Pilot—centered on Moldova's indigenous grape varieties and IoT-equipped smart vineyards—not only exemplifies how a small wine nation can act as a testbed for global innovation, but also outlines a replicable model for integrating emerging technologies into traditional sectors, increasing uptake, and fostering innovation-led development. It also aligns with the OIV's call for a paradigm shift through digitalisation to address climate volatility, market complexity, and consumer demand for transparency and sustainability. In this context, Moldova's initiative demonstrates that emerging wine regions can lead with agility, offering replicable models for value-added, tech-integrated winemaking.

## 2. Moldova's AI-Powered Pilot Project: Overview

### 2.1. Strategic Framing: From Ecosystem to Experiment

The Republic of Moldova has progressively developed the foundational conditions required for digital transformation in agriculture and viticulture. Recent analyses position the country among the most advanced in the Eastern European region in terms of connectivity, digital governance readiness, and institutional alignment for sectoral innovation. This evolution is not coincidental, but the result of strategic investment and policy orientation toward digital agriculture as a pathway for sustainable, high-value economic development.

Digital infrastructure indicators provide a quantifiable basis for this assessment. Moldova currently benefits from near-universal 3G (100%) and 4G (97.9%) mobile network coverage, access to electricity in rural areas above 99.7%, and 100% population-level achievement in basic digital skills. The country's digital agriculture index, a composite measure of infrastructure, affordability, and institutional environment, stands at 66.8—exceeding the average for countries with comparable agricultural profiles. Online service provision (85.3%) and the presence of mobile-specific public goods have enabled integration of advanced technologies, such as real-time sensing and spatial data collection, into field-level decision-making.[2]

At the sectoral level, viticulture in Moldova has become a priority domain for the application of digital technologies. These projects were initiated as part of development projects, funded by USAID and EU. Since 2018, a coordinated initiative has developed a network of 15 IoT-based weather stations deployed across key vineyard zones, integrated into a centralized data processing system. This infrastructure, built through a partnership between private companies, the National Office for Vine and Wine, and the Technical University of Moldova, supports real-time monitoring of 9 agro-climatic indicators. The system is connected to extension services, which utilize the data for tailored guidance to producers, as well as for micro-vinification experiments and field trials evaluating vine management practices and parcellar selection of grape varieties. Additionally, in 2017-2018 a drone-assisted imaging and multispectral analysis have been piloted to enhance phytosanitary surveillance, including for early detection of *Flavescence dorée* and *Bois Noir*. While the UAV-based application faced limitations due to insufficient resolution and interpretation capacity, the IoT infrastructure and its integration into a broader system of applied research and advisory services proved effective. This experience laid the groundwork for the introduction of more complex technological solutions, including AI-driven interventions in viticulture and winemaking.

From a policy perspective, the Republic of Moldova has developed a strategic framework that supports the integration of digital technologies into traditional sectors, particularly agriculture and viticulture. The National Digital Transformation Strategy (2023–2030) prioritizes the adoption of artificial intelligence, blockchain, big data, and Internet of Things (IoT) technologies to enhance productivity, sustainability, and competitiveness. It emphasizes cross-sector collaboration between public institutions, academia, and the private sector to create targeted digital innovation ecosystems[3]. Aligned with this, the National Strategy for Agricultural and Rural Development (2023–2028) promotes the transition to climate-resilient and digitally enabled agriculture. Specific objectives include the expansion of precision farming, smart irrigation, remote diagnostics in viticulture, and sensor-based monitoring—tools seen as instrumental for improving efficiency and meeting quality standards for export markets. As part of these broader efforts, the Technical University of Moldova initiated the establishment of a national AgroTech Park and Arena in 2024, designed as a physical and digital hub to foster research, testing, and demonstration of advanced

[1] Ministry of Agriculture and Food Industry, et all. *Programul Național de Dezvoltare a Sectorului Vitivinicol 2025–2029*, p. 1–3

[2] World Bank. "What's Cooking: Digital Transformation of the Agrifood System." 2021, p. 207

[3] Government of the Republic of Moldova. *Strategia de Transformare Digitală 2023–2030*, pp. 20–27

technologies in agriculture, including the wine industry. The initiative supports innovation acceleration through partnerships with academic institutions, private technology developers, and producers, with the aim to lower adoption barriers and expand Moldova's role as a pilot ground for smart agri-food systems

