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# Process Intelligence
# Six Tenets of Intelligent Process Improvement

## Applications in the Oil & Gas industry

# Introduction

The Westfield Sydney to Melbourne Ultramarathon was first run in 1983. At a distance of 875 kilometers, it was going to be one of the most challenging ultramarathons in the world. Most entrants knew that to be competitive, they would need to run 18 hours each day, while sleeping only six hours.

A 61-year-old man named Cliff Young showed up to run the race wearing worn-down overalls and worn-in work boots. When asked if he had ever run in a marathon before, he replied, "See, I grew up on a farm where we couldn't afford horses or tractors, and the whole time I was growing up, whenever the storms would roll in, I'd have to go out and round up the sheep. We had 2,000 sheep on 2,000 acres. Sometimes I would have to run those sheep for two or three days." The runners all laughed. Young was clearly not up to the standard of these world-class athletes.

Amazingly, though, the 61-year-old underdog won the race, beating the record for similar races by 40 percent, or almost two full days![1] How was this possible? Young didn't "know" what everyone else knew—that he had to sleep—so he just shuffled along each night at a slower pace while all of the pro runners dreamt soundly. His win catapulted him to fame in Australia—the race thereafter was named the Cliff Young 6-Day Australia Marathon—and launched a new era of ultramarathon running. Now that world-class runners "know" that it's possible to run days at a time without sleep and that they can conserve energy by adopting an easy shuffle jog, they have a new way of approaching ultramarathons.

*Business process improvement today is in a similar state as ultramarathons were before Young's feat — people often "know" which process improvement methodologies work, and they approach those methodologies the same as they have for decades. Yet despite those decades of history to learn from, companies are still struggling to realize success from their process improvement efforts.*[2]

*Why do some process improvement efforts succeed and others do not? This paper outlines six tenets to help companies think beyond what is currently "known" and bring more "intelligence" to process improvement.*

[1] "The Legend of Cliff Young: The 61 Year Old Farmer Who Won the World's Toughest Race," Elite Feet for Runners, December 30, 2007, http://www.elitefeet.com/the-legend-of-cliff-young.

[2] 3rd Biennial PEX Network Report: State of the Industry, Trends and Success Factors in Business Process Excellence," PEX Network, Fall 2013, http://www.processexcellencenetwork.com/downloadContent.cfm?ID=1697.

# Tenet #1: Challenge conventional wisdom

Many organizations are constrained by conventional wisdom, much like the world-class runners in Australia. For example, some companies are moving away from Six Sigma as a methodology for process excellence because they believe they lack high-quality data to effectively support a Six Sigma based approach. This may explain why the methodology has steadily declined since 2005.[3] Instead, companies may take a flexible approach to process improvement, allowing teams to pick and choose methodologies and toolsets.

Is flexibility a good thing? Not necessarily. Companies that stick with a consistent approach realize an average of 40 percent more benefit than those that don't.[4] A demonstrated and time-tested approach to process improvement includes the following five steps:

- Clarify the problem and set a goal for improvement.
- Measure performance levels today.
- Uncover the root causes of the problem.
- Figure out ways to address those root causes.
- Make it stick.

These steps happen to be the same logical and time-tested approach employed by Lean Six Sigma, currently the second most widely used methodology in the process improvement tool kit, only behind Lean.[5] It's also quite flexible, as it can be applied to a variety of problems of various sizes. It's an "intelligent" approach that has been shown to be effective and efficient in problem solving, even without significant levels of data and statistical analysis.

Oil & Gas companies are challenged with navigating an environment where volatile demand, rapid technological advancements, multibillion dollar capital projects, and evolving regulatory requirements are all considered par for the course. Given these conditions, it is understandable that some Oil & Gas companies question the applicability of a standardized process improvement methodology. However, the proper application of these principles can help drive value in even the most dynamic environments.

Refinery inventory management, for example, is an area in which challenging the status quo may have a significant impact to the bottom line. Underestimating inventory requirements forces refineries to slow production while overestimating these requirements ties up valuable capital. By following a standardized "intelligent" approach to develop targets, the speed and quality of the analysis will likely improve, potentially reducing inventory costs and more favorable refinery utilization.

**Example**

One refining company's inventory management process relied on time-intensive manual inputs. The company established inventory targets once per year, unless a major structural change (e.g., acquisition/sale of refinery) to the business triggered a reevaluation. Each refinery used a unique approach by using various levels of rigor to calculate the bottoms-up requirements and then estimating the impact of known network changes, such as planned maintenance or the completion of capital projects. Management's ability to make budgeting decisions or evaluate capital projects was slowed as each scenario required the team to "reinvent the wheel." To improve this process, the company implemented a streamlined process—designed using Lean Six Sigma principles —in which inventory targeting tools were developed to calculate inventory targets based on validated inputs and assumptions. The tools incorporated sensitivity testing on predefined variables (e.g., seasonality, operating rates, and shift in supply modes) to calculate the impact on inventory targets. As a result, the organization is now able to conduct scenario analyses in hours instead of weeks and with more insightful results.

