HUB TECH IA

Deliverable report 22

AI and IAGEN Application Use Case

Training through simulation of critical scenarios in the Industry Oil in Vaca Muerta, Neuquén

I. Introduction

The oil industry, particularly the exploitation of unconventional deposits Like Vaca Muerta, it is characterized by its complexity and the risks inherent to its operations. Worker safety and environmental protection are crucial to ensuring the sustainability of operations. In this context, the Constant and effective staff training is essential to prevent accidents, minimize environmental impact and optimize efficiency. Generative Artificial Intelligence (Generative AI) emerges as a tool with enormous potential potential to revolutionize the creation of training guides, adapting to the industry-specific needs and improving preparedness for situations criticisms.

This report analyzes in detail how Generative AI can be applied in the creation of training guides in the oil industry in Vaca Muerta, addressing its Benefits, challenges, implementation strategies, and cost-benefit analysis. AI Generativa has the potential to transform the way companies train their its employees, marking a shift from standardization to customization in the

learning and development.

II. Generative AI in the Creation of Training Materials

Generative AI is a branch of Artificial Intelligence that focuses on the creation of New content and ideas such as models, images, code or text, from data existing. Its ability to analyze large volumes of data and learn from complex patterns makes it an ideal tool for creating dynamic and personalized training materials. In essence, this technology uses advanced algorithms to analyze large amounts of information, Identify patterns and generate new and original content that is often indistinguishable of the one created by humans.

Through advanced algorithms, AI can analyze performance, preferences learning and the needs of each individual, generating customized content that maximize knowledge retention and skill development.

In the training field, Generative AI can be used to:

- Personalize content: AI analyzes learning patterns and preferences of each individual to create tailored training materials. This ensures that materials are presented in formats and styles that conform to the methods of learning of each employee, improving engagement and retention knowledge.
- Create interactive simulations: AI allows the development of simulated environments for training, offering risk-free immersive experiences where Users can practice complex tasks and develop decision-making skills. decisions in a secure virtual environment.
- Generate personalized learning paths: AI-powered platforms They adapt the learning paths according to the progress, strengths and areas to improve each individual. This ensures that employees focus on the content more relevant and up-to-date for your development.

- Automate assessments and feedback: AI offers systems to show ratings and feedback immediately, allowing employees hone your skills in real time. This instant feedback facilitates more efficient learning and accelerated skill development.
- Predict skills gaps: By analyzing performance data, AI identifies and anticipates potential skills gaps within the workforce. This allows companies to anticipate training needs and develop specific programs to address skills gaps.

III. Generative AI for Training in Critical Situations

Generative AI can help create more effective training guides for these critical situations to:

- Generate realistic simulations: The IAGen can create interactive simulations that replicate critical situations with a high degree of realism, such as spills oil, gas leaks, fires, workplace accidents or failures in the teams. These simulations allow workers to practice decision-making decisions, the application of security protocols and teamwork in a secure virtual environment, without putting your physical integrity or the environment at risk atmosphere.
- Personalize training: IAGen can adapt the content of the guides to the specific needs of each worker, considering their role, experience, level of knowledge and learning style. This ensures that the training be relevant, effective and engaging for each individual, maximizing retention of knowledge and skills development.
- Provide personalized feedback: IAGen can analyze the workers' performance in simulations and provide specific, individualized, real-time feedback to improve your skills, knowledge and decision-making. This enables workers identify their strengths and weaknesses, and focus on the areas that need to improve.

- Improve safety and risk management: IAGen can be used to develop early warning systems that identify risk situations in real time, such as leaks, spills, or equipment failures. This allows for faster and more effective response to possible incidents, minimizing negative consequences.
- Promote environmental sustainability: IAGen can contribute to the development of more sustainable extraction techniques that minimize the environmental impact of operations. It can also optimize the use of energy and resources, reducing the industry's carbon footprint.

IV. Application of IAGEN-driven agents to the activity

1. Concept of IAGEN agents

In recent years, generative artificial intelligence (GAI) has revolutionized the way we interact with technology, enabling the development of systems capable of generating content, answering complex questions and assisting with tasks high-demand cognitive skills. From this capacity, a new architecture emerges Technological: IAGen-powered agents. These agents are not simple conversational interfaces, but autonomous systems that can interpret instructions, make decisions, execute tasks and learn from their interactions with the around.

