Industry 4.0: 101 – A Simplified Guide to the Fourth Industrial Revolution and its Application in the Oil and Gas Industry

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Search and Discovery Article #70380 (2019)**
Posted February 18, 2019

*Adapted from oral presentation given at AAPG Middle East Region, Shale Gas Evolution Symposium, Manama, Bahrain, December 11-13, 2018
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Abstract

The fourth industrial revolution or Industry 4.0, is clouded today with technical jargon and confusing concepts. Concepts such as Artificial Intelligence (A.I.) and Machine Learning have attracted a lot of attention in recent times, where in fact, these concepts have been in use and actively utilized for years in various industries around the world. More specifically, the oil and gas industry has been a significant venue for the deployment of such advanced technology applications. This presentation will provide a simplified overview and a more accurate definition of Industry 4.0, discussing best practices and adoption value, to reflect how the revolution has materialized in the oil and gas industry over the past decade. This presentation will cover some of the latest industry 4.0 concepts such as IOT, IIOT Big Data, Machine Learning and A.I. in full technical detail, before diving into industry best practices, and lessons learned. We will also explore the true definition of each of these terms and how they interact, as integration is the key element in developing successful technological solutions. We discuss “Subject-Matter-Expert Machines”, an integrated technological approach that has yielded significant increase in optimization and efficiency, while reducing cost in the industry. Although Industry 4.0 shows great promise, evident in recent advances and various applications in the oil and gas industry, challenges and gaps are still present and areas of high potential return are yet to be discovered.
Noor Alnahhas
Managing Director
ARTIFICIAL INTELLIGENCE
Machine completing a task based on a set of stipulated rules

IF object weight = 175g
AND color = orange
THEN object is an ORANGE

EXAMPLE: Car not starting if not in Park

MACHINE LEARNING
Machine making a decision based on training algorithms

<table>
<thead>
<tr>
<th>Weight (g)</th>
<th>Color</th>
<th>Fruit Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>Orange</td>
<td>Orange</td>
</tr>
<tr>
<td>168</td>
<td>Orange</td>
<td>Orange</td>
</tr>
<tr>
<td>125</td>
<td>Red</td>
<td>Apple</td>
</tr>
<tr>
<td>138</td>
<td>Red</td>
<td>Apple</td>
</tr>
<tr>
<td>133</td>
<td>Red</td>
<td>?</td>
</tr>
</tbody>
</table>

EXAMPLE: Siri / Alexa

DEEP LEARNING
Machine generating training algorithms to make decisions on

Deep Learning algorithms given all data to autonomously create rules table of properties of fruit

EXAMPLE: Autonomous Vehicles
**Data Science**: Extraction of knowledge and insight from data

**Data Analytics**: Inspection of data to discover useful information for the support of decision making

**Big Data**: Data set too large or complex for traditional data processing software to use

**IoT**: Internet of Things

**IIoT**: Industrial Internet of Things

Utilize **Data Science** techniques on large data sets (**Big Data**) to generate **Data Analytics** to create actionable insight from raw data.

A network of devices, vehicles, and home appliances that contain electronics, software, actuators, and connectivity which allows these things to connect, interact and exchange data.

Generating Big Data to be processed...
Fourth Industrial Revolution \( (4\text{IR}, \text{Industry 4.0}) \)

The fourth major industrial era since the initial Industrial Revolution of the 18th century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres, collectively referred to as cyber-physical systems.
DIGITAL TRANSFORMATION

EXPLORATION
- AI Geological & Geophysical Data Analysis

DRILLING
- Real-Time Drilling Optimization
- Remote Surveillance
- Real-Time Failure Prediction & Prevention
- Predictive Maintenance
- Just-In-Time Materials Delivery

PRODUCTION
- Real-Time Production Optimization
Oil & Gas Industry 4.0 Adoption Challenge

- Unproven Technology
- Significant Investment
- High Risk
+ Target Specific Challenges
+ Drive Tech Dev Path

Typical O&G Industry Technology Adoption Point

+ Proven Technology
+ Low Risk
- No Dev Control
- Not Fit for purpose

"The Chasm"
What Will it Take?

Embrace R&D projects & PAID pilots with smaller, riskier more innovative and flexible technology companies

Create, Support & Empower Technology and Digital Transformation Ecosystems

Publish challenges and openly invite companies to submit concepts & solutions