



5 Core digital transformation technologies

Some examples of Drilling & Completion operations

5

Core Digital transformation Technologies

Explores the game-changing technologies that are driving digital transformation across the industry's production chain

Tech. **1** **BIG DATA**

Tech. **2** **ARTIFICIAL INTELLIGENCE**

Tech. **3** **INTERNET OF THINGS**

Tech. **4** **CLOUD COMPUTING**

Tech. **5** **BLOCKCHAIN**

Ramon Perdomo, Sr. Drilling Engineer

5 Core digital transformation technologies



BIG DATA

01



A collection of data that is huge in volume and yet growing exponentially with time.

Tech.

1
BIG DATA



Tech.

2
ARTIFICIAL INTELLIGENCE



Tech.

3
INTERNET OF THINGS



Tech.

4
CLOUD COMPUTING



Tech.

5
BLOCKCHAIN



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THE DRILLING NEWS

www.drillingnews.com
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Drilling Analysis using Big Data has been Misused and Abused

Data mining was misleading when not properly quality-checked, classified and aggregated in a way that made drilling analysis effective. There was not one single methodology that provided all the analysis details necessary to reach a meaningful conclusion. Pure data mining without considering the physics involved limits the full understanding of what is really taking place and can lead to incorrect speculations.

Many people in the industry are incorrectly utilizing big data to produce correlations that attempt to identify operational "sweet spots". This paper show examples and address the need to add several steps to big data before any meaningful correlations results can be obtained, mainly understanding..

1. The sensors involved and their limitations;
2. The errors in the placement of the sensors;
3. The frequency of the data and how this impacts the analysis;
4. The quality of the data itself;
5. The appropriate filtering of data to ensure apples-to-apples comparisons;
6. The rig state must be known;
7. Understanding of the physics involved.



Society of Petroleum Engineers



IADC

Eric Maidia, William Maidia, John Rigg, Michael Crumrine, and Philipp Wolf-Zoellner, ProNova - TDE Petroleum Data Solutions, Inc.