An IAGen agent combines large language models with components additional features such as external tools, memory, planning and autonomous execution. This allows them to operate in complex environments, with the ability to break down Step-by-step objectives, coordinate multiple actions, interact with digital systems (such as databases, APIs or documents) and adapt to changes in context in real time. These qualities distinguish them from traditional chatbots, and open up a spectrum of more sophisticated and customizable applications.

At the organizational level, these agents are being used to automate processes, generate data analysis, assist in decision making and improve the

user experience, both internally and externally. For example, they can assume human resources, legal, financial or logistical tasks, and even those linked to the technical areas of production processes, acting as intelligent assistants that collaborate with human teams. This ability to integrate knowledge and execute tasks autonomously transforms the way organizations can scale your operations without losing quality or control.

In addition, agentic workflows—structures where multiple agents collaborate with each other to solve complex problems—allow responsibilities to be distributed between different agent profiles, each with specific functions. This generates Hybrid work environments where humans and agents coexist, optimizing times, costs, and results. The ability to connect agents with tools such as Google Drive, CRMs or document management platforms further expands its capabilities.

The development of IAGen-powered agents represents a crucial step towards a new era of intelligent automation.

Among the benefits of authentic workflows driven by business models generative artificial intelligence, the possibility of automating processes is found complete, end-to-end production systems, and even add value from the leveraging the skills of language models based on these technologies.

However, its implementation also poses technical, ethical and legal challenges, from responsible design to human oversight. Therefore, understanding your architecture, its operational logic and its potential impacts is fundamental to its effective and safe adoption in various professional contexts.

2. Agentic Flow Design Proposal for Implementation

a. Main Capabilities of the Agent

- **User Analysis**

- Collect data on:
  - ÿ Role and responsibilities
  - ÿ Experience level
  - ÿ Learning style and pace
  - ÿ Previous evaluations and performance

- **Generation of Personalized Content**
  - Develops adapted teaching materials (videos, PDFs, presentations, interactive guides)
  - Use styles and formats compatible with each user's preferences
- **Creation of Interactive Simulations**
  - Generates realistic scenarios such as:
    - ÿ Oil spills
    - ÿ Gas leaks
    - ÿ Electrical failures
    - ÿ Accidents in the plant
  - Includes real-time decision making with multiple consequences

- **Generation of Learning Paths**
  - Create adaptive routes that:
    - ÿ Prioritize critical skills
    - ÿ They adjust to the worker's progress
    - ÿ They integrate reinforcement where there are failures
- **Automatic Evaluation and Feedback**
  - Correct activities and simulations
  - Provides immediate and personalized feedback
  - Recommend new activities or review
- **Predictive Breach Detection**

- Analyze data to:
  - ÿ Identify at-risk skills
  - ÿ Anticipate future training needs
  - ÿ Propose early interventions

- **Safety and Risk Management**
  - Recommends improvements in security protocols
  - Generates alerts for repeated simulations with critical errors
  - Connect with IoT sensors or real incident databases (optional)

- **Environmental and Energy Optimization**
  - Suggests good practices to minimize environmental impact
  - Simulate scenarios with a lower carbon footprint
  - Integrate sustainability KPIs into training.

- **Expected Inputs**
- Employee data (profile, position, seniority, previous knowledge)
- Training objectives (by regulation, by project, by evaluation)
- Types of risks or critical situations that you want to train
- Security policies or internal protocols.
- Contextual information (location, technology used, sector)
- **Agent Outputs** • Customized training program (with schedule and materials)
- Automatically generated interactive simulation
- Evaluation report per worker
- Progress tracking dashboard (per user and per group)
- Automatic recommendations for new workouts or improvements
- Report on detected skills gaps
- Real-time alerts and suggestions in connected environments

b. Practical applications

• Initial and ongoing training of personnel in oil and gas fields • Preparation for industrial or environmental emergencies

• Incident reduction by simulating common errors

• Acceleration of onboarding of new employees in technical roles

• Monitoring critical knowledge in high-risk operations

V. Critical Situations in the Petroleum Industry

The exploitation of unconventional hydrocarbons presents a series of situations critical situations that require specific staff training to ensure safety, efficiency and sustainability of operations. These situations can be categorized into different types of risks:

