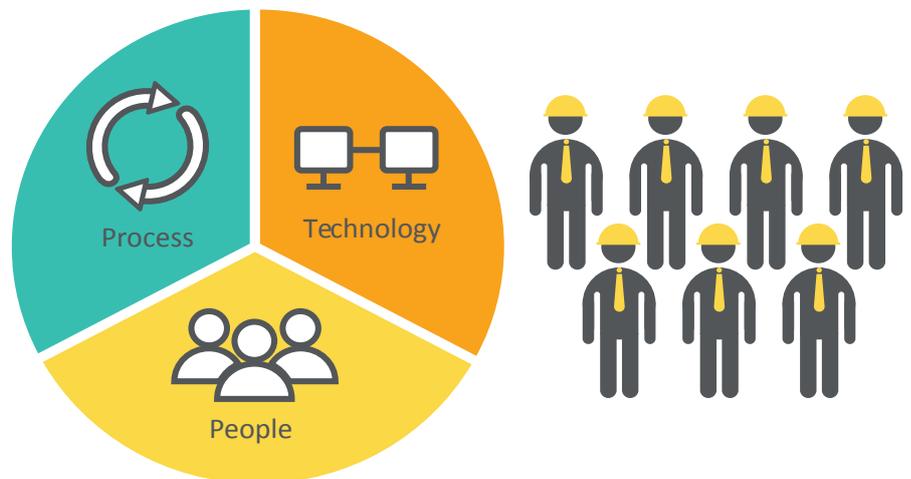


Analytics in the Oil Patch

Insights Hiding in Plain Sight

By Shrivani Kamdar



In an environment where crude oil prices have dropped 60%, it is imperative for companies to truly know their data to be able to see information and gain valuable insights to execute key decisions. This can often be tricky as the data may be right in front of you but the insights are hiding in plain sight. This paper sheds light on the history of the people, processes and technology of the Oil and Gas industry, along with our thoughts on the future path companies should take.

How Come We're Not Seeing It?

Often times, the most obvious answers in life are hiding in plain sight - very much akin to a viewing a stereogram or looking through a murky pair of spectacles. Enterprise Analytics in the Oil and Gas space is no different. The data is right before you but you just can't seem to gain the information and insights you so deeply require to refine and execute your business plan.

There are a multitude of reasons why these insights are so evasive:

- Inconsistent data management and resulting data quality
- Lack of integration and automation of legacy software systems resulting in siloed analysis and decision making
- Not leveraging the latest technology resulting in the use of suboptimal tools
- Use of generic analytics software that is not purpose-built for Oil and Gas

In this paper, we explore the solutions to the above problems in order to uncover the insights needed to make significant bottom line impacts.

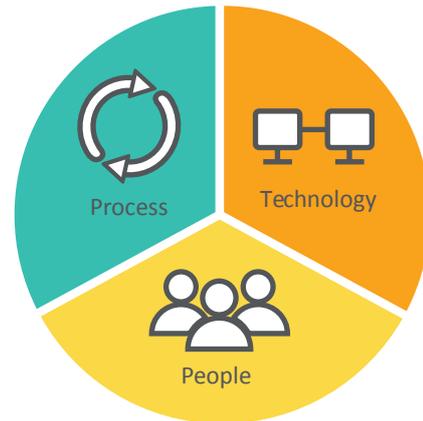
The four key highlights to gaining these hidden insights are summarized below:

- 1 Understand your key business drivers and prioritize the underlying data for BI/Analytics that will result in the greatest impact per these business drivers
- 2 Understand the value of a solution that is built for purpose and is specific as well as relevant to Oil and Gas use cases. It is very difficult to take a generic tool and expect it to provide valuable insights unless considerable thought, planning and analysis goes into making it relevant for Oil and Gas
- 3 Understand the available technology options and the use cases for Enterprise products
- 4 Use Enterprise BI to be agile against pricing fluctuations

If the above four criteria are met, an Oil and Gas player can make an extremely significant impact to the bottom line. Before exploring the details, it is important to understand how we ended up here by reviewing some basic Oil and Gas history and its impact on the industry's adoption of technology and analytics.