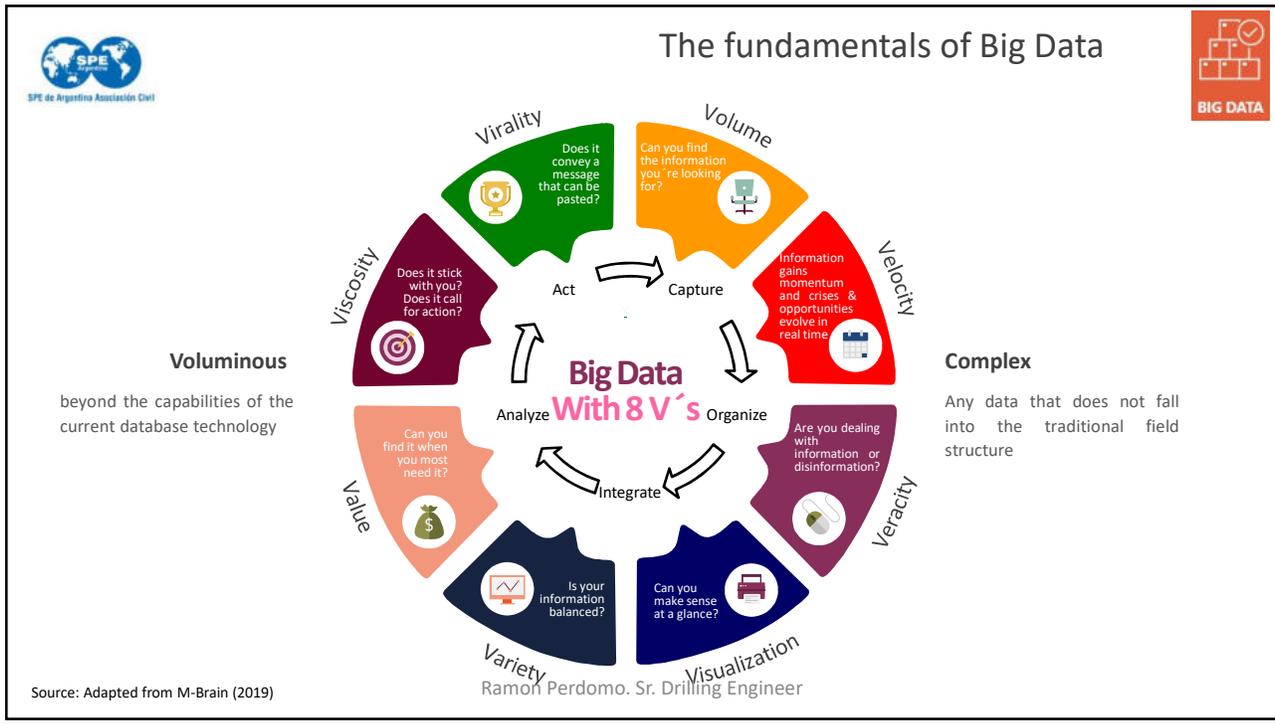
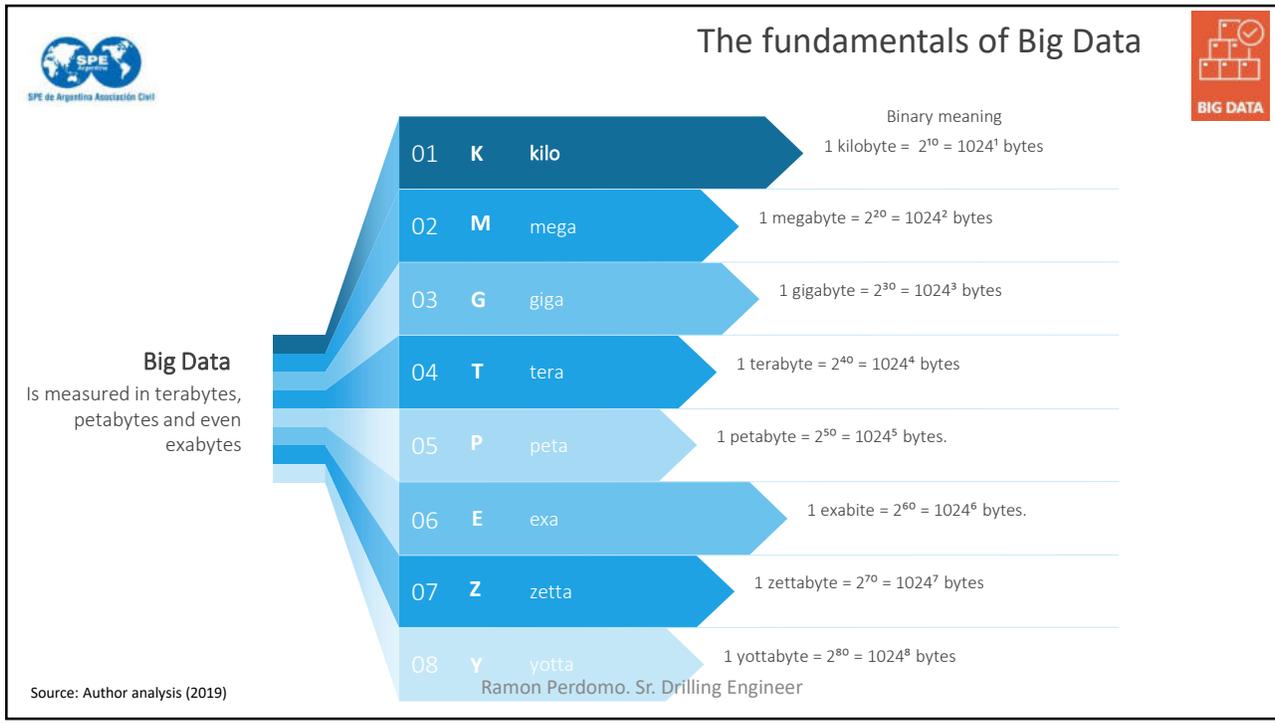
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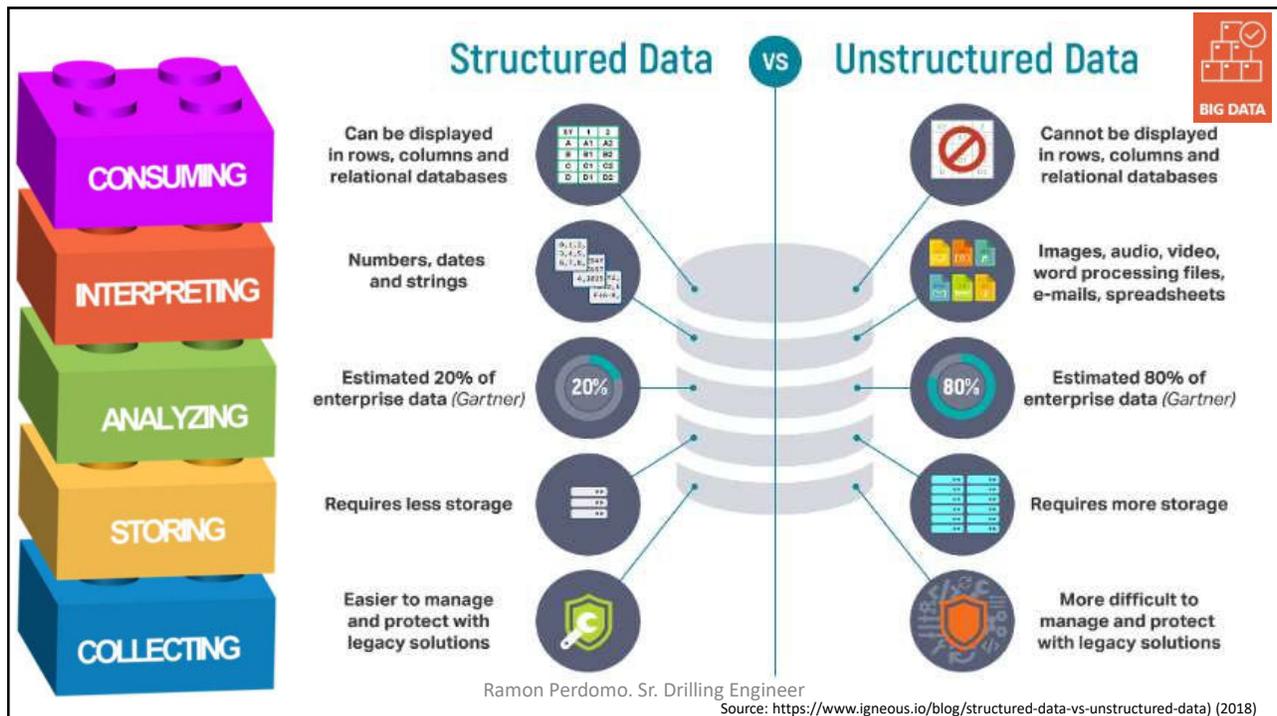