[3] "3rd Biennial PEX Network Report: State of the Industry, Trends and Success Factors in Business Process Excellence"

[4] LSS Aberdeen Six Sigma Report

[5] "3rd Biennial PEX Network Report: State of the Industry, Trends and Success Factors in Business Process Excellence"

# Tenet #2: Stretch beyond process mapping

Another commonly accepted practice is to use process mapping as the core tool in process improvement. Process mapping is an important tool, but it has limitations. Process maps show how people think a process typically works or how it should work. How the process actually works often is quite different.

Various advanced analytical tools can provide much richer insights and "intelligence" related to actual process performance. For example, Deloitte's Process X-ray™ is a process analysis platform that reconstructs the actual process execution based on data from a company's underlying technology (see figure 1). It enables users to ask up to 10,000 questions to find the variants and root causes of problems in the process. Similarly, Detailed Value Stream Analysis recreates actual process performance at a handoff level of detail, enabling process improvement teams to identify which steps in the process are not adding value.

The "intelligent" insights gleaned from these analyses help generate breakthrough improvements that are hard to realize when process maps alone are used. As companies increase focus and investment on workflow automation and data analytics (big data), supplemental analytical process intelligence tools will become increasingly more important in driving toward solutions.[6,7]

Continuous production processes are highly integrated, and altering a process without understanding all of its interdependencies may jeopardize the integrity of the system. Maintaining process integrity is especially important in the Oil & Gas industry in which process failures pose serious safety, environmental, and regulatory risks.

Traditional process mapping techniques provide limited quantitative data as they often lack the rigor needed to capture multiple permutations of process steps.

As an alternative, highly complex processes, such as capital project execution, asset turnarounds, and production operations, should consider process intelligent tools to perform advanced analytics. Detailed value stream mapping can capture the flow of material and information throughout a process and also obtain resource requirements and cycle time data at each step to detect and prioritize improvement opportunities.

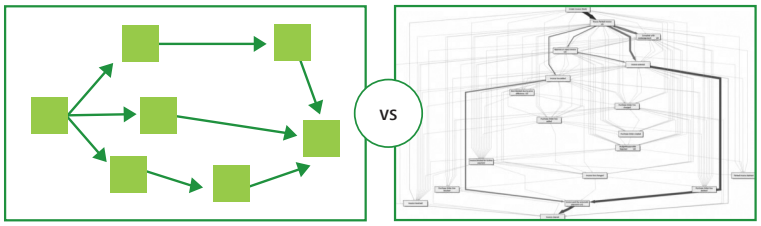



**Figure 1: Traditional process mapping versus analysis of actual process using Process X-ray**

**Example**

One refining company faced challenges meeting the product specification targets in its blending process. Its inconsistencies resulted in product quality give-away affecting profitability. Simply put, gasoline and diesel were produced with attributes above the required specifications, without compensation for the incremental quality. Lacking an approach to identify where the losses were occurring, the company brought in Deloitte to conduct a detailed value stream analysis. Findings showed several root causes, including conservative specification targets, deviations in starting recipe, inconsistent inventory management practices, and limitations in reproducibility and reliability of measurement systems. These insights allowed Deloitte to help the organization develop an online blend analyzer system and a blend approval and auditing process, which minimized product quality giveaway by 55%.

[6] Ibid

[7] Deloitte internal analysis

# Tenet #3: Follow the facts

There is typically no lack of opinions when it comes to business improvement efforts. But when teams act on opinions, they often jump to the wrong conclusion. A more "intelligent" approach is to convert opinions into hypotheses and test them with data before acting on them.

"Data is what distinguishes the dilettante from the artist."[8] According to a study conducted by the University of Pennsylvania and MIT, "data-driven decision making" achieved productivity that was 5 percent to 6 percent higher than could be explained by other factors.[9]

A well-structured set of hypotheses provide an organized framework to evaluate and act on options for business improvements. Furthermore, it can help avoid common pitfalls during improvement projects such as addressing only symptoms or being swayed by the strongest or most senior person in the room. As a result, instead of basing actions on guesses or hunches, companies can have more confidence that their actions are driven by facts. Hypothesis testing also lays the foundation for controlled continuous improvement as hypotheses tested and data collected can be used for future endeavors.

Making process improvement decisions based on data-substantiated facts rather than opinions and perceptions may take a little longer, but over the course of time it helps foster alignment among people with different opinions and can lead to greater results.