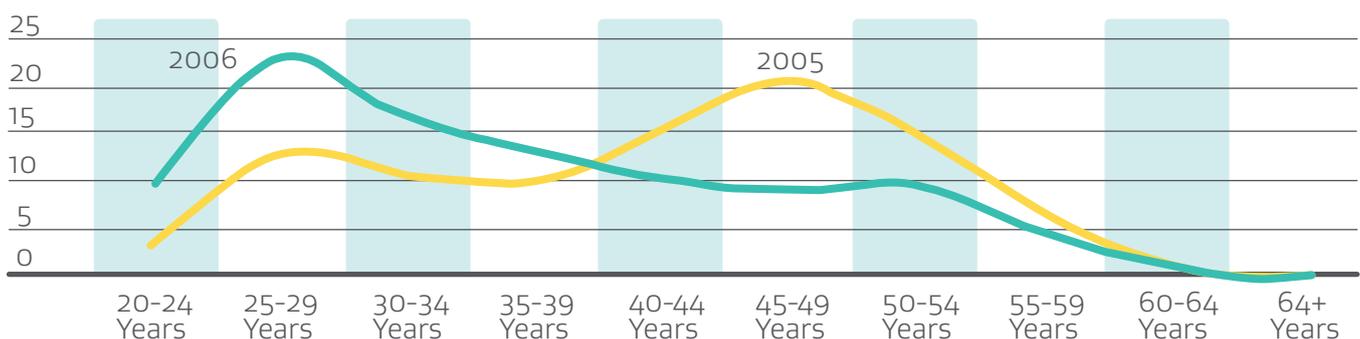
How Did We Get Here?

History. The story of how we got here starts in the 1980s and can be explained using three categories; namely People, Process and Technology.



People. The Oil and Gas industry went through a period in the 1980s when oil prices went bust and many workers were laid off. Oilfield workers left the industry for jobs in construction in more suburban areas. Colleges scaled back their Petroleum Engineering programs and for the next 15 years (approx. 1984-1999), very little talent entered the industry. This left the industry with two groups: a large pool of workers nearing retirement by the turn of the century, and very few people after them to be the next level of leadership and experience. At the turn of the century, large amounts of fresh talent were starting to come into the industry as the oil industry had a supply/demand problem for talent. The fresh talent from the early 2000s is now 10-15 years in and ready to take over the reins as the industry embarks on the phenomenon known as "the great crew change".

Figure 1. Oil Industry Professionals, by Age¹ (Percent of global petrotechnical professionals)

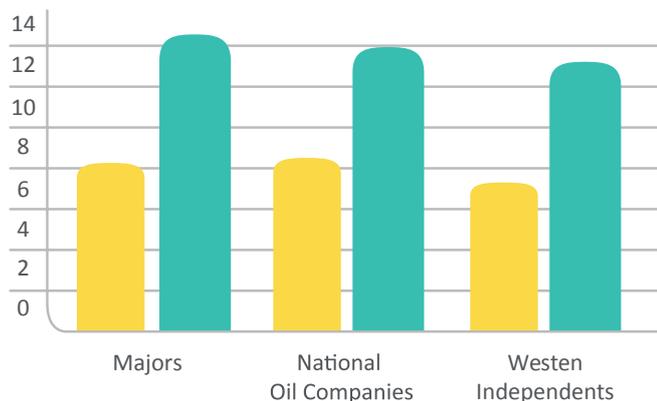


Geoscientists and petroleum engineers. China excluded. Oilfield services excluded.

Source: Schlumberger Business Consulting

Figure 2. Oil Industry Professionals, Years to Autonomy

(Estimated number of years for a fresh graduate to attain autonomy/leadership by type of company)



Source: Schlumberger Business Consulting; Thomson Reuters Datastream

Process. Due to the lack of continuity among the management ranks, the personnel in charge were left to make all the decisions with very few tech savvy people left to consult. This led to the development of very manual business processes which did not always leverage the latest technology available. The processes are now ready for a change as the new generation is ready to give Oil and Gas its first set of upgrades.

Technology. Due to the industry’s overall reduction in spending during the 80s and 90s, IT technology expenditure was also scaled back which left the industry in a tech slump while other industries were rapidly adopting new technology, resulting in a long – term lack of familiarity with the latest advanced software. This also meant there was very little incentive for software technology vendors to innovate with industry specific solutions until very recently. In recent years, there has been an explosion of generic software consumption by the Oil and Gas leadership as well as industry - specific solutions that are being developed. The challenge however, is figuring out which technology to use, where to use it, and what to use it for.

