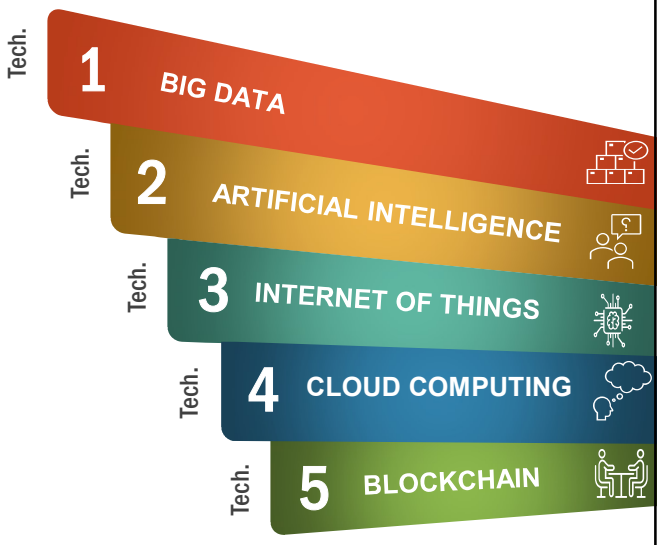
5 Core digital transformation technologies

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



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CLOUD COMPUTING

04

The on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user.

Tech. 1 BIG DATA

Tech. 2 ARTIFICIAL INTELLIGENCE

Tech. 3 INTERNET OF THINGS

Tech. 4 CLOUD COMPUTING

Tech. 5 BLOCKCHAIN

THE DRILLING NEWS

www.drillingnews.com THE DRILLER'S FAVOURITE NEWSPAPER - Since 2019

Development and Field Trial of the World's 1st Cloud Connected Wireless Intelligent Completion System

The benefits of wireless intelligent completions that can be deployed as simply as a conventional completion and can be readily demonstrated as a more cost-effective solution plus one that can expand the application range of traditional intelligent completions.

Using a low-complexity pressure pulse telemetry minimizes the hardware requirements and minimizes system interface challenges

While the development of wireless Intelligent Completion is still at an early stage in comparison to traditional hydraulic technology, significant milestones have been achieved in its progress which have culminated in the deployment of the world´s first wireless cloud-connected Intelligent Completion, Having successfully demonstrated the viability and flexibility of the technology, the future of wireless Intelligent Completions holds great potential in improving reservoir management as an integrated part of the digital oilfield solution

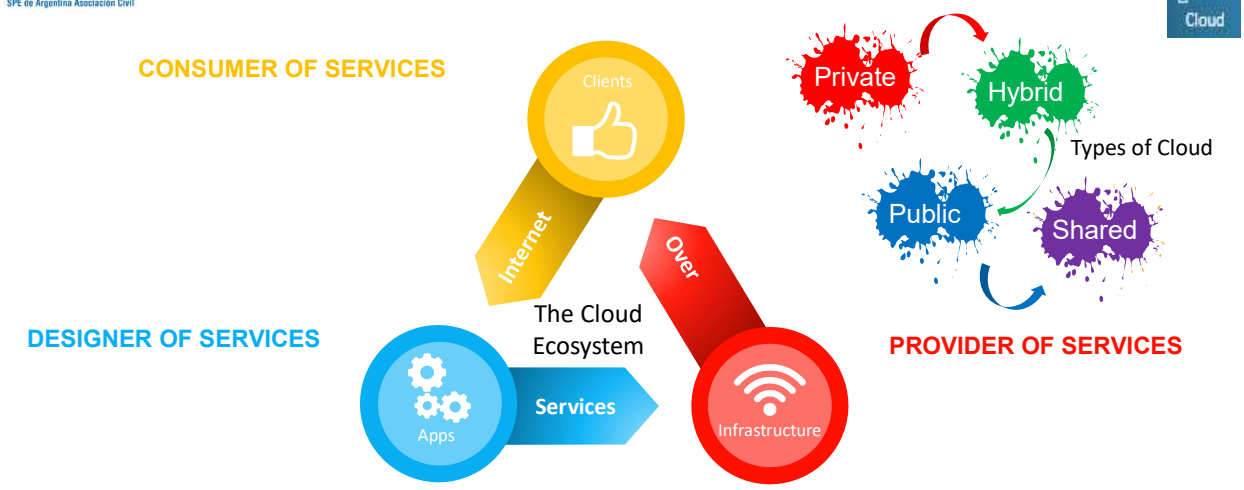
The oil industry is driven to increase the production of hydrocarbons from all production wells, as well to extend the life time of the production well. By using intelligent completions, it is possible to have production optimization and improved reservoir management. The application and value of this technology has been well documented since it´s first deployment in 1997.