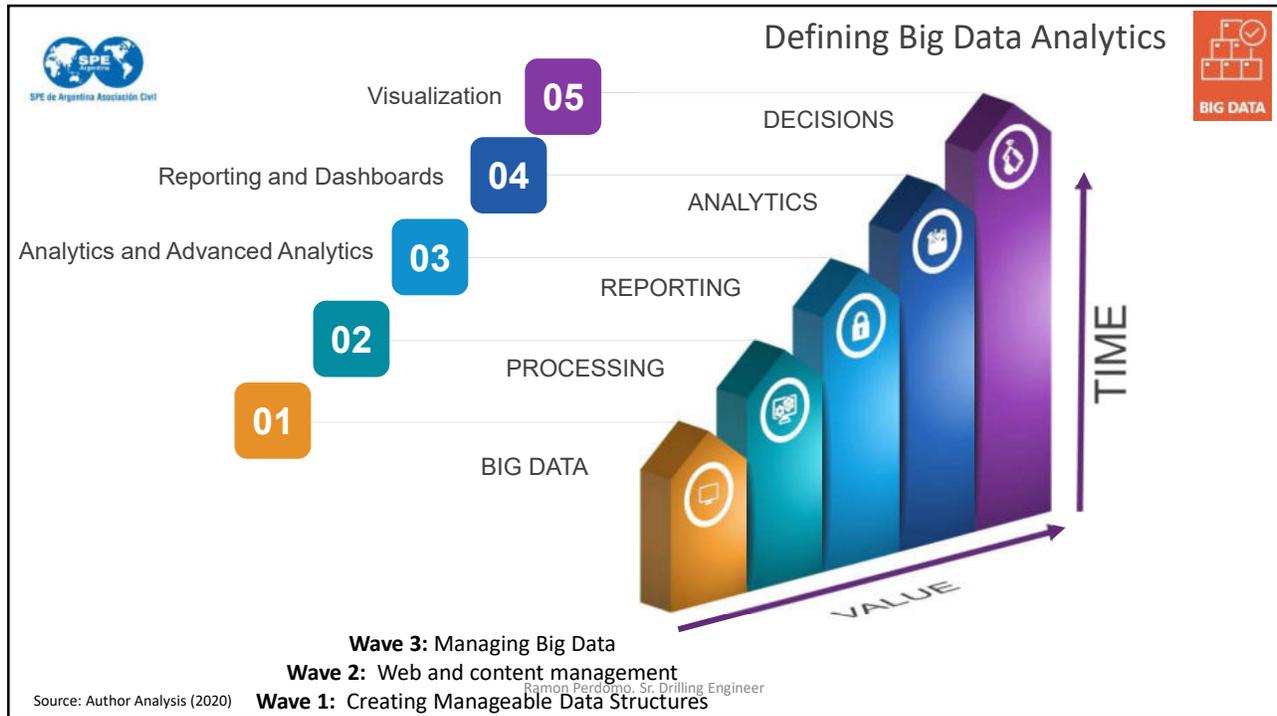
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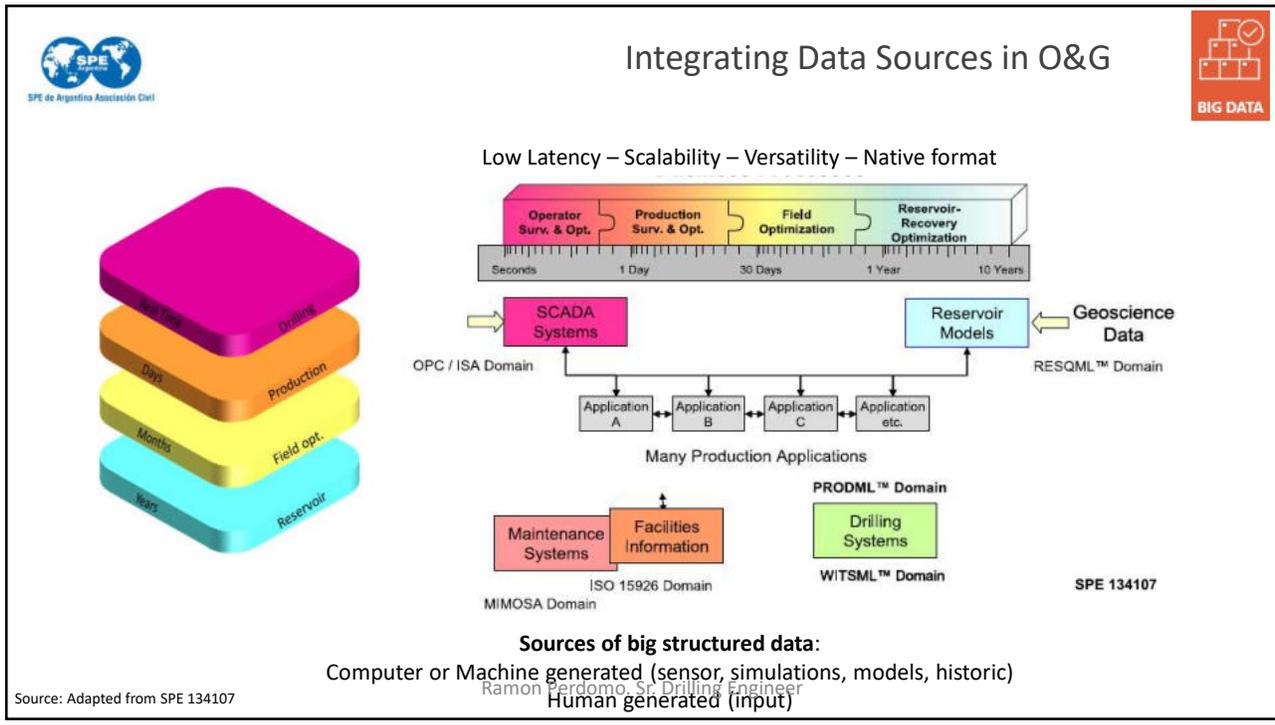
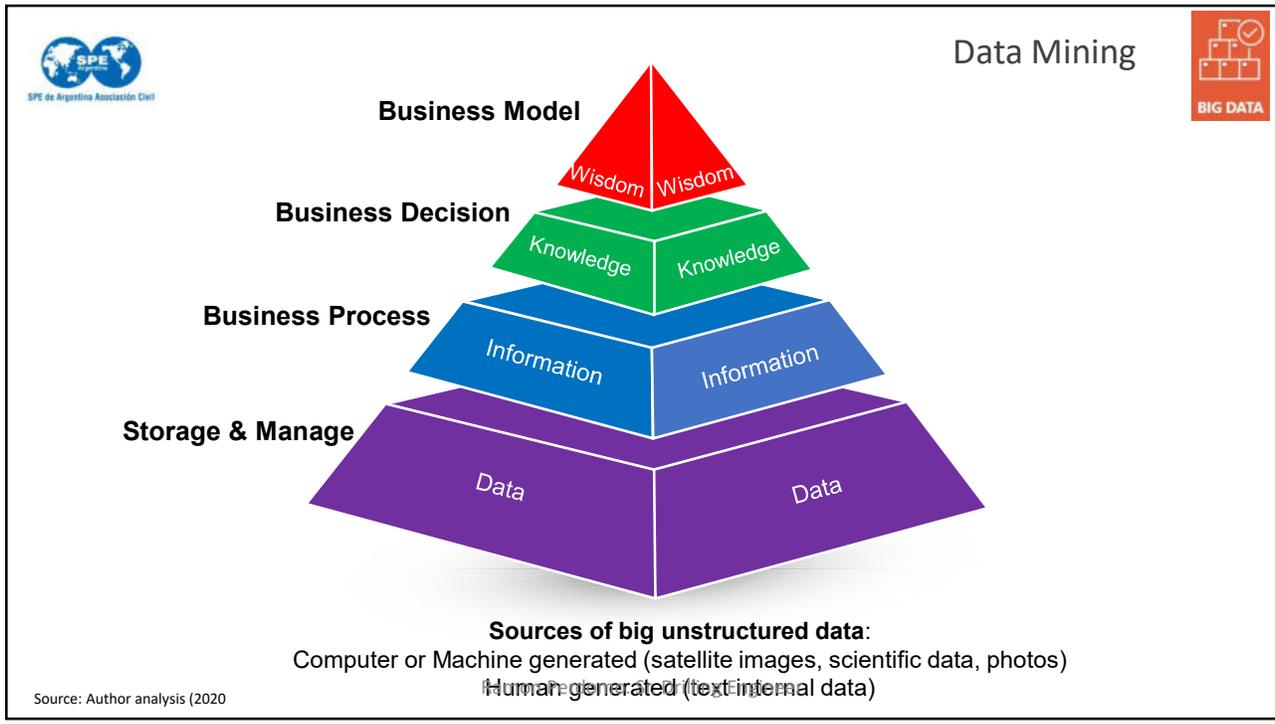


