Automated Engineering System Project

Digital Transformation for The Midstream Oil & Gas Industry

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Introduction:

With the world developing oil and gas companies are facing a challenge of the need to evolve and work more efficiently, while also maintaining safety and sustainability. In order to achieve growth, increase assets, accelerated production with higher efficiency and reduced downtime many companies are using digital transformation. Digital transformation in oil and gas companies is the use of digital technologies to change and reshape the operating system, which will help improve productivity and efficiency at a lower cost.

In addition to that, the oil and gas sectors transformation to informational technology methods is discussed and how the artificial intelligence has increased in growth of the digitalization, how cyber-attacks and its patterns of attacks on network has been discusses. When the industrial sector is converting to digital form the major threat on these industrial sectors is the malware attacks.

Midstream Oil And Gas:

The midstream oil and gas companies are those who operate on the second major stage of the oil and gas industry. The midstream companies operate after the upstream operation and before the downstream operation. The midstream operation is the transportation and storage, in which pipelines are used to transfer the product from production sites to refineries and deliver to the downstream companies.

Digital Transformation In The Midstream Oil And Gas Industry:

The Oil & Gas Industrial Sector is known for its large-scale economies all around the world. When compared with past few decades Oil & Gas sector are transforming from influential to digitalization because of the growth in digital sector. According to George Stergiopoulos, Dimitris A. Gritzalis, & Evangelos Limnaios. (2020) Over the past two decades all over the

world oil and gas operational has updated their large-scale industries into the information technology systems that has increased in cyber attacks on newly interconnected systems.

Digital transformation in the midstream oil and gas industry is the growth and efficiency of the company using digital technology with consideration of sustainability. The growth of production in the midstream industry has resulted in constraints of moving the oil and gas to the downstream companies. The midstream industry lacks investment in the use of technology, and there are many risk factors in demands and supply that the industry is facing.

The midstream oil and gas sectors are facing many struggles, like overproduction with the change of supply and demand, high operating costs with pricing fluctuations, environmental pressures and decline in skilled workforce. Digital transformation is now important for the performance of the midstream oil and gas industry. It is known that the digital usage in the midstream industry is very low in comparison with other sectors of the industry.

The midstream sector has not fully transferred to digital use yet and competition in the sector is getting higher. It is a challenge to get profit in times the world itself is changing. The use of technology must be embraced in order to keep up with the world's needs and to gain advantages from it's use. Because of these struggles, many midstream oil and gas companies are transferring, these efforts of digital transformation can help with real-time insights and operational intelligence which help with efficiency. Furthermore, the company will be able to make more precise data-driven decisions based on digital studies and performance, they will also be able to cut costs with condition-based maintenance, commercial accounting, lost and unaccounted system inventory while also being environmentally aware and sustainable.

How The Midstream Oil And Gas Companies Can Digitally Transform:

Midstream companies need to maximize the use of technology to gather precise data and to gain profits from this shift. A few ways to start the digital transformation journey are:

- Retool the organization with digital capabilities.

  Many midstream companies still use their past systems for supply and demand. Accenture case study states that "82% of players are not ready to let go of traditional tools just yet.". Many companies have yet to change their legacy systems even while knowing using digital and technology solutions are better in showing cost models, organizational structure and streamlining processes. Also, according to a report published from World Economic Forum in "Digital Transformation of Industries" the switch to digitally transform for midstream oil and gas companies has the potential to approximately generate $100 billion of value. So, the use of digital tools like software applications can drastically improve the company's efficiency, save on costs, and help better assist them with supply and demand data.

- Develop a more agile approach.

  Many studies state that an agile approach is a great approach for a business digital transformation, and that can be applied to midstream oil and gas companies. The agile approach helps companies adapt to new technology. To maximize the use of digital transformation in the midstream industry, the company must:

  - Start small:

    Start by improving one department at a time to see if the approach is working.

  - Rethink processes:

    Rethink of the goals and how to achieve them with the new technology.

  - Make changes stick:

When a change is made, make sure that practice is given and an environment that encourages questions to learn the new approach.

- Leverage better data management.

  The midstream industry has been collecting data for years about their operation and process but according to a report from Oil & Gas Journal, only 2%-10% of the data has been analyzed. Instead of storing the data, midstream companies can use the data collected for precise data-driven decision making.

Digital Transformation Efforts Failed At First In The Midstream Oil And Gas Industry For The Following Reasons:

- They started off as technology projects.
- They were implemented as technology roadmaps and long-term goals.
- There was insufficient culture change management.
- There was either insufficient or too much innovation.
- There was insufficient integration of people, work process, strategy, and technology.

Digital Transformation In Midstream Oil And Gas Industry Succeeded For The Following Reasons:

- They started as work transformation projects
- They were implemented as holistic combinations of people, work process, strategy, and technology
- Senior management actively and constantly sponsors the “new way of working”
- They applied best-practice methods for culture change
- They developed methods to maximize end-user adoption

A Digital Tool For Success In The Midstream Industry – Digital twin:

In the oil and gas industry, many companies undergoing digital transformation are adopting digital twins i.e., virtual representations of a physical product, process, or facility. Until recently, digital twins have mainly been used in individual lifecycle stages, limiting their effectiveness. Because oil and gas equipment and systems generate massive data volumes throughout their entire lifecycles, adding predictive capabilities to a digital twin can dramatically increase its insights.

