Digital Transformation and applications of DARQ technologies in the oil and gas industry use cases

by Ir. Assoc. Prof. Dr Chong Chien Hwa

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Talk on "A Chemical Engineering Technical Division (CETD) organised a pre-AGM talk 5 October 2019 to share how imperative that the oil and gas industry embraces and accelerates digital transformation to stay relevant in the era of industry 4.0. We invited Ir Dr. Chan Tuck Leong from PETRONAS and Mr. Adrian Lim from Accenture to present this topic. They shared with the participants how they make use of existing technology to enhance the system and methods efficiency, how to use data science as the foundation of statistically modeling, which is different from traditional engineering approach that based on first principle. The digital capabilities including advanced analytics, artificial intelligence, innovation and IOT.

The main business areas of oil and gas industry are Health, Safety and Environments (HSE), upstream wells, downstream plants, digital procurement and retail. According to Ir. Dr. Chan, the oil and gas industry focus on very specific Health, Safety and Environments problems, optimising the drilling cost at upstream well, improving the efficient of downstream plant not on the CAPEX of the plant, optimising the procurement spend and transforming retail experience of petrol stations. The digital transformation is one of the initiatives to enhance the system and methods of the business strategy. Ir Dr. Chan gave an example related to digital transformation using plant analytics.

He identified the pain point with the process engineer by linking it to the target of the process planning. For instance in heat exchanger fouling, many calculations to estimate the fouling rate using excel spreadsheets for over 20 heat exchangers. Through digital transformation, statistical modelling by employing data science approached for the past 5 years can predict faulty of instruments in 60 to 90 days time. If heat exchanger efficiency drop, the heat transfer drop, to maintain same inlet to downstream processing, the process need more heat and it will burn more fuels. The condition become complex as either shutdown the process or burn more fuel. The digital transformation tools and data science will provide a proposal for further actions.

According to Ir Dr Chan, staff with right skillset and mindset is very important. They need to collaborate, progress, user centric, fail fast, and fail small, ambiguity, adaptability and curiosity. Currently, the job opportunity for this area are data analyst, data engineer and data scientist who can contribute as project specialist and content experts. Culture, mindset, and outcome led the implementation of digital transformation. Around 10am, Mr. Adrian

start to talk about Distributed ledger Technology (DLT), Artificial Intelligence (AI), Extended Reality (ER), and Quantum Computing (DARQ).

DARQ technologies are the key post-digital differentiators. DLT is a consensus of replicated, shared, and synchronised digital data geographically spread across multiple sites, countries or institutions. There is no central administrator or centralized data storage. It should exhibit at least on the characteristics like multiple parties in the ecosystem, data is maintained by multiple parties, collaborate between known and/or unknown parties, reconciliation of data, a verified record or audit trail I needed or reliance on intermediaries. Artificial intelligence is a collection of multiple scientific disciplines, supported by technologies, which enable machines to sense, comprehend, act and learn, either on their own or to augment human practice. It has become a technology that appears to think like you do. In an onion model, the core is neutral networks followed by deep learning as the second layer and then machine learning as the third layer.

The forth layer is artificial intelligence. An example related to developing a corrosion-detection model to improve a pipeline management was presented during the talk. He mentioned that by infusing advanced analytics with artificial intelligence (AI) and machine learning, the resulting model predicts corrosions rates, identifies high-risk inspection locations and detects real-time corrosion in a fast and accurate manners compared to manual inspection process for a global oil and gas company. Quantum computing harnesses quantum mechanical phenomena to enhance the way in which information is stored and processed. The "qubit" basic unit of information can perform many computations simultaneously, which theoretically allow the quantum computer to solve a difficult subset of problems much faster than a classical computer.

For example, in quantum computing, it is probabilistic and superposition are different from classical computing. The confidence in answers builds up through repeated computations and the state of qubit is with some probability equal to 0 and with probability one minus the probability of being 0 and equal to 1. He concluded the session with some data about the implementation of digital transformation. He claimed that now 80% of upstream and 90% of downstream executives is currently experimenting with one or more DARQ technologies. The pre-AGM talk concluded with a Q&A session.

Ir. Assoc. Prof. Dr Chong Chien Hwa presented token of appreciation to Mr. Adrian Lim and Ir. Dr. Chan Tuck Leong