Despite these advances, adoption of digital tools across the wine sector remains inconsistent. A survey of Moldovan wine industry stakeholders conducted in 2024 demonstrated significant latent demand: over 72% of respondents expressed a high level of interest in adopting digital technologies across key operational domains—viticulture, winemaking, marketing, e-commerce, and enterprise management. However, over two-thirds of respondents also indicated uncertainty about how to begin the process of digital transformation. Identified barriers included insufficient internal capacity, difficulty understanding available technological options, and a communication gap between wine producers and digital service providers.[4]

This juxtaposition—high interest versus low implementation capacity—is consistent with international patterns. While over 85% of global experts surveyed by the OIV recognize AI, IoT, and blockchain as critical to advancing traceability, productivity, and sustainability in viticulture, actual adoption remains limited among SMEs[5]. A 2024 study by Geisenheim University further confirms this gap: although digital tools are commonly used for back-office functions like accounting and direct sales, adoption in vineyard management and cellar operations remains below 40%[6]. The majority of producers still rely on manual data handling, and only a minority utilize advanced analytics or AI-based solutions, underscoring a structural lag between digital awareness and operational integration.

Beyond structural readiness, the application of digital technologies in viticulture has already demonstrated measurable impacts. Integration of AI and IoT-based systems enables optimized fermentation, predictive disease control, and greater consistency in wine quality, contributing to both product differentiation and operational efficiency. In the Republic of Moldova, micro-vinification trials between 2018-2024, based on parcel-level data and sensor-informed harvest timing have supported improved fermentation management while enabling a deeper understanding of the organoleptic profiles of indigenous grape varieties and their adaptive responses to evolving climatic conditions. International experience confirms that such systems can reduce resource inputs, automate quality monitoring, and support real-time decision-making across the production chain—from vineyard health assessment to blending and labeling. At a broader level, digital agriculture pathways emphasize that access to structured, machine-readable data improves technical and allocative efficiency, while reducing transaction costs and environmental pressures[7]. These converging insights reinforce the rationale for Moldova's progression from foundational digitization to the orchestration of integrated, AI-enabled solutions.

The emergence of Moldova's AI Wine Pilot in 2023–2024 must therefore be interpreted not as an isolated initiative, but as a logical extension of a pre-existing ecosystem. It represents a transition from discrete technological interventions—such as drone scouting or IoT monitoring—to integrated, AI-assisted systems capable of supporting decision-making across the entire winemaking process. These include harvest scheduling, fermentation control, blending composition, and even marketing design and brand narrative development. As such, the pilot exemplifies Moldova's dual potential as both a digitally capable nation and an emerging center for wine innovation, offering a replicable model for integrated technology adoption in traditional production systems.

The launch of the Republic of Moldova's AI Wine Pilot in 2023–2024 should be viewed as a natural progression within an evolving ecosystem of digital experimentation in agriculture and winemaking. Rather than representing a radical departure, the initiative built upon earlier efforts in drone monitoring, IoT-based data collection, and digital traceability, aiming to explore how artificial intelligence could complement existing processes. The pilot introduced a more integrated, system-wide approach—linking vineyard data with fermentation management, blending trials, and marketing content development. Its conceptual framework was underpinned by the Wine & Tech Forum in July 2023. The initiative adopted a collaborative methodological approach often described as the "golden triangle" (triple helix) , involving public institutions, academic actors, and private sector partners. This model facilitated the alignment of technological experimentation with sector-specific priorities and operational realities. While exploratory, the AI Wine Pilot served as a structured testbed for assessing the relevance of emerging technologies—such as large language models—in the context of Moldovan winemaking sector. Simultaneously, it functioned as a public-facing initiative, fostering interest among domestic stakeholders and positioning Moldova as an open innovation space for foreign technology developers seeking new application environments.

## 2.2. Project Design and Implementation: From Data to Cuvée

The AI Wine Pilot project, launched in the Republic of Moldova in 2023–2024, was designed as an applied

[4] Brini M, et al, *Roadmap for digital transformation in the agriculture of the Republic of Moldova,* 2022, p.11-20.