Similar to other industries, Oil & Gas companies are benefiting from the big data revolution. Advanced sensors and telemetry provide real-time data across the industry, from upstream measurement while drilling to remote monitoring of retail station inventory levels.

The sheer magnitude of data produced creates a new set of challenges. Investments in IT infrastructure and business intelligence solutions are needed to capture and analyze the data. Companies will also need to invest in training for effective use of these tools. Capable employees are necessary for testing hypotheses and deriving meaningful insights.

Oil field production data can be analyzed to help improve selection of new development sites. Midstream operators can now minimize downtime by using supervisory control and data acquisition systems to direct preventative maintenance activities. As data becomes more ubiquitous, the question will likely shift from what can you measure to what should you measure.

**Example**

A midstream logistics company's crude trucking fleet operations lacked visibility into operating costs by geographical market. They engaged Deloitte to evaluate the competitiveness of the company's fleet relative to third-party common carriers. First, the team extracted roughly 34,000 expense records from SAP and isolated costs for each region. Then, the team reviewed more than 75,000 historical shipment records to determine the trucking activity per region. Using this information, the team developed a lane costing methodology to enable an "apples-to-apples" comparison of the proprietary fleet to third-party carrier costs by region and mileage band. The company now has the tools needed to conduct network optimization analyses to determine the optimal proprietary fleet size within each geographic market.

[8] George V. Higgins, The Guardian, June 17, 1988.

[9] "When There's No Such Thing as Too Much Information," Steve Lohr, The New York Times, April 23, 2011, http://www.nytimes.com/2011/04/24/business/24unboxed.html?_r=0.

# Tenet #4: Buy runs, not players

In the movie *Moneyball*,[10] a statistician suggests the following: "People who run ball clubs, they think in terms of buying players. Your goal shouldn't be to buy players; your goal should be to buy wins. And in order to buy wins, you need to buy runs. Baseball thinking is medieval. They are asking all the wrong questions."

The same is true in process improvement. Many companies ask questions and use tools that fail to address root causes of problems. They employ temporary fixes that end up being costly and unsustainable. Fixes often focus on one aspect of the issue and commonly are in the form of process tweaks such as an additional quality check, creating new roles that are potentially redundant, or implementing a new system, but these actions are equivalent to buying individual "players" to fix a process rather than understanding the process itself. Such process improvement efforts effectively put a bandage on visible symptoms of problems, thus laying the foundation for disappointment—addressing symptoms alone can often lead to problems reappearing.

**Example**

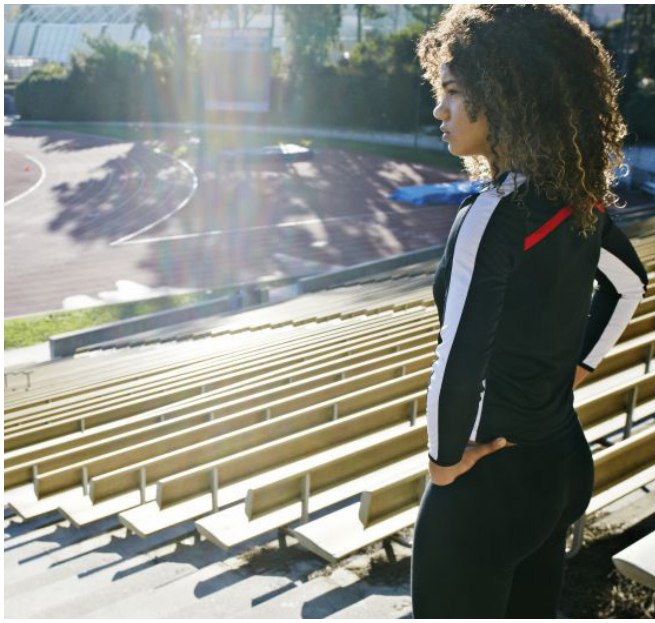
A refining company operating a fleet of natural gas liquids (NGL) railcars was experiencing high costs relative to the low utilization of its fleet. They engaged Deloitte to review the network and identify cost-reduction opportunities. After conducting a current-state assessment, it became clear that the company was asking the wrong question. Management historically measured fleet performance in terms of railcar turns defined as the average number of railcar shipments per period. This definition implicitly assumes that the transportation of product is the only utility provided by the railcars. In reality, refineries also hold loaded railcars to buffer against inbound supply variability and hold empty railcars to provide containment storage during operational disruptions. With this broader perspective in mind, a holistic fleet sizing analysis ultimately led the team to recommend expanding the fleet size. By redefining railcar utilization to include nontransportation uses, the team avoided arriving at a conclusion that would have jeopardized the continuity of NGL supply and reduced the refineries ability to mitigate variability.