BIG DATA

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Security and governance for big data environments

STEP 1 DATA PROTECTION

- Data anonymization
- Tokenization
- Cloud database controls

STEP 2 DATA GOVERNANCE

- Visibility
- Unvetted employees
- Authorizations & protocols

STEP 3 AUDITING PROCESS

- Business process
- Engineering process
- Database
- Warehouse

Source: Author analysis (2020) Ramon Perdomo, Sr. Drilling Engineer

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ARTIFICIAL INTELLIGENCE (AI)

02

Refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions

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THE DRILLING NEWS

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THE ROLE OF MACHINE LEARNING IN DRILLING OPERATIONS

Machine Learning has the possibility to definitively improve various important decisions taken on a daily basis by managers and engineers. Nevertheless, the forthcoming benefits of the data are only attainable if the suitable tools are exploited to incorporate the various data types and forms, and transmute them in to valuable knowledge contributing to smart deductions. Several applications using AI and DDM can be implemented to mitigate different drilling problems and to assist in the development of **cost effective solutions**.

Several disciplines, especially drilling are resorting to the replacement of physics-based models with AI and data-driven modeling or its combination via a hybrid approach. Even though data-driven techniques are powerful in unravelling complex industry challenges, a number of design glitches have the capability of disqualifying ML models. For improved solutions, several critical factors should be taken into consideration when dealing big data. The factors include optimizing the number of layers for problems, the number of units required per layer, and the algorithm's learning capability along with the model constrains for successful implementation.

Traditional data preparation and analysis methods are not sufficiently capable of rapid information extraction and clear visualization of big complicated data sets. Due to the petroleum's industry unfulfilled demand, Machine Learning (ML) assisted industry workflow in the fields of drilling optimization and real time parameter analysis and mitigation is presented.



Society of Petroleum Engineers

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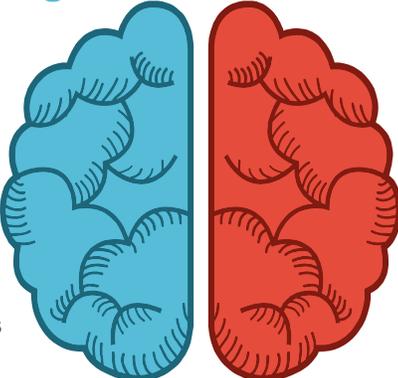


Artificial Intelligence



Discerning intelligence

- Learning
- Reasoning
- Understanding
- Grasping truths
- Seeing relationships
- Considering meanings
- Separating facts from beliefs

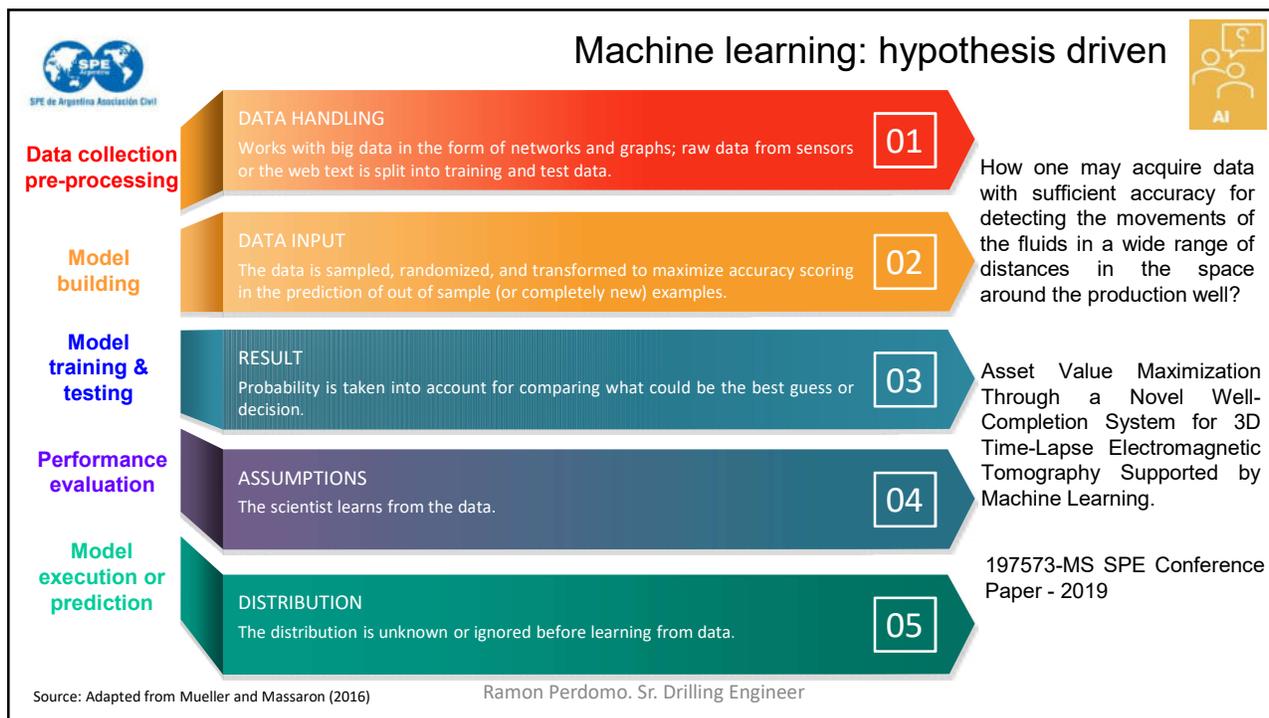
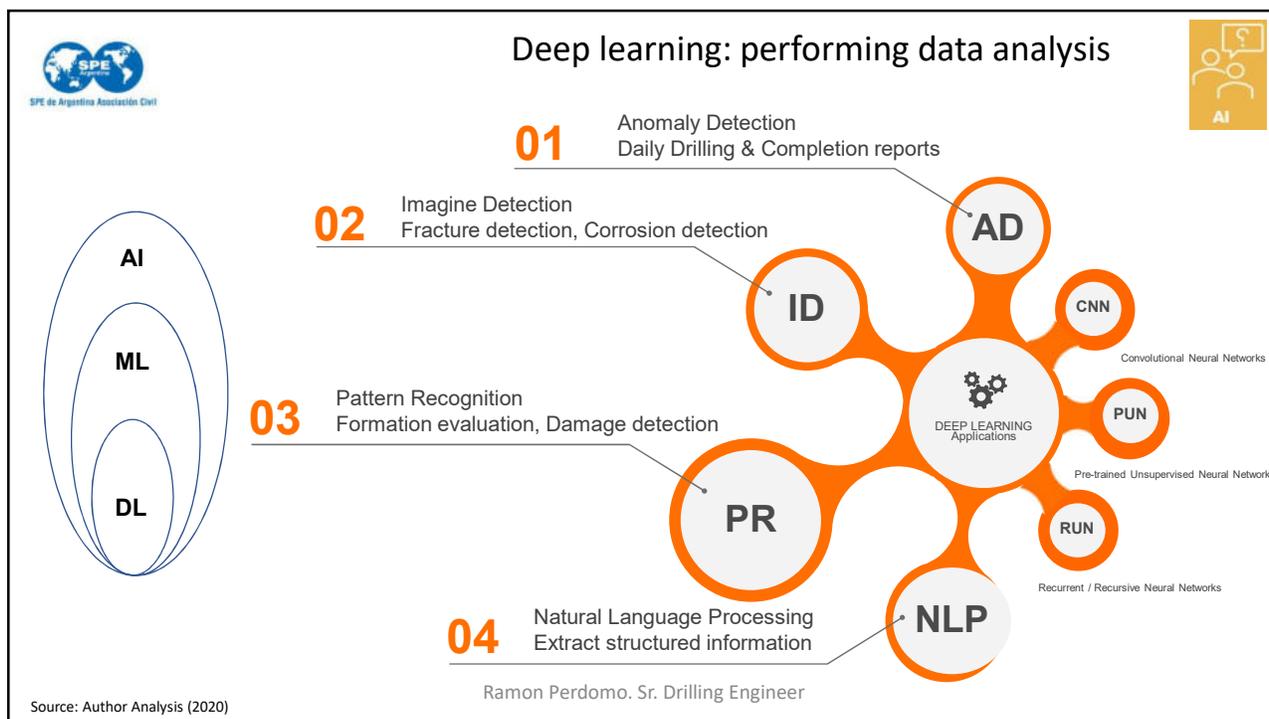