[5] OIV. "Digital Trends Applied to the Vine and Wine Sector." 2021, p. 76

[6] Loose, S. "Digital Data Management in Wine Sector," Meininger's Conference, 2024, slides 6–8.

[7] Izquierdo-Bueno I. et al., *Smart Viniculture: Applying Artificial Intelligence for Improved Winemaking and Risk Management*, *Appl. Sci.* 2024, 14, 10277, pp. 2–4.

experiment to test the integration of artificial intelligence across selected phases of the winemaking value chain. The overarching objective was to explore the extent to which generative AI models and structured data environments could support human expertise in making informed decisions related to harvest timing, fermentation control, blending design, and brand communication.

The project followed a structured methodology based on a three-stage protocol developed and validated by the partner stakeholders. These stages included:

1. Input and training of the AI system, using contextual materials specific to Moldovan wine heritage and grape typologies;

2. Interactive implementation, where AI systems were prompted with real-time and historical data to generate actionable suggestions; and

3. Evaluation and validation, involving a multidisciplinary panel of winemakers, researchers, and technology developers who reviewed and selectively applied the AI outputs.

This framework was implemented through a triangular cooperation model, often referred to as the "golden triangle," bringing together public sector institutions (e.g., ONVV), academic expertise (notably from the Technical University of Moldova and Moldova State University), the centers of excellence and private sector entities from wine and tech sectors. The involvement of multiple actors across domains ensured that the pilot remained technologically innovative yet practically grounded in Moldova's specific oenological conditions and institutional capacities. The pilot was not designed to replace human decision-making, but to enhance it through augmented analysis and knowledge extraction from both structured (e.g., sensor data, lab analyses) and unstructured (e.g., winemaking books, protocols, narrative documents) sources. Over the course of the program, the AI system was trained and guided using approximately 120 curated documents, comprising validated protocols, datasets, literature, and expert input amounting to several thousand pages of domain-specific knowledge. Additionally, the system accessed over 850,000 individual sensor records, estimated from IoT stations, further enriching the model's analytical environment.

The pilot's cornerstone principles aimed to ensure replicability within SME wineries, full traceability through systematic documentation, and adherence to expert-validated, real-world protocols—ensuring that AI outputs remained practical, contextual, and aligned with current sectoral challenges such as climate variability, labor shortages, and the accelerating pace of innovation. The initiative also sought to create a scalable foundation for broader adoption and experimentation, including potential applications by startups developing localized digital solutions for the wine industry.

## 2.3. Data-Driven AI Training and Implementation Process

The implementation of the AI Wine Pilot was structured as a stepwise technical process integrating multiple data streams into a supervised generative AI environment.

The curation and tagging of knowledge sources at the foundation of the project's success. A variety of information were used to train the AI model (based on GPT-4 architecture) in Moldovan wine-specific terminology, regional typologies, winemaking protocols, and quality standards. This included:

- Approximately 120 curated documents, comprising PGI specifications, scientific papers, winemaking protocols, historical data, lab reports, and fermentation logs.
- An estimated over 3,000 pages of domain-specific information, manually organized and indexed using a hybrid approach of semantic tagging and predefined prompt structuring.
- Weather station metadata and summaries from over 7 years of IoT records across 19 locations, enabling climate-pattern calibration and region-specific phenological insight.
- Special attention was paid to grounding the AI in regional specificity—such as Feteasca Neagră phenolic profiles, fermentation behavior of Viorica, and climatic thresholds in the Codru, Ștefan Vodă, and Valul lui Traian regions, complemented where available by pedological assessments of soil structure and drainage, to inform AI modeling of root-zone dynamics and terroir expression.

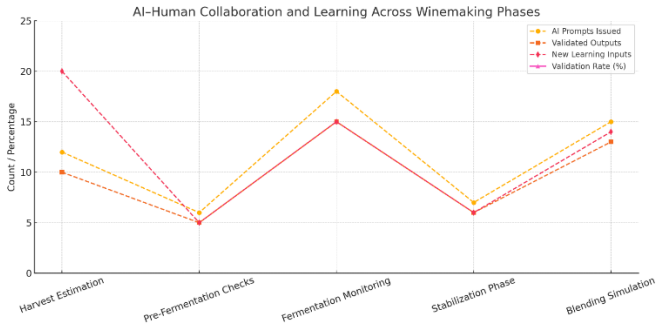


**Figure 1.** Timeline of AI engagement throughout winemaking phases.

Prompt design was executed under a supervised framework, where human specialists generated targeted queries related to harvest optimization, fermentation, blending, and marketing. To ensure semantic accuracy and contextual relevance, all AI-generated outputs were reviewed in parallel by winemakers and researchers, who iteratively refined prompts based on real-case applications. The leaning process was a continued process all the long of the pilot project.