Many industries struggle with People, Process and Technologies. However, the Oil and Gas industry’s history caused an IT talent vacuum at a time when top IT talent was getting the same or better salaries, benefits and lifestyle from new tech companies like google, Facebook and Amazon. The industry had isolated itself from the software tech trade and did not have enough insiders to relate to, attract and foster the relevant technology and talent it needed to keep up with innovation in other industries. Over the years, this has resulted in large barriers to achieving operational excellence magnifying efficiency issues in times of volatility. The Oil and Gas industry is now primed and ready for this change at all three levels:

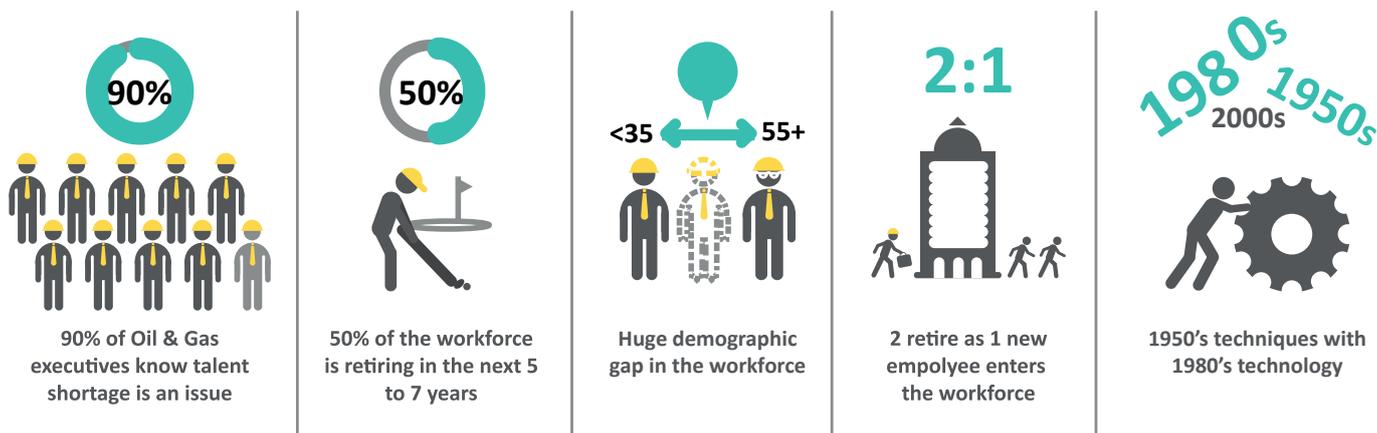
- **People.** The great crew change is underway and the new wave of personnel in charge of our energy future are ready to embrace and leverage the latest business processes and technologies.
- **Process.** New and more efficient business processes are available for use and much easier to implement using the latest technology.
- **Technology.** The supply-demand curve has shifted for Oil and Gas software technology enabling the leading vendors to deliver innovative new products that are ready to make an immediate impact to the bottom line.

Focus on the Core Problem

Focusing on the core problem requires understanding your key business drivers and prioritizing the underlying data for BI/Analytics that will result in the greatest impact to the bottom line. A general summary of data problems and their cascading impact is shown in Figure 4.

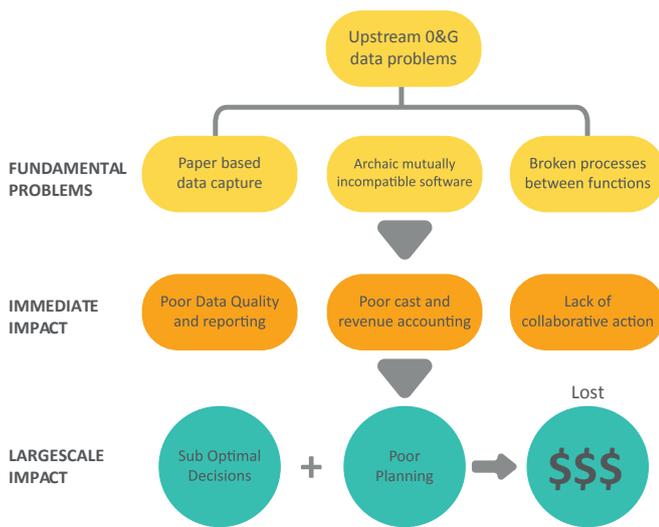
As Figure 4 shows, data problems in oil and gas cause a trickle—down effect across the enterprise impacting both top line growth and bottom line cost. These problems can be particularly exacerbated in low price environments.

