Chapter 16

Adaptive Advisory Systems for Oil and Gas Operations

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ABSTRACT

This chapter describes a framework that captures knowledge in an organization and applies it in daily operations. Knowledge capturing is one of the biggest upcoming challenges to oil and gas organizations as operations become more remote, more challenging, and many experts are leaving the oil and gas industry. A methodology is described to capture the knowledge of experts centrally and apply it throughout all operations in the organization. Due to the fact that an asset team is facing different constraints and challenges throughout the lifetime of a field, the system needs to gather experience from decisions and learn together with the asset team. Technologies that are flexible enough to process uncertainties are discussed as well as the effect on people, processes, and organization.

INTRODUCTION

Many oil and gas asset teams nowadays face increasing challenges in daily operations due to strict production targets imposed by the economic objectives of their organization. Asset teams have to strive for lean and efficient technologies and processes to maintain or increase production and at the same time maximize profits. Maintaining a high level of production requires complete asset awareness and hence occupies a significant amount of an asset’s resources.

A typical asset team is confronted with several challenges on its way to efficient production operations. An increasing amount of sensors in the
field delivers more and more data. Maintaining control over the data flood in fields with many sensors and high frequency data may turn out to be a very challenging endeavor. Furthermore it requires fully accessible personnel on site that is skilled enough to detect performance problems in the field at a very early stage, to analyze those problems in a short time frame and to suggest activities to correct the issues. Very often these experts and their highly valuable knowledge are not available at all times and hence the asset team needs to solve issues without the input of the organization’s experts.

This challenge is even more pronounced when taking a closer look at the age distribution of petrotechnical professionals in the oil and gas industry. According to Rostand and Soupa (2011) the Big Crew Change, a phenomenon according to which about 5,000 experienced petrotechnical experts are about to leave the oil and gas industry due to retirement by 2014, will seriously challenge oil and gas companies in their knowledge retention efforts. The resulting demographic shift will not only reduce the number of experts in every organization, it will also very likely lead to the loss of tremendous amount of experience and knowledge and ultimately will increase the risk of not maintaining current production levels. The challenge is even aggravated by the rising need to produce hydrocarbons from more remote and more complex reservoirs. The authors emphasize that in order to ensure unhindered production growth the industry will have to manage the handover from retiring petrotechnical professionals to the new generation as effectively and smoothly as possible.

Simply having enough workforce does not necessarily mean that the expertise is maintained in the industry. Constant knowledge capturing and transfer is necessary in order to increase an organization’s knowledge and not to stagnate or even decrease. While the industry is running the risk of not attracting enough talented young petrotechnical professionals to maintain the available expertise in the industry, it is very important to not only approach the knowledge retention challenge through people, but also through technology (such as workflow standardization and knowledge capturing) and organizational changes (such as outsourcing knowledge intensive work to internal or external competency centers) to support or enhance production efficiency.

Hite, Crawley, Deaton, Farid and Sternevsky (2007) discuss in their paper how 91% of participants in a survey conducted by the SPE Real Time Optimization Technical Interest Group spend more than 50% of their time looking for, accessing and preparing data, which ultimately leaves less than 25% of their professional time for analysis as well as for evaluation of operational options and decisions. Based on this work Brulé, Charalambous, Crawford and Crawley (2008) proclaim in their paper how “faster decisions with precision have tremendous value, and provide much leverage in any industry hindered by a shortage of qualified people”.

The Digital Oilfield initiatives started to tackle some of the workflow standardization challenges by automating repetitive yet time consuming and error prone tasks, such as the data transfer from the sensors in the field to the desks of the engineers and partially the data preparation (Brulé et al., 2008). In some projects even more complex workflows including simulation models and optimizers were automated, which freed the asset team to put increased focus on value adding activities such as root cause analysis and production optimization (Brulé et al., 2008; Sagli, Klumpen, Nunez, & Nielsen, 2007; Stundner, Nunez, & Møller Nielsen, 2008).

However, in order to not only streamline production processes but whole decision making processes, many asset teams are looking for the right technologies to capture, continuously update and apply knowledge of skilled personnel. A demand to move from pure Information Technology (IT) to Knowledge Technology to better leverage the available expertise is generally observed in the petroleum industry. As presented in this