Society of Petroleum Engineers

SPE-192940-MS

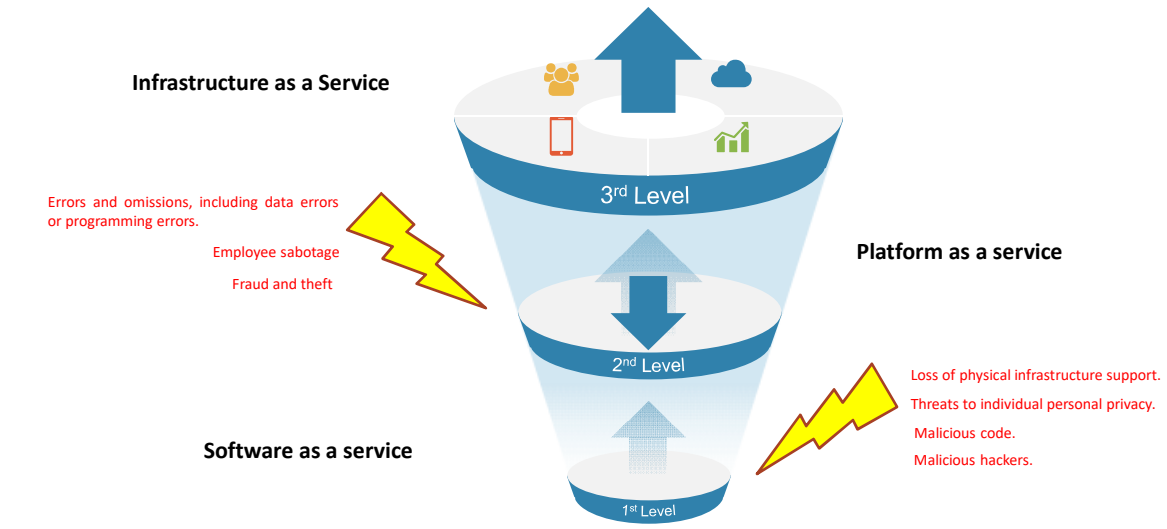
Cloud

Understanding Cloud Concepts



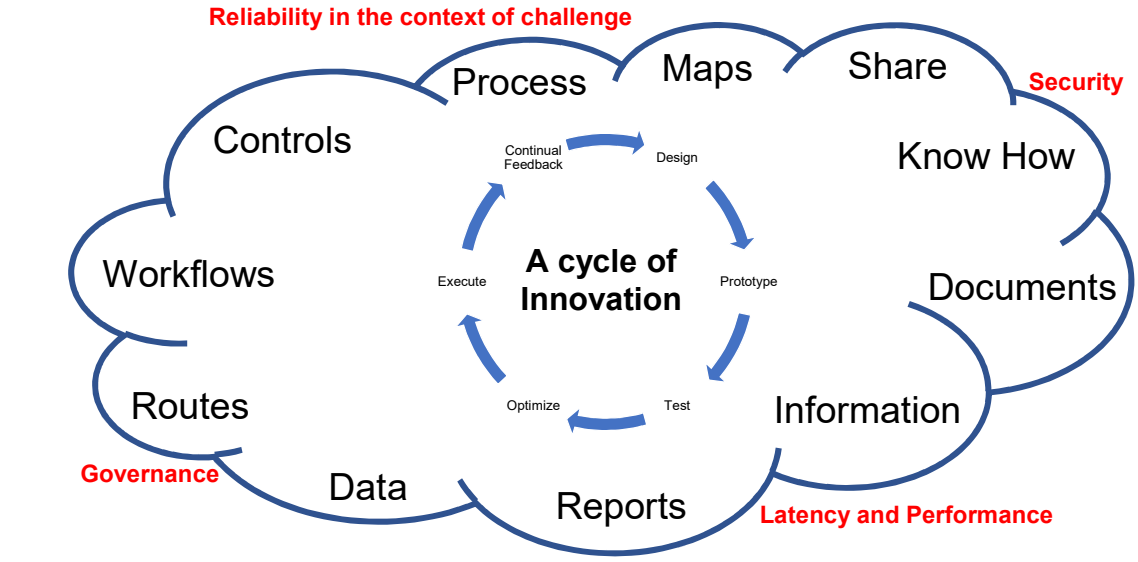
Source: Adapted from Kirsch and Hurwitz, (2020)

IaaS, PaaS, SaaS



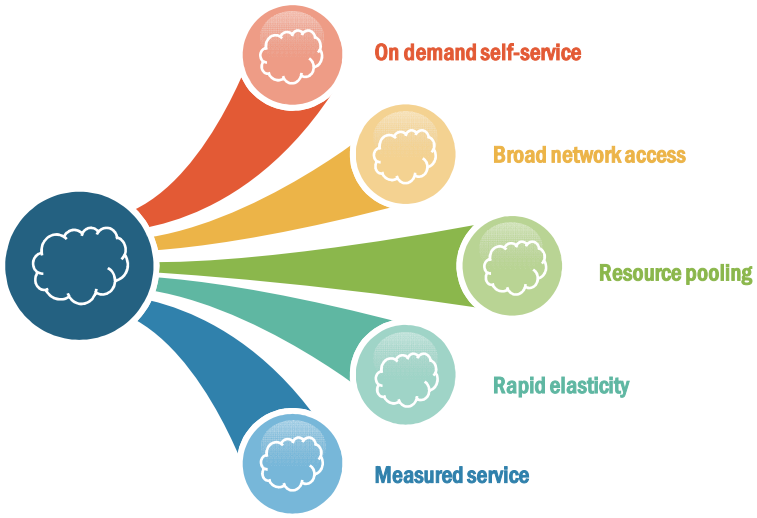
Source: Adapted from Golden, (2013)

Managing Data Storage in the cloud



Source: Adapted from Kirsch and Hurwitz, (2020)

Cloud Models



Source: Adapted from Golden, (2013)

Cloud Strategies – Integration scenarios

On-premises data center to cloud

Connectivity from the data center to the cloud is one of the fundamental tools used to build cloud integrations.

Connectivity in clouds

Companies may need to create multidirectional integration with multiple SaaS applications in order to support a business or engineering process.