Figure 3. Oil and Gas Industry by the Numbers



Source: www.forbes.com

Figure 4. Impacts of Data Problems in Oil and Gas



Strategic research from Gartner Oil and Gas analysts Rich McAvey and Morgan Eldred shows the following recommendation (among others) in a declining price environment⁶:

Balance tactical cash flow requirements with strategic IT investments to improve competitiveness.

Depending on the internal opportunities of the subject organization and the oil price environment, Figure 5 shows a sample of the opportunities that a producer may want to prioritize its BI focus on as per the Gartner guidance above.

Figure 5. Areas of Focus Based on Oil Price



- Rig Scheduling and Optimization
- AFE Routing
- AFE Analytics
- Downtime Analytics
- Drilling and Completions Analytics



- LOS Analytics
- G&A Analytics
- Well Profitability
- Vendor Spend
- Supply Chain

Once the general business areas of focus have been identified, the organization can start to identify the right internal personnel and solution providers to clean, connect, and visualize the data in a seamless, user- friendly, enterprise manner within a short and efficient time period.

One Size Fits All vs. Purpose Built

The technology available for Oil and Gas specific analytics is minimal. Most of the standard analytics tools available are from the traditional “one size fits all” (OSFA) vendors and not specific for Oil and Gas.

These OSFA solutions are meant for traditional and generic enterprise use. They are great for power users such as division business analysts but of very little use to the rest of an organization. They can also be expensive, non -intuitive, extremely difficult and time consuming to deploy. Finally, the fact that they are not built- for - purpose or directly relevant to Oil and Gas makes them all the more difficult to extract immediate bottom line value.

An Oil and Gas data set can have thousands of different metrics – each with their own nuances, uses and data rules that are vastly different from data sets in other industries. Individual sets and groups of metrics are important to executives, departments, and analysts to garner the appropriate insights they need to run different parts of the business. For example, Well Downtime is an important metric but it may have numerous sub-metrics which could be important at different levels of an organization from the COO to the operator in the field and each of these metrics may be based on multiple pieces of information that can be sourced from data available in multiple systems.

Is it absolutely necessary to have a built-for-purpose solution? Although it is definitely beneficial, each organization must consider the following prior to selecting a solution:

- Volume and quality of data present
- Requirement for solution to be simple/intuitive to use so that executives and mass end users can attain the insights relevant to the priority business drivers to make impactful decisions
- Budget/schedule constraints in terms of time and cost efficiency to implement per internal targets and needs as well as competitive options available
- The need for an Enterprise product

Seeing the complexity of Oil and Gas data, it is beneficial to have an Oil and Gas specific analytics solution.

So What’s on the Tech Menu?

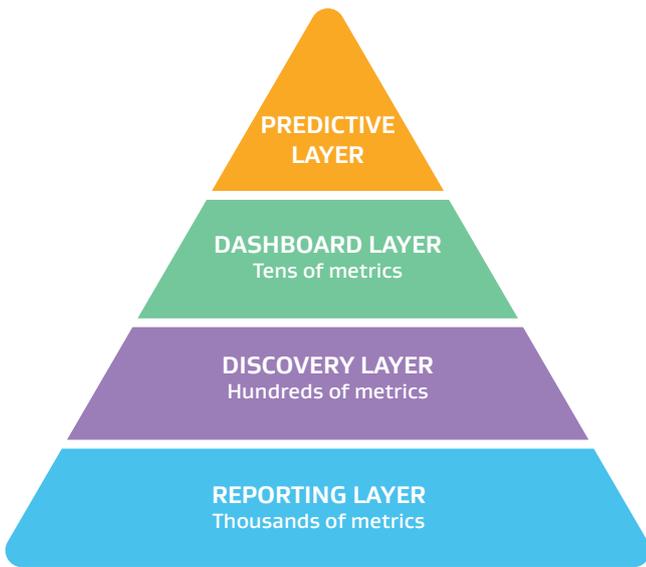
MDM, Big Data, Hadoop, Natural Language Processing (NLP), Search, MongoDB, SQL, MySQL, Oracle, etc, are some of the

names thrown around when discussing some of the latest concepts or technologies that backs up today's software.

But from a business standpoint, getting into the granular details of these technologies is a more involved technical discussion.