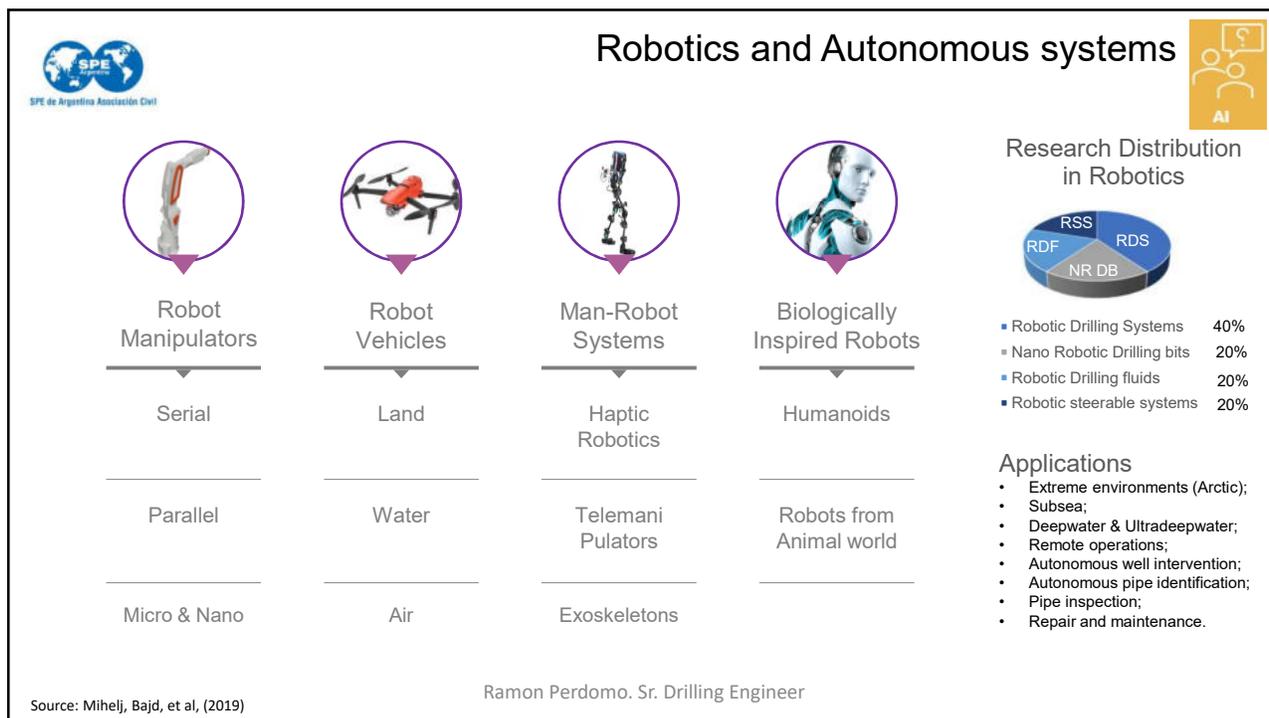
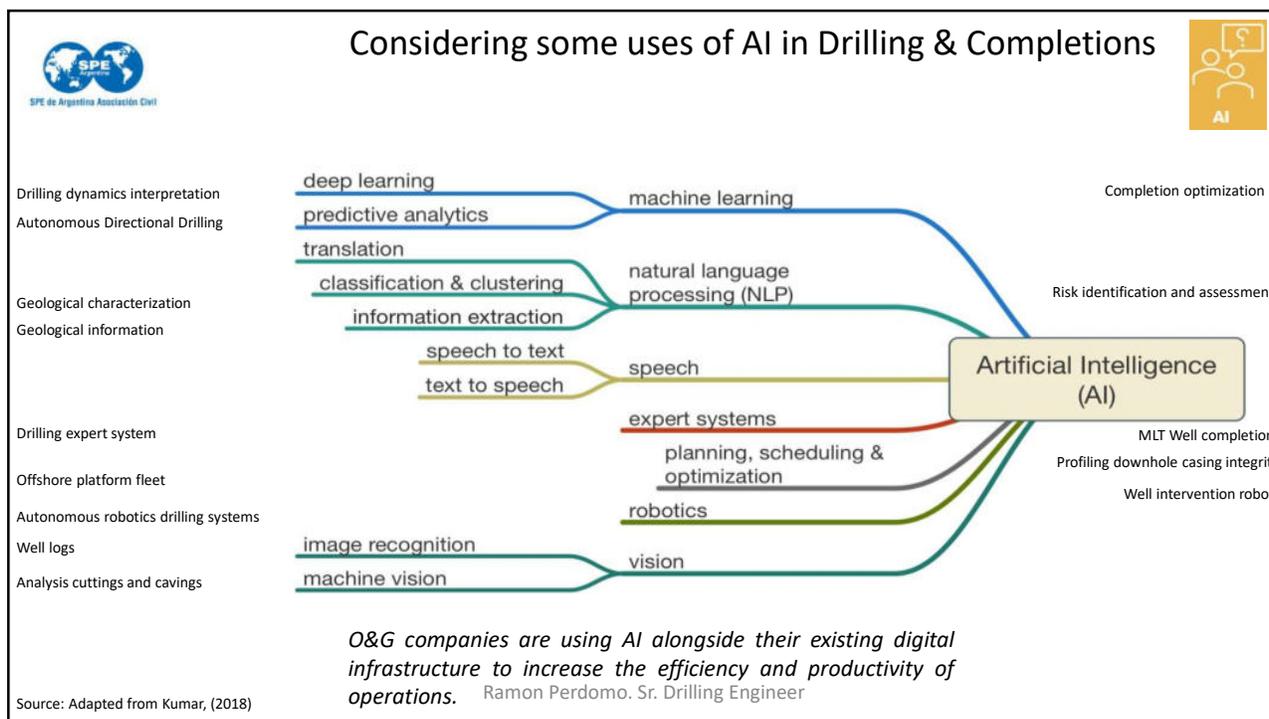
Human Computer

- Set a goal based on needs or wants
- Assess the value of any currently known information.
- Gather additional information.
- Manipulate the data such that it achieves a form consistent with existing information.
- Define the relationships and truth values between existing and new information.
- Determine whether the goal is achieved.
- Modify the goal in light of the new data and its effect on the probability of success.

Source: Adapted from Mueller and Massaron (2018)

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12.66%
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The future of AI in O&G





Morning

Disconnected environments

O&G has made fewer investments in incorporating AI and ML technologies in its processes.