Connectivity between (or among) clouds

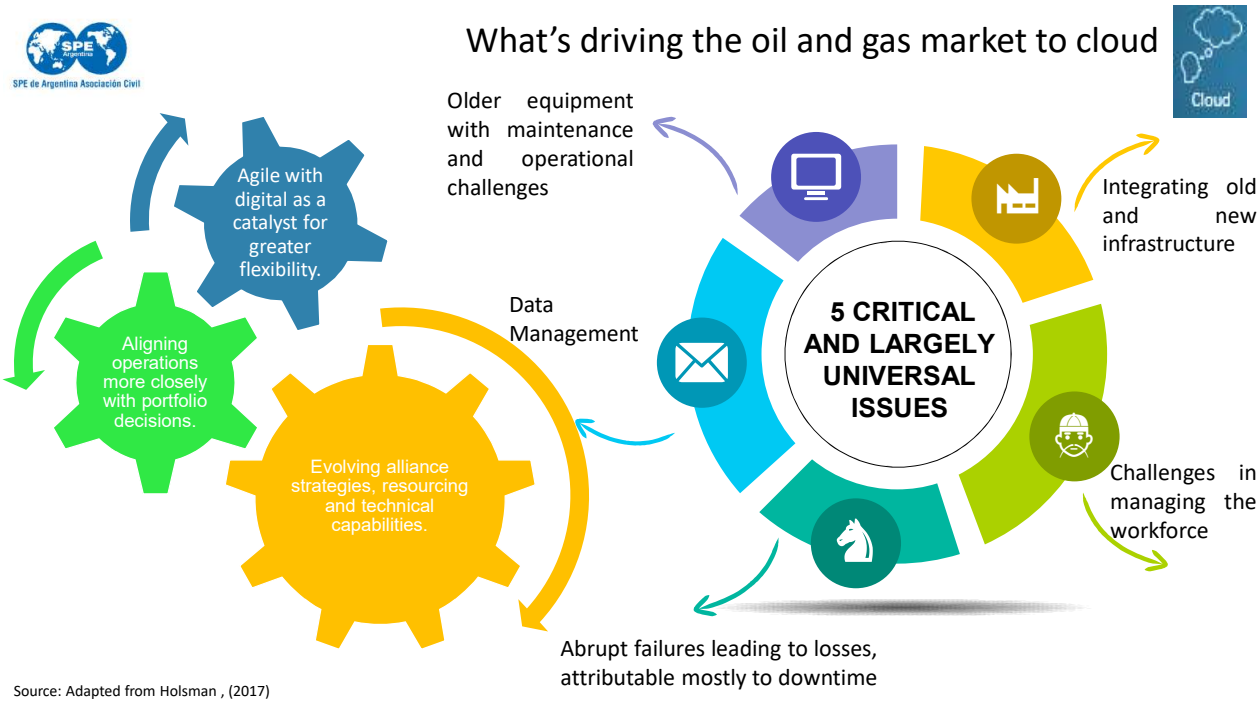
Companies may need to integrate a private cloud and multiple public clouds. One common example of this occurs when a business uses several public clouds across divisions.

Keep an eye on security

When considering cloud strategy, make sure you understand you will lose control over how many things are done. Use an integration method to monitor these connections and standards are met.

Source: Adapted from Kirsch and Hurwitz, (2020)

What's driving the oil and gas market to cloud



Source: Adapted from Holsman , (2017)

5 Core digital transformation technologies

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BLOCKCHAIN

05

A time-stamped series of immutable records of data that is managed by a cluster of computers not owned by any single entity

Tech. 1 BIG DATA

Tech. 2 ARTIFICIAL INTELLIGENCE

Tech. 3 INTERNET OF THINGS

Tech. 4 CLOUD COMPUTING.

Tech. 5 BLOCKCHAIN

THE DRILLING NEWS

www.drillingnews.com THE DRILLER'S FAVOURITE NEWSPAPER - Since 2019

Unlocking Oilfield Development using Blockchain

Blockchain is a fast-evolving technology that decentralizes, accelerates, connects and elevates trust. Its implementation for small transaction in a global scale market remains a technical challenge, which can be met by using wellhead contracts to address transaction volume limitations today. As society moves toward greener efforts and carbon capture gathers more attention, abuse potential exits if operators are relied upon to log their own carbon credit generation.

Blockchain technology provides a platform to keep all data linked. The data is smoothly shared among different groups like exploration, drilling, completion and production. Over time, some data might be lost of which the inheriting company might not be aware. If all the data is loaded onto the Blockchain, it becomes easy to track.