**Excerpt from Human–AI Interactions During the Pilot (ChatGPT-based interface)**

| No. | Human Prompt | AI Response Summary | Estimated Correctness Rating (%) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Given the sugar level is 208 g/L, total acidity 5.6 g/L, and pH 3.3 for Feteasca Neagră in the southern PGI, what is the optimal harvesting window? | Suggested harvest in 3–5 days based on maturity indices and forecasted stress; validated by field team. | 95% |
| 2 | Suggest nutrient adjustments during fermentation if density drops below 1.010 and temperature exceeds 28°C. | Recommended DAP addition and cooling; aligned with winemaker adjustments. | 90% |
| 3 | What adjustments are needed to preserve acidity during a prolonged malolactic fermentation? | Suggested lowering temperature and limiting oxygen exposure; partially implemented. | 80% |

### 2.3.1. Harvest Timing Estimation

A central component of the pilot was to evaluate whether AI could offer decision-support in estimating optimal harvest dates, a task traditionally reliant on human observation and experience. The approach leveraged both real-time sensor/laboratory data and historical field records, analyzed through the AI system to generate site-specific harvest window suggestions.

The AI was trained using input from 15 IoT weather stations installed across Moldova's viticultural zones, each recording 9 agro-climatic parameters daily, including soil moisture, solar radiation, and temperature. These stations monitored eight representative vineyard plots where local varieties such as Feteasca Neagră, Feteasca Regală, and Viorica were grown and which were identified for use into the micro vinification. These were used to correlate phenological development with meteorological patterns and yield characteristics, thereby enriching the AI model's ability to suggest optimal harvest dates based on projected ripening behavior and forecasted climatic stress.

To support harvest date estimation, the AI model evaluated multiple parameters including °Brix, titratable acidity, pH, soil moisture, solar radiation, berry sampling reports and near-term weather forecasts and short-term weather forecasts. A heatmap analysis (Figure X) demonstrates the relative contribution of each parameter across three actual use cases. The model consistently prioritized forecasted weather conditions, sugar accumulation, and soil moisture—validating its alignment with viticultural best practices and field-based confirmation by winemakers.

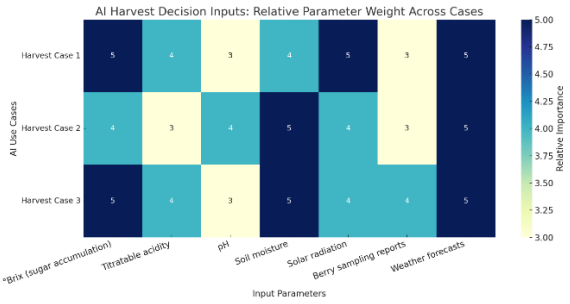


**Figure 2.** AI Harvest Decision Inputs: Relative Parameter Weight Across Cases . relative importance of input parameters used by the AI model in three separate harvest estimation scenarios. Weather forecasts, °Brix levels, soil moisture, and solar radiation consistently ranked highest in decision logic.

In one illustrative case, for a Feteasca Regală parcel in the Valul lui Traian PGI, the AI suggested harvesting five days earlier than the date initially proposed by the winemaker, based on signs of elevated radiation and reduced soil moisture indicating peak phenolic maturity. A micro-vinification trial later confirmed the AI's assessment, showing improved aromatic balance and acidity retention.

### 2.3.2. Fermentation Monitoring and Decision-Support

Post-harvest, AI was applied to fermentation-stage monitoring and analysis. Daily records from lab teams—including must temperature, density progression, and yeast activity—were compiled and interpreted by the AI system.