When it comes to analytics, the following pyramid shows the different types of layers for a typical solution:

Figure 6. BI Pyramid Depicting BI Capabilities



Source: Derived from a graphic by Wayne Eckerson, BI consultant and expert via www.trustradius.com

The Reporting, Discovery and Dashboard layers are typically used for Descriptive analytics whereas the Predictive layer is used for Predictive and ultimately Prescriptive analytics.

As discussed in the prior section, there are multiple generic tools that can be used to satisfy each of these layers or multiple layers and in some cases - all the layers. For example, tools such as Spotfire and Tableau are great for skilled analysts who want to query and explore data, and create visualizations on an ad-hoc basis (i.e. Discovery layer).

However, keeping in mind the complexities around Oil and Gas data sets, the most important part of executing any technology is to ensure it is contextually relevant and scalable.

The solution should be able to understand and pivot around the multiple hierarchies within an Oil and Gas company (such as Corporate, Operational, or Cost Center). For advanced features such as NLP and Search, it should be able to understand Oil and

Gas acronyms and industry terminology seamlessly. Finally, when getting to the predictive and prescriptive levels of sophistication, it should be able to give sensible recommendations that are contextually relevant.

Note that predictive analytics requires a large volume of data to understand what may happen next in order to build reliable forecasts. Such large volumes of data may only be available in certain parts of the business (e.g. SCADA) where data may be coming in from field sensors. Such volumes of data are prime candidates for predictive analytics.

However, for all other data - there is a large possibility of low hanging fruit in the area of Descriptive analytics. At Seven Lakes, we strongly believe in understanding your past and present history (i.e. descriptive analytics) prior to predicting your future. Quality descriptive analytics serve as a strong foundation for predictive and ultimately prescriptive analytics.

Enterprise Solutions and Maintaining Agility Towards Pricing Fluctuations

NOTE: Often times, the word **Enterprise product** as it relates to software is implicitly used to define a product that is meant to support the entire organization or enterprise (i.e. every employee, every department). For the purpose of this white paper, we will explicitly define Enterprise product as follows:

A product that is required to support a mathematically predetermined number of combinations of relevant (i) **databases**, (ii) **departments** and (iii) **direct reporting employee levels** within an organization to keep the relevant set of personnel on the same page and deriving the same insights for priority business drivers. We will discuss more on what we believe this number should be in the latter parts of this paper.

To run a business efficiently amidst fluctuating commodity pricing, it is imperative that everybody stays on the same page. Therefore, an EnterpriseTo run a business efficiently amidst fluctuating commodity pricing, it is imperative that everybody stays on the same page. Therefore, an Enterprise Analytics solution seems like a must.

Siloed analyses by department analysts can be done using powerful visualization tools. However, each department may come up with insights based on their own incentivized assumptions and they may roll up to the executive level in a conflicting manner. Furthermore, there is no limit to the amount of reports analysts may churn out and the underlying assumptions and calculations of these reports may not be standardized which adds to the confusion during times of price fluctuations.

An example of self-service BI gone wrong is best given by the following quote from Wayne Eckerson (BI expert):

“While self-service BI is critical for power users, it is overkill for casual users. Many companies carry self-service BI too far, and the result is report chaos, which ultimately causes usage to drop among casual users. One large energy company embraced self-service BI tools several years ago and recently found it had 26,000 reports stored on its servers in one department alone. The reports were generated by 450 users in a department of 3,500, most of whom found the tools and maze of reports too overwhelming to use. The company is now pulling back from self-service, implementing 300 ‘standardized reports’ that encompass the majority of metrics and dimensions in the 26,000 reports, and reserving self-service BI for ad hoc requirements outside standard information views.”

With all of the potential challenges in selecting and implementing solutions, it would be wise to figure out whether an enterprise solution is needed or not. To do so, we must redefine the Enterprise. At a high level, if the combinations of multiple databases, departments and direct reporting hierarchy levels requiring successful interaction to gain the correct insights is greater than or equal to 24, an Enterprise product is recommended. See Figure 7 for details.

Figure 7 shows how a situation involving three data systems, three departments and two levels of direct reports could potentially cause 72 possible combinations of potential misunderstandings. Trying to chase down these misunderstandings can spiral a company into analysis paralysis mode very quickly, thereby delaying key decisions and business plan execution. After such a rigorous effort, the insights gained after such analysis may be no better than the original.