When we deal with surface analysis in offset well analysis, the data of all wells in a field (or a nearby field) readily become available on a Blockchain database to assist in better decisions-making. The data generated are stored in Blockchain and can act as historical data in the future to better train models and assist in making informed decisions in both green and brown fields, as in subsurface analysis.

The automated nature of Blockchain allows a pollution monitoring and control system to purchase best-priced (verified) CDR credits in real time, validating the purchase on the Blockchain. In practice, the market will clear the cheapest credit first – leading to economically-efficient CDR. The validation component of the Voluntary Carbon Offset (VCO) market by providing both an automated mechanism for price formation and discovery, and some implicit expectation of reliable contractual performance.

Society of Petroleum Engineers

SPE-199170-MS

This paper was prepared for presentation at the SPE Latin American and Caribbean Petroleum Engineering Conference originally scheduled to be held in Bogota, Colombia, 17 – 19 March 2020. Due to COVID-19 the physical event was postponed until 27 – 31 July 2020 and was changed to a virtual event. The official proceedings were published online on 20 July 2020.

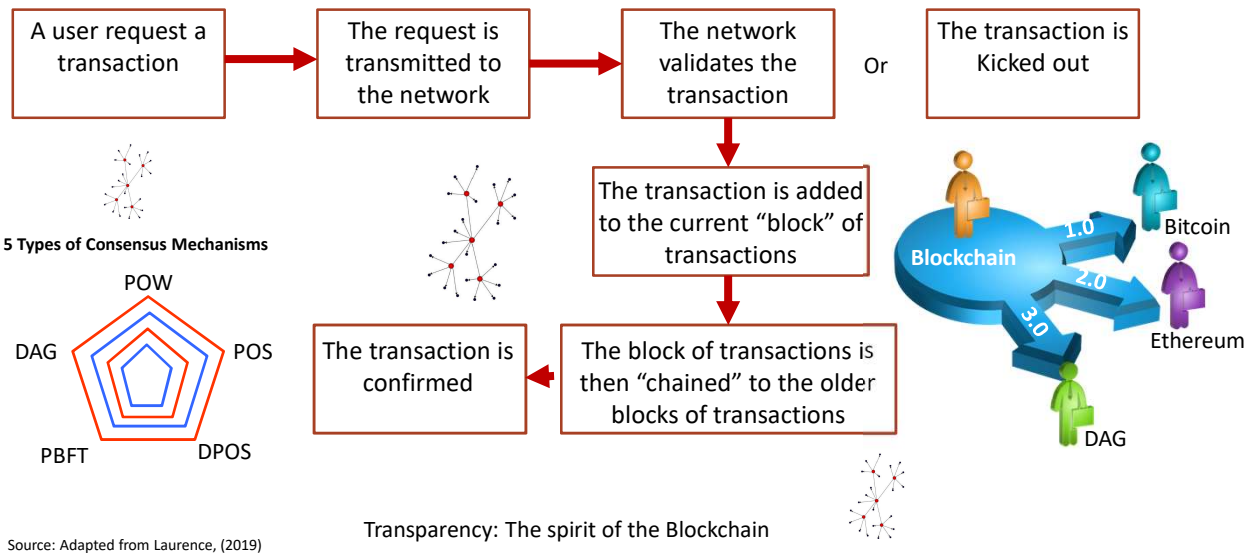
Introduction to Blockchain

Feature	Traditional Database	Blockchain
Location	One central database copy	Each node stores a complete copy of the Blockchain
Operations Supported	Crete, Read, Update, Delete (CRUD)	Read, Write
Performance	Optimized for short response time and high-throughput	Not optimized for performance
Integrity	Dependent on DBMS and application	Consensus and immutability provide integrity
Transparency	As allowed by central DBMS	Each node stores a complete copy of the Blockchain
Control	Centralized	Decentralized

Distributed Ledger Technology (DLT) supporting P2P trading
Consensus is required to commit transactions in blocks

Source: From Solomon, (2019)

Consensus: The driving force of Blockchains



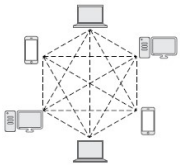
Transparency: The spirit of the Blockchain

Source: Adapted from Laurence, (2019)

Why use Blockchain technology

Public Blockchain

- Permissionless;
- All nodes can freely access the Blockchain without restriction;
- The Blockchain is shared and available to all.