Afternoon

Improving efficiency & productivity

O&G companies have started on the path of AI after witnessing how the technology has helped cut operational costs and enhance efficiencies across other industries.



Evening

Automation & Optimization

AI systems can automate and optimize the initial stages of the exploration and production lifecycle, including geology, drilling, and completions.

Source: Nair, (2020)

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DUPTS Drilling Uncertainty Prediction Technical Section



Members 1911

Regions 15

SPE ATCE 2020

Student Competition

SPE-DUPTS are collaborating with DSATS on the Drillbotics® competition.

DUPTS provide a multidisciplinary forum for technical exchange and skill development focused mainly on data science, artificial intelligence and machine learning solutions supporting drilling planning and execution challenges in a safe, fast and cost-effective manner.

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DUPTS Drilling Uncertainty Prediction Technical Section



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Monthly Webinars
Conducted by international experts

We take part in special events
SPE ATCE 2020
Workshops

Student Competition
SPE-DUPTS are collaborating with DSATS on the Drillbotics® competition.

- ✓ Clarifying existing challenges in drilling domain.
- ✓ Pointing education resources.
- ✓ Stimulating the community to share knowledge and collaborate in this area.
- ✓ Spread the awareness about AI, ML and data mining.

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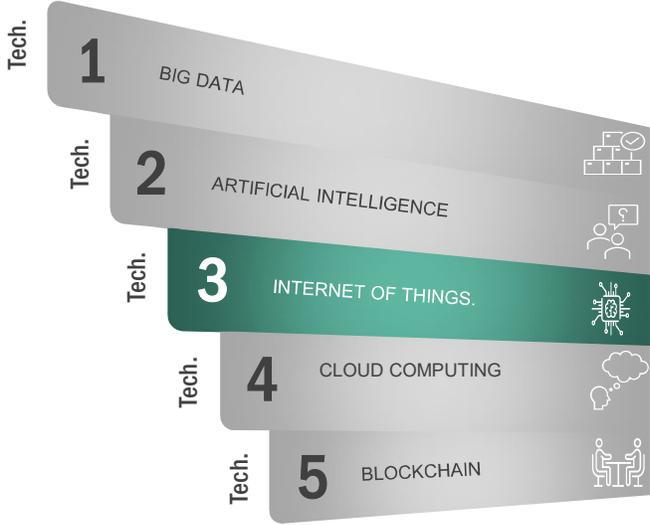
INTERNET OF THINGS (IIoT)

03



A system of interrelated computing devices, mechanical and digital machines provided with the ability to transfer data over a network without requiring h-t-h or h-t-c interaction.

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DIGITAL TWIN FOR WELL INTEGRITY WITH RT SURVEILLANCE

The Well Integrity Surveillance Model presents an important case of success, the pilot of production unit A, where pressure and temperature data are real time integrated with the structural model, as well as valve status analysis. The development computational tool offers high-frequency dashboards, alerts and advanced data analytics, being available through a friendly graphical interface, custom graphics and plug-ins. Pointed out as unique in the oil and gas industry.

With the Well Integrity Surveillance (WIS-LIVE), PETROBRAS successfully implemented a monitoring pilot project on three offshore production units in Brazil, increasing the knowledge of the well structural behavior and consequently the assets operational safety, during its lifetime. The integration of a design software with the production data system provided a novel approach for integrity monitoring in the industry, allowing minimal safety factors evaluation during critical operations, tracking the number of functional cycles in completion valves and identifying well abnormalities, all of this in real time.

PETROBRAS Well Integrity Surveillance Model aims to contribute to the integrity of operational assets, by supporting fast and correct decision making in real time, resulting in a reduction risk, maintenance savings and increased well productivity.



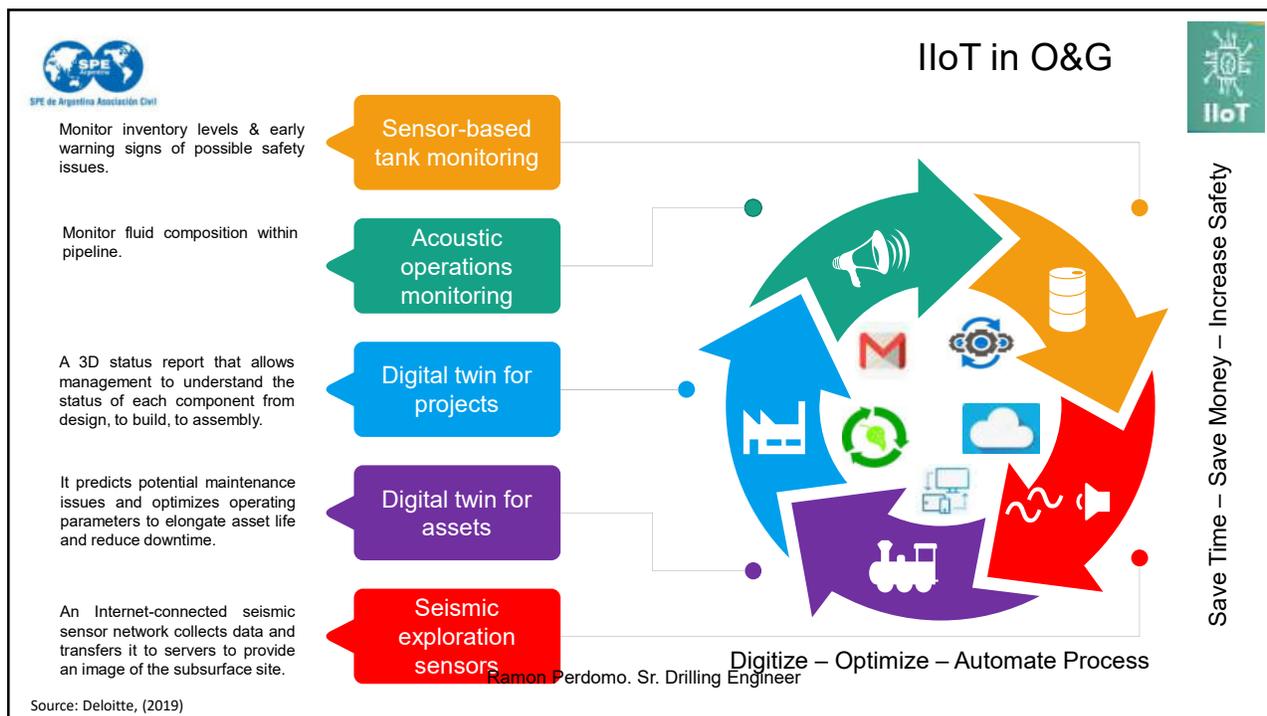
Jorel Lopes Anjos, Pedro Esteves Aranha, André Leibeohn Martins, Felipe Lima Oliveira, Clemente José Gonçalves, Douglas Ribeiro Silva, Cesar Luis Dudek, and Claudio Benevenuto Lima, Petróleo Brasileiro S.A.

