The Oil and Gas Sector has been implementing digital solutions for increasing efficiency in both midstream and upstream processes, but still has issues with integrating and utilizing all of the data. As digital solutions for big data analysis become more efficient, the industry has increasingly invested in data collection and digital initiatives to integrate supply chain’s data and analyze it to streamline extraction and moving of assets in an effort to achieve real-time monitoring and analysis. This study will shed light on the most valuable methods for integrating and utilizing data from asset management systems, as well as some of the problems faced when doing so.

The article will include problems that the digital oil field is currently being implemented to rectify, and a study of the most popular solutions currently being used in the industry and the results they have yielded. Following this, some of the problems being faced by the digital oil field will be highlighted, as well as present some solutions to these. I conclude with a summary of the findings and issues still to be addresses, and how to move forward with my own project.

**Background**

**Digital Oil Field Solutions**

With the advent of the digital oil field it has been apparent that an increase in integration and analytical processes between business units in the supply chain is vital. In the past, digital solutions to address efficiency issues at separate stages along the production timeline which have yielded significant results for each stage. Gringarten et al. (1998) details innovations in Reservoir Management Processes to obtain and interpret data to model and predict reservoir levels and production possibilities to better visualize and predict production goals for development processes. However, it also highlights the issues plaguing the entire industry in its diagnosis that the separation of petroleum careers and lack of interdisciplinary education in both universities and carrying over to industry is drastically slowing innovation in the sector. In other words, lack of integration is hindering growth. Other projects, such as Virtual Asset Management of offshore assets have increased data collection and management of equipment and maintenance by huge leaps. These databases can help mitigate large cost overruns, project delays and lost productive time of workers by large margins, however they highlight the uncertainty of multi-firm cooperation in business projects which limits the integration and therefore efficiency of utilizing these huge datasets in the entirety of the Digital Oil Field (Leon et al. 2017).

Again, and again the issue of integration being needed comes as the main issue facing the supply chains in Oil and Gas management, with individual business units not sharing data and analytics across supply chains. Ossai (2012) describes the issue of corrosion on wells and drills due to oxidation and the types of chemicals being used in the formation and pipelines, and explains the use of subsurface in addition to surface sensors to mitigate the risks of equipment failure and help predict future issues this may present and circumvent them. While this is mostly a midstream issue, it costs the industry exorbitant amounts of money and should this data be shared in a multi-disciplinary approach, costs could be reduced, and risk mitigated. The article closes with “the effectiveness of the policy will therefore depend on the willing of the leadership and commitment of other personnel at all ranks.” Integration of digital processes seems to be the number one factor today in the utilization of big data in streamlining and improving of everyday processes along the supply chain. Individual units are utilizing new sensors and datasets to improve upstream and midstream business, but the major roadblock is the inability or unwillingness to utilize multidisciplinary solutions across the entire supply chain.

**Problems with Integration**

After the individual successes in the implementation of digital solutions in the oil field, it is logical to wonder why integration has taken so long. This is where new Digital Oil Field initiatives are focusing their attention for the future of Oil and Gas optimization, but there are roadblocks in the way of integration, slowing the process down. The industry has succeeded largely in establishing the infrastructure for large-scale data collection, with most components along the production cycle being recorded and monitored. However, this is a double-edged sword as there is so much data being collected that most of it goes untouched and discarded, with individual units containing as much as 20 petabytes of data in some cases. Utilizing this much data requires new approaches in big data and machine learning solutions, which the oil and gas industry has been slow to implement due to its fundamental view of data as a information, and not as an asset for value creation like it is in many other firms (Perrons et al. 2015). Better data processing solutions are necessary for processing these enormous datasets, but a fundamental viewpoint change by management is necessary to adopt these new, more expensive processes for data analysis and prediction. Steps are being made in this direction, despite the challenges being faced.

Optimum field management with Field Performance Models have begun development in companies such as Chevron, with the i-field program to accomplish real-time asset management. However, the major challenges they are facing are detailed by Unneland (2005) as the methods by which the data is stored and lack of standardization in established data collection infrastructure. Analysts spend 60-80% of their time locating and preparing data for analysis, negating any efficiency or value created by the implementation of digital solutions. The timeline of optimization has been decreased in certain portions of the supply chain; however, some processes can still take years to analyze and implement solutions, significantly slowing progress (Fig. 1, Unneland 2005). Standardization of data structures and inter-firm cooperation are necessary for the digital oil field moving forward. Slowly, through Value of Information (VOI) metrics and cooperation in data collection, steps are being made in the correct direction, however there is still a long way to go for many corporations.

**Solutions Addressing Integration**

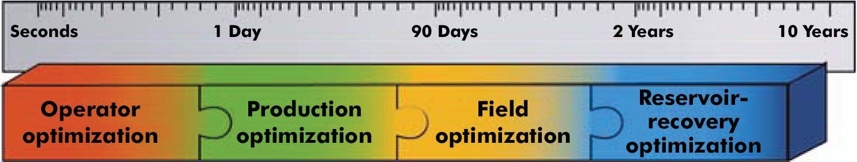
Moving forward, in the past 5 years many initiatives and models have been created for addressing the problems hindering integration of supply chain processes for increased efficiency in the Oil and Gas industry. Shuen et al. (2014) works to address these issues, developing a business framework, the Dynamic Capabilities Framework, to increase profits and mitigate loss in a dynamic way to account for volatility and address the need for reconfiguration and integration of existing process, a vital framework if the Digital Oil Field is to be realized. The three main strategies this framework are coordination/integration, learning, and reconfiguration. This is vital moving forward when data structures and processes will need to be reconfigured and relocated, centralized and processed in new ways without sacrificing profits from disorganization. BP has a success story involving the digital oil field, where standardization of data software and information services with suppliers has produced tremendous successes in utilizing data from multiple levels of the extraction lifecycle to increase efficiency and predict processes and problems in the future. Their Maximo system has decreased the lost efficiency in non-standardized data systems and made real time data sharing throughout multiple firms possible, yielding economic, strategic and behavioral benefits. This standardization of data information requires a level of influence over suppliers, however, and a willingness in firms to change existing processes to the standardized method (Holland et al. 2005).

**Conclusions**

The Digital Oil Field has made great progress in the collection and utilizing of data to streamline and manage processes in the Oil and Gas industry, such as the increase in sensors and analysis within business units and individual points along the supply chain to minimize loss from accidents and failures, and increase the efficiency of everyday processes. However, there are still challenges before the goal of real time asset management can be realized. Integration is the last important leap the Digital Oil Field must address. While data standardization and cooperation are the biggest obstacles, many are finding innovative ways to bring about this large undertaking.

My project involves the utilizing of up to date well data in Texas to create a web map visualization of wells and pipelines to most efficiently route transportation of oil and gas to its destination. This review has highlighted the importance of two key aspects in the project, namely the importance of real-time management as well as standardization of data storage. Due to this, I have decided to incorporate a real-time daily update of data, if possible, to incorporate closures of wells and pipelines for real-time analysis, as well as a standard database of the information to facilitate easy utilization across disciplines. Clean data structures and real-time updating will help create the digital oil field of the future and utilizing them in my project will only increase the utility of the application.

**Fig. 1**



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