In particular, the model was tasked with:

- Identifying fermentation deviations and risk thresholds (e.g., stuck fermentation),
- Recommending yeast nutrient additions (DAP, thiamine),
- Suggesting temperature control strategies to preserve varietal aromatic profiles.

An applied example involved a Viorica-based cuvée undergoing fermentation at an elevated initial temperature. The AI recognized a slowdown in density decline and recommended immediate cooling to 16.5°C to maintain aromatic integrity. The intervention was adopted and positively evaluated by the panel in terms of aroma preservation and mouthfeel clarity.

The AI system was also exposed to a database of malolactic fermentation logs and was able to generate context-specific timelines and stabilization recommendations based on trends in post-primary fermentation acidity and temperature.

### 2.3.3. Blending Design

The blending phase marked a pivotal point in the AI Wine Pilot, transitioning from analytical and fermentation stages to the final expression of the wines' character. Once stabilized, the pilot yielded 27 micro-vinified base batches, including 19 red wines—18 from Feteasca Neagră and 1 from Rară Neagră—and 8 white wines produced from

Feteasca Albă, Feteasca Regală, and Viorica, each averaging 50 liters. With these as building blocks, the team set out to design and finalize two flagship wines—one red and one white—crafted exclusively from local Moldovan grape varieties. This step was both technical and symbolic: the resulting cuvées were envisioned as ambassadors of Moldova's winemaking identity, uniting indigenous expression, regional typicity, and AI-supported innovation under the Wine of Moldova country brand.

For the red wine, eight samples were selected for consideration, representing seven distinct parcels of Feteasca Neagră from Moldova's three PGIs—Codru (Speia, Nisporeni, Stăuceni, Cricova), Valul lui Traian (Lingura, Leova), and Ștefan Vodă (Purcari)—along with one parcel of Rară Neagră, also from Ștefan Vodă (Purcari). Each wine underwent comprehensive spectrometric analysis, including measurements of color intensity, phenolic content, anthocyanins, polyphenolic index, and optical density across nine wavelengths (280–620 nm). These data allowed for detailed profiling of structure, aromatic potential, and softness—providing the analytical foundation for informed blending.

Initially, two strategic profiles were defined: a robust, age-worthy red and a light, fruit-forward red, with a strong desire from the team to feature Rară Neagră as part of the final blend due to its delicate aromatic lift and freshness. However, based on structural analysis and comparative scenario evaluation, the AI consistently rejected the inclusion of Rară Neagră, considering it incompatible with the briefed objectives related to body, aging potential, and compositional integrity. After several trials and discussions, the team ultimately concurred with the AI's recommendation and finalized a monovarietal cuvée composed entirely of Feteasca Neagră, sourced from multiple PGIs to ensure balance, depth, and regional representation.

Despite this, the human winemakers proceeded, in parallel, to create a parallel blend, combining Rară Neagră with selected Feteasca Neagră parcels to highlight elegance and fruit-forward character—a deliberate counterproposal to the AI's choice. This human-designed wine later served as the comparative reference in public and professional tastings, including the AI vs. human "taste-off" activation, designed to explore perception, bias, and consumer curiosity toward AI-generated products.

For the white wine, the blending process followed a similar logic. The composition that met the defined criteria was based on 70% Feteasca Albă (sourced from *Ștefan Vodă, Purcari*), 20% Viorica (*Codru, Speia*), and 10% Feteasca Regală (*Valul lui Traian*). The AI model interpreted fermentation logs, acidity trends, and aromatic indicators to suggest ratios that would balance freshness, floral intensity, and mid-palate texture. These were refined through trial blending and expert validation, with adjustments based on sensory evaluation and targeted aromatic retention strategies, including cold stabilization and controlled lees contact.