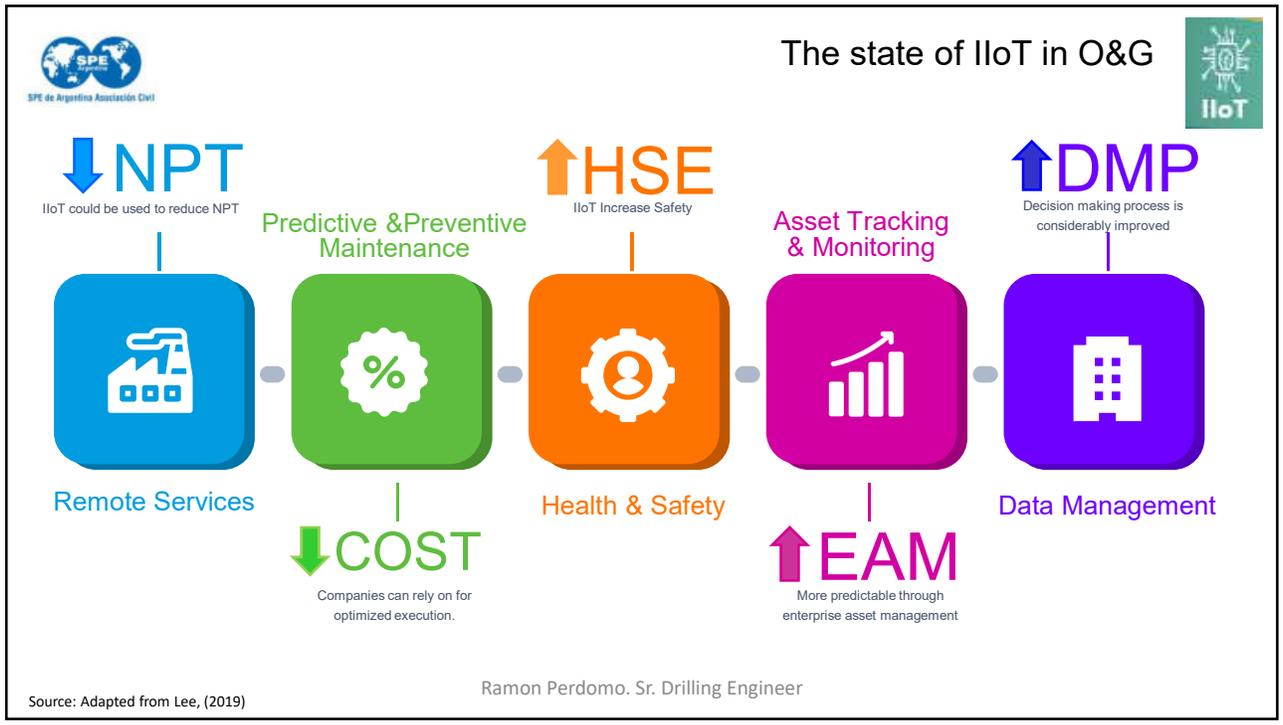
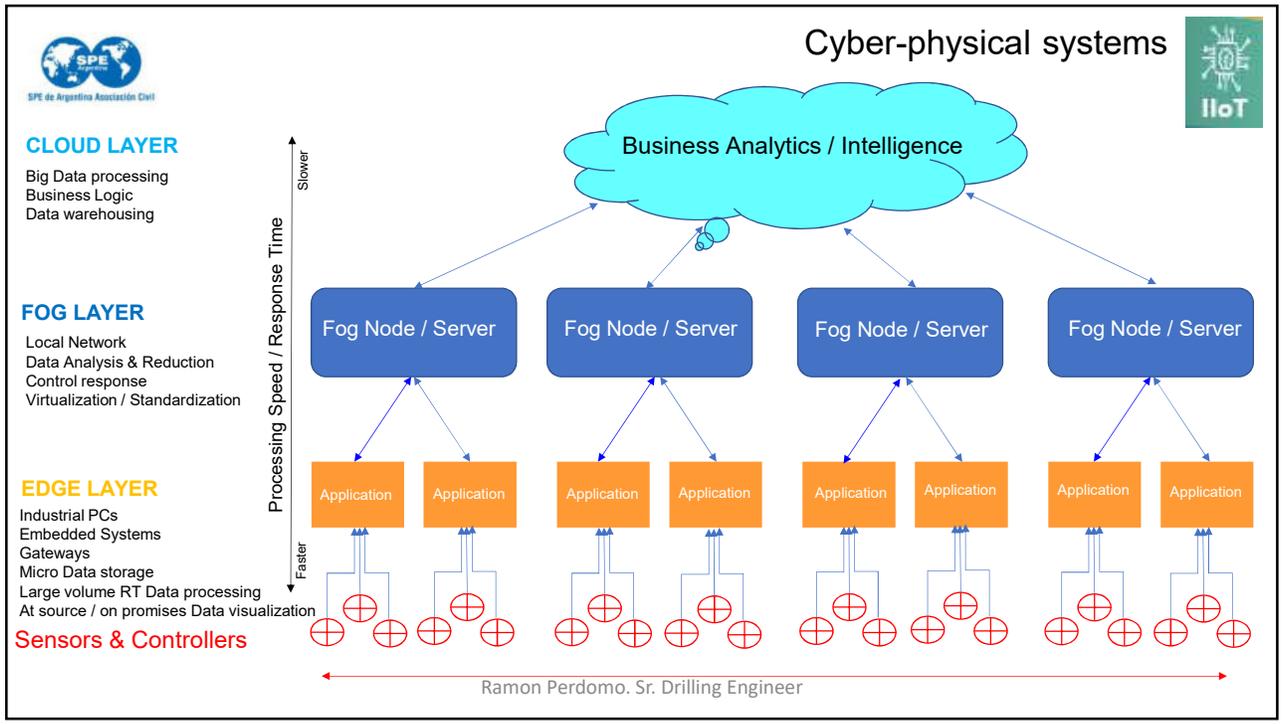
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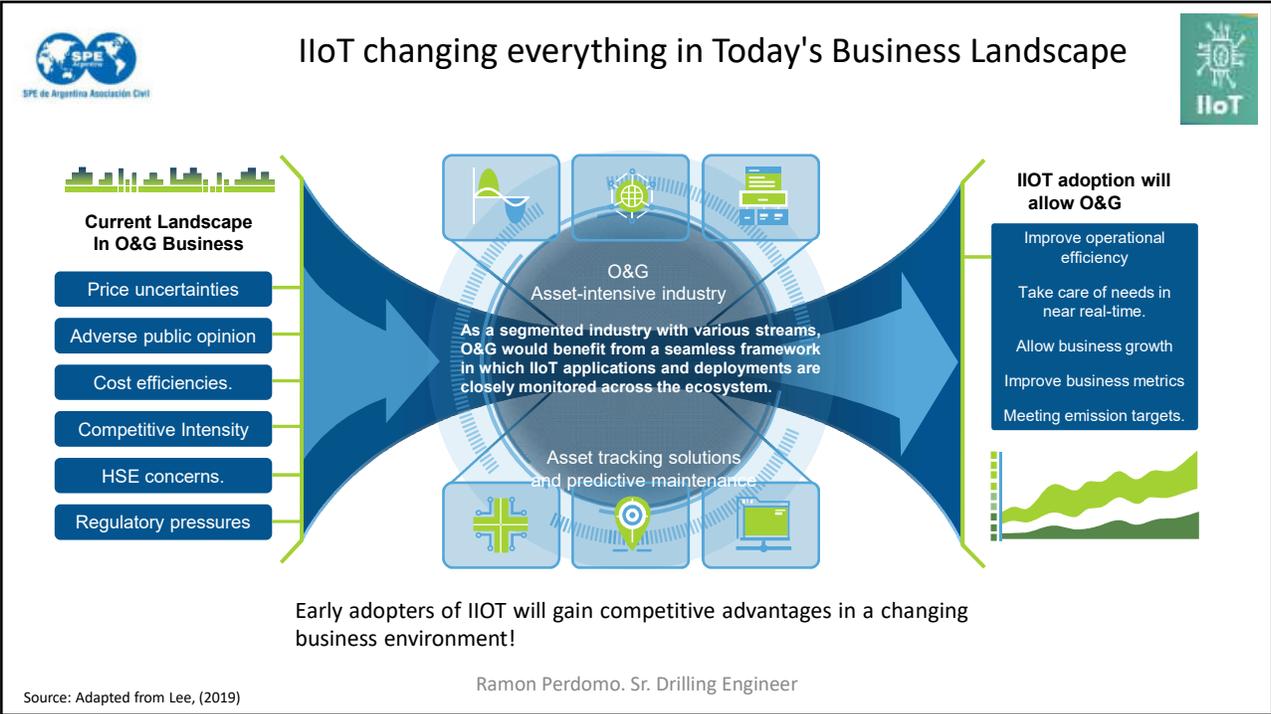
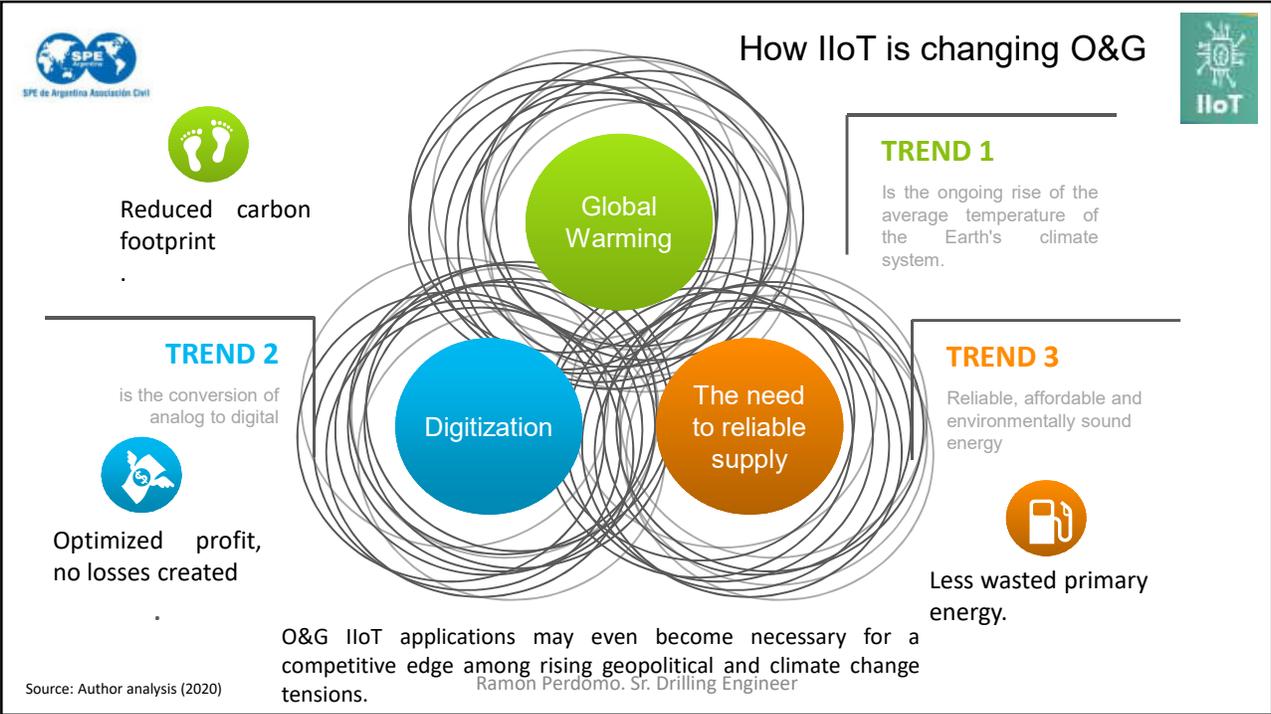
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What is a digital twin and why it's important to IIoT