Private Blockchain

- Permissioned;
- Only nodes authorized by the owner can freely access the Blockchain;
- Data is shared and available only to authorized users.

Source: Adapted from Solomon, (2019)

Blockchain as a solution for

Each Blockchain node runs as a completely independent computing device and doesn't support launching remote processes on other nodes.

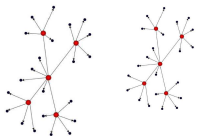
Remote processes don't communicate in Blockchain technology because there are no remote processes.

A Blockchain is an ever-growing chain of blocks, with the blocks linked into a chain structure. New blocks can be added only if a majority of the nodes agree to each addition.

Blockchain define how peers — nodes that operate at the same authority — work together.

Effectively Using Blockchains

- Transferring value without trust.
- Reducing transaction costs by eliminating middlemen.
- Increasing efficiency through direct interaction.
- Maintaining complete transaction history.
- Increasing resilience through replication.
- Providing transparency.

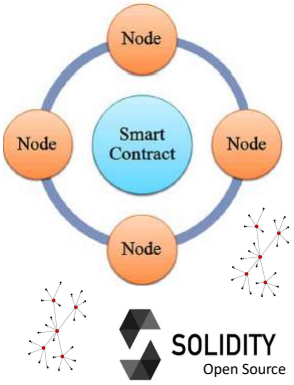


Ethereum and Smart Contracts

Traditional Market

- **The buyer** creates a transaction that sends money to the seller in exchange for the asset.
- **The buyer** sends **the seller's** address as input to the smart contract's address.
- **The smart contract** runs to carry out the transaction. It verifies that you have Gas (funds) in your account to pay for the asset.
- **The smart contract** verifies that the seller has the asset you want in stock.
- **The smart contract** deducts Gas (funds from the buyer), sends the funds to the seller, and tells the seller to send the asset to the buyer. In the same step, the smart contract sends the required tax to the tax authority account and sends the remaining amount to the seller's account.

Smart contract based Distributed Markets



Source: Adapted from Solomon, (2019)

Reverse securitization

Better valuation and price discovery

The transparency could reduce the information asymmetry and network disadvantages that some entities, especially smaller ones

A complete, immutable, and traceable audit trail.

Blockchain can create a chronological and immutable audit trail of all transactions.

One version of the truth

Blockchain enables a single, consistent source of information for all participants in the network.

Speed and certainty

With disintermediation and simultaneous recording of information across the system, can virtually eliminate time lags in information and payment flows throughout the securitization process.

Blockchain's capacity to increase the security of transactions and data, and mitigate fraud could be appealing to the securitization industry, where integrity of data is paramount.

Security

Source: Adapted from Deloitte, (2017)