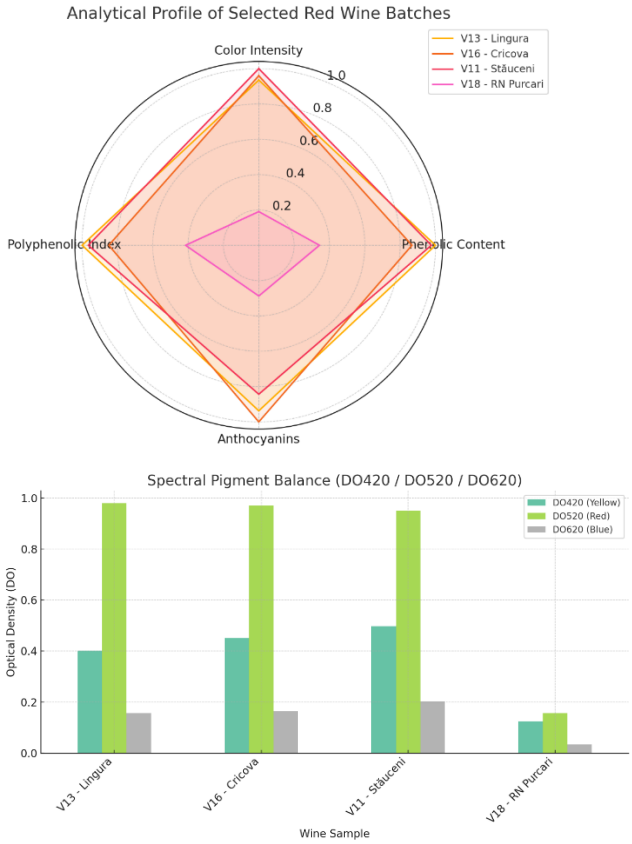


**Figure 3.** Spectrometric Analysis of Red Wine Samples Used in Blending

### 2.3.4. Branding, Communication, and AI-Driven Campaign Design

Beyond production, the AI Wine Pilot extended its innovation into branding and strategic communication, leveraging artificial intelligence to co-create not just wines, but narratives, identities, and public dialogue. This phase of the project embodied the intersection between tradition, digital creativity, and sector-wide engagement, with the goal to position Moldova as a forward-looking wine nation—rooted in tradition, yet actively shaping the digital frontier.

### 2.3.5. AI Contributions to Branding and Communication

As part of the identity-building process, AI tools were used to generate name proposals aligned with Moldova's cultural DNA and the emotional register of the wines. The final naming decisions—though supported by LLM ideation—were made by the project team to preserve semantic depth, mythological resonance, and local relevance.

– The white wine, was built around themes of serenity, biodiversity, and transformation. The AI had been prompted to ideate within symbolic frames such as nature, cyclical balance, and inner clarity. These motifs were further reinforced by references to the Cucuteni–Trypillia civilization, an ancient Neolithic culture rooted in the territory of today's

Republic of Moldova, known for its symbolic art and spiral pottery forms. The final name selected—*Elysium*—evokes an idyllic, harmonious space, while the label's spiral imagery reflects both natural cycles and Moldova's layered cultural identity.

– The red wine, was constructed around strength, depth, and tradition reimagined. The name *Rubrum Aeon* reflects the fusion of ancient lineage (*rubrum* – red) and a new era (*aeon*). The key and geometric motifs on the label were selected to signal unlocking knowledge and algorithmic structure.

The campaign aimed to position Moldova as a modern wine-producing nation, technologically bold, emotionally resonant, and strategically positioned under the `Wine of Moldova. Unexpectedly great` brand. While the concept and vision were steered by human creativity and market expertise, the integration of AI enabled fast iteration, visual experimentation, and unprecedented narrative cohesion.

A variety of AI tools were used across the communication chain:

### 2.3.6. Summary of AI Toolchain for Communication Components:

| Task | AI Tool Used | Output Generated |
|---|---|---|
| **Label concept visualizations** | Midjourney | Dozens of unique label options with symbolic consistency |
| **Name ideation (AI support only)** | ChatGPT | Names inspired by mythology, algorithmic clarity, and Moldovan motifs |
| **Character concept (Chelaris)** | Unreal Engine + VEED.IO | Avatar persona of the AI winemaker with scripted voice and 3D motion |
| **Campaign narrative and press content** | ChatGPT | Launch speech, FAQ, blog posts, digital copy |
| **Video editing** | Invideo.ai | Promotional and documentary-style videos for online distribution |
| **Public voting interface content** | GPT-supported | Side-by-side AI vs. human wine copy for tasting engagement |

### 2.3.7. Global Rollout and Media Engagement

The successful completion of the AI Wine Pilot was enhanced by a strategically designed and impactful country promotion initiative, aimed at translating technological experimentation into practical applications across branding, marketing, and public engagement.