What is a digital twin?

- It is based on engineering and operational data from a physical asset or system.
- More the data, more insights, and benefits it provides.
- It is the Virtual representation of a physical product, process, or facility.
- It is not being used to its full potential in the midstream Oil and gas industry.
- Oil and gas generate mass volumes of data which can be used to add predictive capabilities and increase the insights of the entire process.
- This digital representation can be further used to create simulations to accurately predict real world behaviors of equipment's or systems where data is missing.
- Example - heat exchangers - High fidelity finite element analysis (FEA) and computational fluid dynamics (CFD) forecasting flown distribution and heat transfer. It can take place because the digital twin uses predictive data for flow assurance in subsea production.

The Oil And Gas Sectors literature review on cyber-attacks:

George Stergiopoulos, Dimitris A. Gritzalis, & Evangelos Limnaios. (2020) has stated that the Many of the industrial controls and SCADA architectures of the oil & gas industries have generic domains when addressing to the cyber-attacks and needs to increase cyber security that

can address the issues, threats, and vulnerabilities. The artificial Intelligence plays a crucial role in present industrial sector, Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision. Digitalization is expected to have large-scale, long-term effects throughout the oil and gas industry, with emerging technical solutions offering ways to connect supply chains, improve productivity, and enable huge cost savings.

Advanced Technology in Oil & Gas Sector:

According to Gupta, D., & Shah, M. (2022) Artificial Intelligence can improve the streaming and advancement of oilfield improvement which can increase the utilization of large communications and information in the oilfield advancement. The main advantage in digital artificial intelligence that can applied overseeing the resources that existed in supply chain management and internet of the things. AI can improve the dependability, streaming activities that can make new worth in upstream and oil industries. All over the world many oil & gas industries are trying to improve their productivity with the help of the optimization equipment's that can provide the workers safety by monitoring from any remote areas. Many sensors are help in detecting the leaks in oil & gas pipelines and storage containers which can prevent from major disasters

The Benefits Of Adopting Digital Transformation:

The current business model for companies in the Midstream Oil & Gas industry is unsustainable. Additional regulations, aging infrastructure, limited resources and labor shortages are forcing these firms to adapt and change. The massive growth in Permian production further underscores the role Midstream companies play in the Hydrocarbon value chain. A lack of

processing facilities and pipeline capacity adversely impacts the value of E&P onshore pure plays. The access to markets is curtailed for these E&P companies by lack of capacity to process and transport production to refining facilities and/or export markets. The advent of digital enablement such as cloud storage, open-source Artificial Intelligence (AI), Deep Learning applications and low-cost super-computing can be of great benefit to Midstream operators. Embracing a technology-oriented mind-set allows operating companies to explore innovation and deploy non-traditional processes to mitigate capacity constraints and key operational challenges. Adopting a digital transformation theme points the way to operational performance gains, minimized downtime, utilize any identified capacity and further enhances shareholder value. While the benefits of digitalization are proven and documented in other Oil & Gas segments, Midstream must avoid a "follow the herd" approach. The adaptability and scaling of technology can only be considered when needed and with precise business goals. Embarking on the digital transformation mission requires that companies perform a thorough assessment of organizational digital readiness and available technologies to attain business value. Many existing applications such as ERP, Computerized Maintenance Management Systems (CMMS) , Historian (OSI PI) and others offer a head start, and only then if operational data are accessible with an acceptable level of veracity.

Midstream facilities operate varieties of industrial control systems and digital sensors. Secure and reliable streaming of sensor data is a key step in implementing a holistic digital vision that yields considerable gains. Interface with industry-standard sensors regardless of whether mains power is available. Configure multiple I/O with threshold and delta alarms to remotely monitor, report and diagnose the status of tanks and equipment at the edge. Automate remote industrial processes with a complete SCADA system in a box for rapid deployment

across many industrial applications. Our sophisticated PLC-like automation control application is the result of years of development based on OEM feedback and provides you with a user-friendly experience — no coding expertise required.

Conclusion:

Digital transformation is the way to evolve and move forward in the midstream oil and gas industry. It has many proved studies and many guides to help in successful digital transformation for the industry. Digital transformation is here to help the success of the industry, and competitors who take the opportunity are getting a step ahead in comparison with the rest in the industry.

Many Midstream operators have adopted a 1st principal equations for computational monitoring such as leak detection, spills and theft. Running smart PIGS for In Line inspection (ILI) data is a key input in Integrity management programs and a leading indicator of internal corrosion. Using advanced analytics and incorporating data from ILI and, metallurgy and previous historical data provide a self-learning models for the optimum corrosion prediction. Advanced analytics tools offer engineers acceptable means to predict the outcomes of future operational decisions and monitoring the integrity of the pipelines with/out the absence of PVT simulation models.

AI can improve the dependability, streaming activities that can make new worth in upstream and oil industries. The main advantage in digital artificial intelligence that can applied overseeing the resources that existed in supply chain management. Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. When compared with past few decades Oil & Gas sector are transforming from influential to

digitalization because of the growth in digital sector. When the industrial sector is converting to digital form the major threat on these industrial sectors is the malware attacks.

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