ICO´s

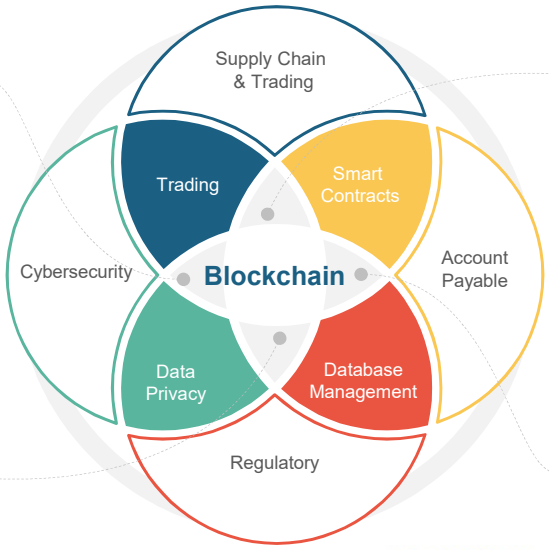
Characteristic	IEO	ICO	STO
Token Sale	The exchanges are selling the tokens once listed.	The issuer is responsible for the sale.	Security token issuer taker care of the fundraising process.
Marketing & Advertising	Exchanges do all the marketing and advertising.	Project teams take care of all the advertising and marketing.	The team behind the project does the marketing and advertising.
Transactions	Investors transact directly with the token issuer.	The issuer is responsible for the sale.	Takes place on the issuer website.
Trust	No trust issues; exchanges ensure due diligence before listing a token.	There are trust issues due to some token issuers providing misleading information.	High trust levels since the tokens have intrinsic value / they represent real assets.
Security	Highly secure since all transactions happen within the exchange website.	Highly insecure as transactions happen on ICO project website which could lack proper security measures.	Highly secure since the token falls under regulations like under the SEC In the US.
Fees	Exchanges charge issuers commission.	No fees.	No fees.
Regulation	Unregulated.	Unregulated.	Regulated.

Source: From Goyal, (2019)

Blockchain in O&G

Technologically The O&G industry has been very innovative

The administrative and managerial functions are still done in a somewhat traditional way



The Blockchain technology can help the industry become more efficient by streamlining these traditional methodologies

The industry currently has little or no knowledge about Blockchain technology and hence

SPE-191750-MS

Source: From Lakhanpal and Samuel, (2018)

Key challenges in O&G

- Increase exploration success rate
- Reduce exploration, project and construction times
- Faster and lower-cost supply and logistics

- Increase & sustain operational efficiency
- Decrease operational downtime
- Faster and top-quality engineering designs

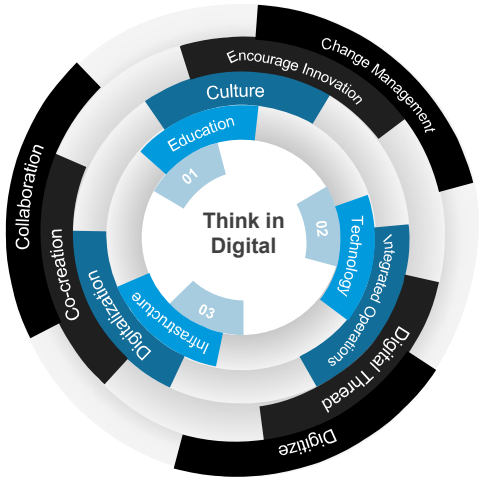
- Improve HSE performance
- Increase assets security (cybersecurity)

- Improve internal sectors cross-discipline integration
- Improve external supply & delivery integration
- Decrease vendor technology dependency

- More accurate & agile decision taking
- Improve leadership & workforce training
- More efficient business change model for fast repositioning
- Balance between operations and innovation

Source: Author analysis (2020)

Digital Transformation Pillars



01 Digital Culture

Is a blanket concept that describes the idea that technology and the Internet significantly shape the way we interact, behave, think, and communicate as human beings in a societal setting.

02 Digital for productivity

Digital transformation represents an opportunity for improving productivity growth by enabling innovation and reducing the costs of a range of business processes

03 Digital for stakeholders

Organizations today must find a way to create emotional connections with their users on their mobile devices, let their stakeholders provide feedback, and respond to those issues.

Source: Author analysis (2020)

DUPTS Drilling Uncertainty Prediction Technical Section

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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Student Competition

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

DUPTS Drilling Uncertainty Prediction Technical Section

- ✓ 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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Thank You!

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#WeAreSPE

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

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.