Environmental:

- Water pollution: Hydraulic fracturing, a method used for extraction of hydrocarbons in Vaca Muerta, involves the use of large volumes of water and chemicals that can affect the quality of surface water and underground. The possibility of these substances migrating into the subsoil and reaching aquifers used for human consumption is a major concern.
- Air pollution: Soil blasting and emissions from mining operations Hydrocarbons affect air quality, with consequences for the health of the people living near wells or facilities.
- Soil degradation: Lack of vegetation and bare soils in the area increase runoff and erosion, which reduces soil fertility.
- Induced seismicity: The injection of fluids into the subsoil during fracturing hydraulics can generate induced seismicity, with possible consequences for the infrastructure and nearby towns.

Operational:

- Waste management: Drilling and operating wells generate large amounts of waste.
  volumes of hazardous waste, such as oleophilic blankets, sludge
  drilling and rock cuttings, which require treatment and disposal
  final suitable to minimize their environmental impact. The capacity of the plants
  treatment to handle the growing volume of waste is a challenge
  important.
- Leaks and Spills: There is a risk of gas leaks and oil spills during
  extraction, transportation and processing operations, with serious
  consequences for the environment and people's health.
- Equipment failures: The machinery and equipment used in the industry
  Oil refineries are complex and can suffer failures that cause accidents or
  production interruptions.

Social:

- Working conditions: Workers in the oil industry may be
  exposed to long working hours, extreme weather conditions and
  toxic substances, which can affect your health and safety.

Economical:

- Price volatility: The oil industry is subject to price volatility.
  international prices, which may affect the profitability of operations and the
  investment in the region.
- Hidden costs of fracking: The environmental and social costs of fracking are not
  are always accounted for in economic analyses, which can lead to a
  underestimation of the real impact of the activity.
- Energy transition: The growing demand for renewable energy and the transition
  towards a low-carbon economy represent a long-term challenge for the
  oil industry.

VI. Challenges and Limitations of Generative AI

Despite its potential, the implementation of Generative AI in the creation of guides Training also presents challenges and limitations that must be considered:

- Data dependency: The quality of the data used to train the IAGen models are crucial to the accuracy, reliability and effectiveness of the generated guides. It is essential to have complete, accurate and representative of the critical situations that are to be addressed in the training.
- Content Accuracy: IAGen does not guarantee the accuracy of the content generated, Therefore, review and validation by experts in the field is crucial. IAGen may make mistakes or generate incomplete information, so it is It is essential to have a quality control process that ensures accuracy of the training guides.
- Need for an instructional design framework: IAGen needs a solid framework instructional design so that the content is relevant, effective and impactful. It is important to define the learning objectives, the structure of the content and the pedagogical strategies that will guide the creation of the training guides.
- Data security: The use of IAGen in business environments raises concerns about data confidentiality and security, especially when processing sensitive information. It is essential implement security measures to protect data and prevent unauthorized access authorized.
- Risk of deepfakes: IAGen can be used to create "deepfakes", which are fake videos or audios that look real. This can be a problem in the training, since deepfakes can be used to spread information wrong or manipulate workers.
- Bias in algorithms: IAGen algorithms may be biased, which can lead to the generation of discriminatory or unfair content. It is important Use diverse and representative data sets to train the models IAGen and minimize the risk of bias.

- AI Hallucinations: AIgen systems may produce results that are not
  are based on real or accurate information, which is known as "hallucinations". It is
  It is important to be aware of this risk and validate the information generated by the
  IAGen.
- Difficulty in data recovery: It may be difficult to recover specific data
  of IAGen models, which can make it difficult to comply with the
  data protection regulations. It is important to consider the implications
  for data privacy and security when using IAGen.