The communication campaign was launched under the theme "Unexpectedly Great. First AI Vintage", with its international unveiling at ProWein Düsseldorf 2024. Moldova's AI wines were introduced in a tech-enhanced, immersive booth experience, centered around the story of *Chelaris*—a digitally rendered Metahuman Winemaker, personifying Moldova's fusion of innovation and heritage. The campaign invited visitors to engage in a blind tasting and public voting activation, where they compared the AI-created wines with those blended by human oenologists.

Voting took place across multiple touchpoints: at the stand, via online platforms, and through a curated masterclass attended by high-end wine professionals, journalists, and buyers. Results showed a preference for the human-made red wine, appreciated for its layered texture and classic structure, while the AI-created white cuvée was most often favored for its balance, aromatic expression, and modern profile. These outcomes—aligned with the campaign's dual narrative of tradition and innovation—were echoed across Moldova's internal promotion channels and international PR rollout.

The campaign's storytelling approach remained fully integrated across all channels—from product naming and label design to media coverage, social platforms, and international events. Its impact was significant: over 1,900 international media mentions across more than 30 countries within two weeks, with an estimated audience reach exceeding 1.3 billion. Coverage extended beyond the wine industry into tech media and startup communities, triggering new interest from accelerators and innovation stakeholders and reinforcing Moldova's positioning as a sandbox for applied innovation[8].

This multidimensional initiative demonstrated that digital storytelling, when grounded in place, product, and purpose, can amplify the visibility and perceived value of small, tradition-rich industries. The Moldova AI Wine Pilot thus delivered not only technically validated products, but a replicable model for AI-assisted brand building, market activation, and integrated country promotion.

## 3. Conclusions, Lessons Learned, and Future Directions

The AI Wine Pilot implemented in the Republic of Moldova during 2023–2024 offers a compelling case of how emerging technologies—particularly artificial intelligence—can be applied to a traditional sector such as winemaking in a structured, results-oriented, and nationally relevant manner. Beyond producing innovative wines, the pilot served as a testbed for process optimization, knowledge augmentation, branding enhancement, and institutional coordination.

Lessons learned from the implementation process include:

– Human supervision remains critical. The most reliable outcomes were achieved when AI

[8] Wine of Moldova Launches World's First Serious AI Wine at ProWein 2024 - Chemonics Moldova.

suggestions were reviewed and refined by experienced oenologists, data scientists, and communication professionals.

- Input structure determines output quality. The quality, traceability, and contextual specificity of documents, datasets, and prompts used to train the model directly influenced the relevance of AI-generated outputs.
- Stakeholder alignment is essential. The triangular cooperation model (public sector, academia, and private sector) enabled rapid iteration while ensuring institutional backing, field validation, and practical adaptability.
- Digital readiness is uneven. While Moldova demonstrates strong ICT infrastructure and sectoral interest in digitalisation, SME wineries continue to face barriers related to digital literacy, cost, and vendor coordination.
- Narrative and design must reflect origin. AI proved useful in generating options for names, visuals, and storytelling, but human guidance was required to ensure cultural coherence and emotional resonance.

Among limitations or challenges, itw as noted that the AI model at times offered speculative or non-applicable suggestions, particularly when insufficiently constrained by local context or protocol. Some digital tools lacked interoperability, and technical assistance was needed to convert AI logic into operational winery workflows. Limited understanding among winery staff of prompt-based interactions also limited full-scale internal adoption.

The next phase of development should focus on scaling the AI model into a modular decision-support system that can be offered as a service to other wineries; developing training modules and prompt templates for broader SME adoption; establishing structured feedback loops based on real-world input and sensory validation; integrating the model with Moldova's National Vine and Wine Register and digital traceability platforms; and pursuing follow-up pilots in areas such as e-commerce personalization, predictive disease management, and immersive wine tourism storytelling.

The Moldova AI Wine Pilot ultimately demonstrates that when technological innovation is grounded in sectoral knowledge, national strategy, and stakeholder inclusion, even small economies can produce globally relevant breakthroughs. The initiative offers not only a replicable blueprint, but also a mindset shift toward agile, interdisciplinary experimentation in the wine industry and beyond.

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