Figure 7. Redefining the Enterprise

We now discuss a rule of thumb recommendation on what this mathematically predetermined number should be.

Our rule of thumb is as follows:

Use an Enterprise product if:

$$\gg D1! \times D2! \times D3! \geq 24$$

Where:

- >> D1 = # of data systems
- >> D2 = # of departments or divisions
- >> D3 = # of direct reporting levels

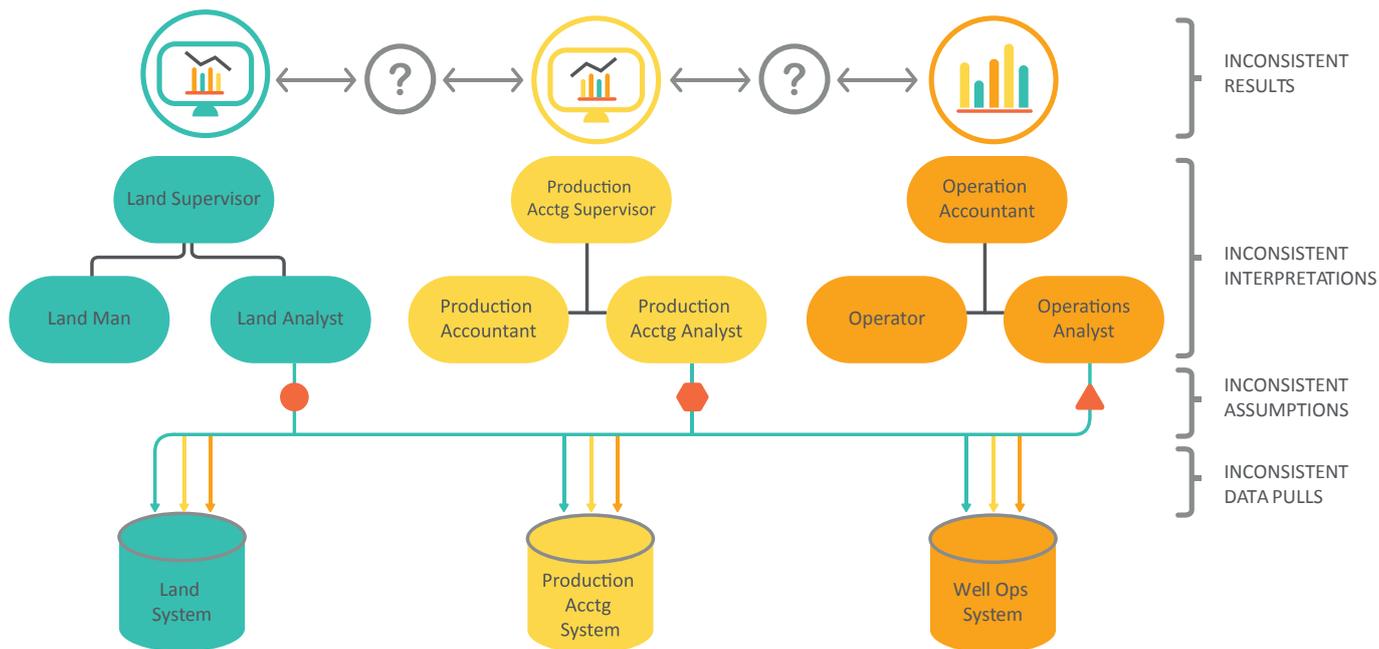
If the factorial product of these three values is greater than or equal to 24, this means that there are at least 24 permutations and combinations of misunderstanding or miscommunication that may be possible by using a non-enterprise tool.

For example, if you have three different systems of data (i.e. Land system, Production Accounting system, Well Ops system), being worked on by three different departments (Land, Production Accounting, Operations) and being reported across two levels of direct reports (Analyst, Supervisor) in an organizational chart:

$$\begin{aligned} \gg & 3! \times 3! \times 2! = \\ \gg & (3 \times 2 \times 1) \times (3 \times 2 \times 1) \times (2 \times 1) = \\ \gg & 6 \times 6 \times 2 = 72 \end{aligned}$$