VII. Strategy for Implementing Generative AI

To implement Generative AI in the creation of training guides in the
oil industry in Vaca Muerta, the following strategy is proposed, which incorporates
Specific research recommendations:

1. Needs assessment: Identify specific training needs
   in critical situations, considering the risks, challenges and regulations
   of the operation in Vaca Muerta. This involves analyzing previous incidents, the
   best practices and areas where training can have the greatest impact
   in safety and efficiency.
2. Data collection: Collect relevant data on critical situations,
   security protocols, best practices, performance of the
   workers, environmental conditions and applicable regulations. It is
   It is essential to ensure the quality, integrity and representativeness of the data
   for training IAGen models.
3. Short-term investment in AI agent implementation teams
   Technology and training: Investment in proof of concept and testing is required
   pilot. The focus here has to be on training the talent to implement, since
   There is a trend towards cost reduction in systems that allow
   “no code” and “low code” automation. For the first stage, we also
   recommends using teams with experience in design and implementation
   AI agents. Finally, it is key to form an in-house team for the

accompaniment and appropriation of an agentic culture that redefines the human-computer interaction.

4. Creating training guides: Using IAGen to create simulations interactive, multimedia content, personalized assessments and tailored guides to different roles, experience levels, and learning styles. It is important ensure that the guides are clear, concise, attractive and easy to understand.
5. Validation and evaluation: Validate the accuracy, effectiveness and relevance of the guides generated by IAGen with the participation of experts in the field, experienced workers and representatives of local communities. The Validation should ensure that the guidelines reflect best practices, regulations and specific conditions of Vaca Muerta.
6. Implementation and Monitoring: Implement the training guides in an environment controlled and monitor its impact on worker performance, operational safety and process efficiency. Monitoring must include data collection on employee engagement, retention of knowledge and application of skills learned in the job.
7. Continuous improvement: Adjust and improve training guides based on the worker feedback, data analysis and progress in Technology. Continuous improvement should be an iterative process that allows for optimization the effectiveness of training over time.
8. Training and change management: Implement a training program for the staff who will use IAGen tools and manage the change effective way to ensure acceptance and adoption of technology.
9. Ethical Considerations: Establish a governance framework to address the ethical dilemmas that could arise with IAGen, such as issues of bias, data privacy and the generation of deepfakes.
10. Regulatory Compliance: Ensure that IAGen tools comply with the most current legal and regulatory requirements regarding the use of data, the

privacy and intellectual property rights. It is important to stay updated on regulations and adapt IAGen tools to ensure compliance.

11. Data Strategy: Develop a robust data strategy that ensures the quality, availability and security of the data used to train the AI models. This involves implementing collection processes, data cleaning, labeling and storage.

VIII. Cost-Benefit of Generative AI

The implementation of Generative AI in the creation of training guides involves an initial investment in software, hardware, staff training and development models. However, the long-term benefits may outweigh the costs, generating a significant return on investment (ROI):

- Cost reduction: AI can automate tasks, optimize production, predict equipment failures and improve energy efficiency, which translates into in significant savings. The large-scale adoption of AI in the industry Oil and gas could represent a 10-20% reduction in costs.
- Improved efficiency: AI can accelerate content creation, personalize training, provide real-time feedback and optimize flows work, which increases the efficiency of the training process and frees up time so that employees can focus on more strategic tasks. On average, Employees using Generative AI save 1.75 hours daily.
- Increased security: AI can improve the security of operations by provide realistic simulations of critical situations, train the workers in decision-making, identifying risk situations in time real and develop early warning systems.
- Greater knowledge retention: AI can personalize content, routes learning and feedback, which improves knowledge retention, the development of skills and the motivation of workers.

- Improved customer service: Generative AI can provide answers fast, accurate and personalized responses to customer queries, leading to higher levels of satisfaction and loyalty.
- Increased productivity: AI can automate routine tasks, freeing up employees to focus on higher-value activities.

The ROI of Generative AI in training can be significant, especially in high-risk industries such as oil, where safety, efficiency and sustainability are crucial.

IX. Conclusions

Generative AI has the potential to transform the creation of training guides in the oil industry in Vaca Muerta. By generating realistic simulations, personalize content, provide targeted feedback, improve performance security and promote sustainability, AI can improve the preparedness of workers in critical situations, increase the safety of operations and optimize the efficiency of the training process.

While there are challenges and limitations, an appropriate implementation strategy, the selecting the right tools and involving subject matter experts can maximize the benefits of Generative AI. Investing in this technology can generate a significant long-term return by improving security, efficiency and sustainability of the oil industry in Vaca Muerta. The adoption Generative AI can provide a competitive advantage for businesses, allowing them to optimize operations, reduce costs and improve security more effectively than those that do not adopt this technology.

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