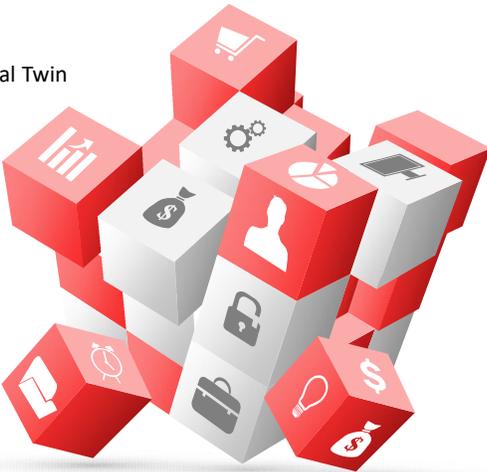




The Golden Circle of Digital Twin

WHAT
A digital twin is a digital representation of a physical object or system.

HOW
A computer program takes real-world data about a physical object or system as inputs and produces as outputs predications or simulations of how that physical object or system will be affected by those inputs.



Digital Twin = IIoT + AI + Data Analytics

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WHY
The twin is constructed so that it can receive input from sensors gathering data from a real-world counterpart. This allows the twin to simulate the physical object in real time, in the process offering insights into performance and potential problems.

The more that a digital twin can duplicate the physical object, the more likely that efficiencies and other benefits can be found

Source: Adapted from Shaw and Fruhlinger, (2019)

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Thank You!




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#WeAreSPE

Senior Drilling Engineer, over 14 years of oil and gas upstream sector experience. PhD student at Ukhta State Technical University, his research focuses on how use concrete down-hole data collected and the use of analytical workflows/process to achieving drilling performance. He is paying close attention to the journey to digital transformation in the Oil and Gas industry.



Ukhta State Technical University (VITYU)
Oil and Gas Faculty
Oil and Gas Drilling Department
25.00.15 Drilling and Well Completion Technology

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