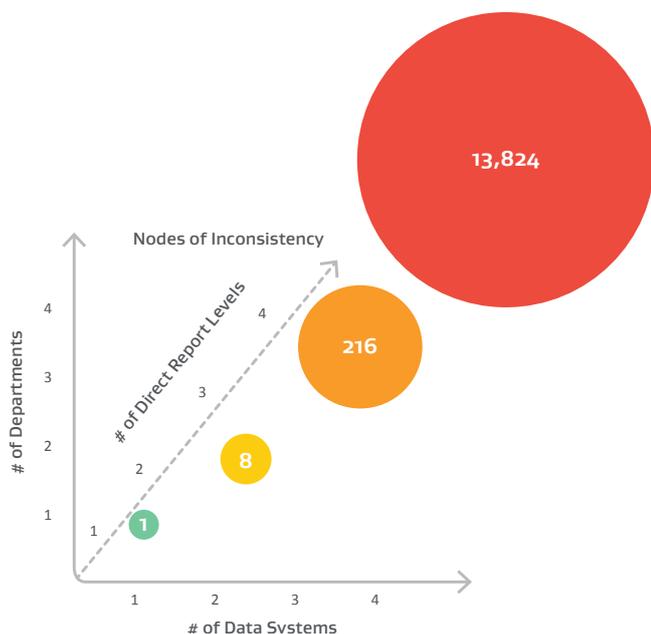
There are 72 possible combinations of something not being aligned due to differences in assumptions, data cleansing methods, entity or metric names in different departments, etc. Therefore, an enterprise solution is recommended. From our experience, any time this formula is greater than or equal to 24, it is seriously worth considering an enterprise solution or product.

Figure 8: Visual Depiction of Potential Misalignments Where BI Affects Different Cross Sections of the Organization



For further illustration on how these data driven misunderstandings can balloon out of control without the proper tool use, refer to Figures 8 and 9. With a scenario as simple as four data systems, four departments and four direct reporting levels, the potential for confusion balloons exponentially to 13,824 opportunities for error. Enterprise BI helps avoid such issues which can be of real value amidst price uncertainty.

Figure 9: Permutations and Combinations of Errors for Multiple Combinations of Data Systems, Departments and Direct Reports



Conclusion

E&P players can follow the four highlighted points to uncovering key information to make a significant bottom line improvement:

- 1 Prioritize the business drivers and underlying data for Enterprise BI Analytics.
- 2 Use industry-specific Enterprise solutions built for purpose that can be deployed in a short amount of time to enable analysts to perform required ad-hoc analytics while providing the organization with simple, canned analytics tools.
- 3 Understand and determine the right technology for Enterprise BI/ Analytics.
- 4 Take advantage of Enterprise BI to better maneuver pricing fluctuations in an agile manner.

This expedites the flow of key insights lodged deep within the corporate databases to the forefront for efficient, value-added decision making and prevents the organization from being caught up in analysis paralysis.

Focusing on key analysis, workflows, ease-of-use and guided analytics specific to Oil and Gas provides far greater insights and bottom line impact than that garnered from non-specific and generic tools.

Finally, after basic data problems are solved and an organization is getting consistent value from descriptive analytics, further value can be attained by using this descriptive foundation to pursue further predictive and prescriptive efficiencies.

The industry is ready to take the great leap into the future along with the shift in its three key components: people, process and technology. However, taking the leap should be a measured approach. Companies should prioritize their focus areas depending on the macroeconomic oil price environment and the internal optimization needs.

Insights from a thorough, focused and prioritized enterprise BI strategy help ensure the organization is now able to find and view the data as well as derive the required insights from it.

In short, it's time to trade in the murky pair of glasses and start looking through a clean pair of glasses.

Visit us at www.sevenlakes.com or contact us at info@sevenlakes.com

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ABOUT THE AUTHOR



Shrivani Kamdar

Shrivani Kamdar is a Business Development Manager at Seven Lakes Technologies and has a decade of experience in the oil and gas sector dealing with cross-departmental data and its impact across organizations. Prior to Seven Lakes Technologies, Shrivani worked with Exxonmobil as an Engineer, Project Manager and Risk Strategist. Shrivani joined Seven Lakes Technologies in 2014 and is involved in business development, strategy and product marketing.

Shrivani is passionate about the intersection of business intelligence, technology and energy. He completed his bachelor's degree in chemical engineering from UCLA in 2005. In 2013, Shrivani graduated from the USC Marshall School of Business with an MBA.

ABOUT SEVEN LAKES TECHNOLOGIES

Seven Lakes Technologies provides simple and innovative Oil and Gas software built for a purpose in order to transform the way data is used in the Oil and Gas industry to drive significant improvements to the bottom line.