Instead, companies can better understand how to generate "runs" when they look holistically at the process to identify root causes and systemic issues. Rather than focus on short term fixes, when problems are identified and addressed at their core, the benefits tend to be greater and longer lasting.

The Oil & Gas industry has been trending toward increased collaboration through vertical integration, marketing alliances, strategic partnerships, and joint ventures that present opportunities to streamline processes across the Oil & Gas value chain. To realize these benefits, companies may have to reevaluate how they currently assess process performance.

Siloed operating models create barriers to collaboration both within and across organizations. Business units compete amongst themselves for scarce resources. Departments seek to optimize their own performance without considering broader organizational impacts.

To overcome these challenges, process improvement teams need to build a case for change. Highlighting opportunities through objective, fact-based analysis and including cross-functional team members in analysis development brings additional clout to the recommended approach.



[10] *Moneyball*. Dir. Bennett Miller. Perf. Brad Pitt and Jonah Hill. Columbia Pictures, 2011.

# Tenet #5: Carry it across the goal line

In Super Bowl XXVII, the Dallas Cowboys' #78, Leon Lett, recovered a fumble on the Dallas 35-yard line and ran it toward the end zone. At the 10-yard line, approaching the end zone, Lett slowed down and held the football out in celebration, unaware that an opponent was chasing him down from behind. The opponent knocked the ball out of Lett's outstretched hand just before he crossed the goal line, sending the ball through the end zone and costing the Cowboys a touchdown.

In the absence of proactive leadership alignment and change management, process improvement teams can fumble before they cross the goal line, too. Two-thirds of executives indicated in a recent survey that competing priorities for time and resources often take precedence over process improvement efforts, resulting in an unstructured or undefined process excellence program.[11] Because of this, process excellence efforts can either have a tough time getting off the ground or go after too much and stretch their resources too thinly. Instead, leadership can take on fewer improvement efforts and execute well against those things rather than taking on too much at once and fumbling. Process improvement efforts can have the flashiest data-driven analyses and the most insightful recommendations that get at the root causes of the problem, yet those recommendations are worthless if others in the company don't accept and act on them in a committed and coordinated manner.

The stakes for project execution have never been higher as the supermajors and the larger independents are undertaking multiple billion dollar megaprojects. For these high-visibility projects, it can be difficult to obtain resources and executive sponsorship to execute process improvement projects.

Stakeholder analyses are necessary to identify individuals whose support will be vital to project execution. Soliciting input from these stakeholders and conducting intermediate stage gates helps maintain alignment and momentum throughout the course of the project. After completion of a project, having a benefit tracking and reporting process to demonstrate tangible results can provide credibility and increase sustainability of the process improvement program.

**Example**

The retail distribution division of a refining and marketing company engaged Deloitte to evaluate its current operating model. Up to that point, the company had operated two distinct models operating concurrently. The first model consisted of a proprietary fleet with centralized scheduling and dispatch operations. The second model relied exclusively on contract carriers who worked directly with retail sites to schedule and deliver orders. Stakeholders on each side held strong opinions on the relative merits of each model. Rather than relying only on opinion, the team identified key stakeholders to participate in workshops and collaboratively develop a methodology to evaluate a range of operating models. The outcome resulted in a third operating model, which incorporated elements of the two previous models to provide the best mix of price, reliability, and safety. Since all of the key decision makers were engaged in the development of the approach and validation of the assumptions, the team encountered little resistance and received authorization from leadership to implement the recommendations.

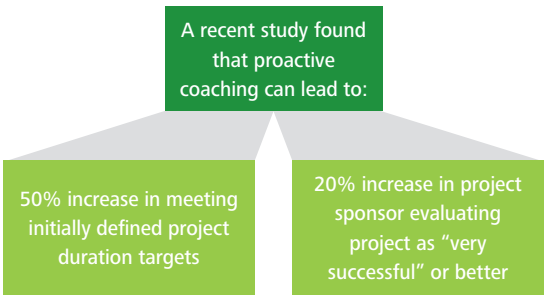
[11] "3rd Biennial PEX Network Report: State of the Industry, Trends and Success Factors in Business Process Excellence"

# Tenet #6: Two heads are better than one

While training is essential for obtaining skills and knowledge, coaching and mentorship help people apply learning in the real world. Research of coaching effectiveness shows that a structured, proactive coaching approach where a schedule is followed leads to more successful project completion in comparison to an ad-hoc coaching approach (see figure 2).[12]

Such a mentorship model is necessary for effective implementation of Lean Six Sigma; it can keep teams motivated, foster continuous learning, and, most importantly, maintain improvement gains. One such model, the "belt" method, has been successful in helping teams draw from the wisdom of those who have walked the path before.

Figure 2: Coaching Improves Outcomes




The Oil & Gas industry first began applying Lean Six Sigma in the early 2000s, with the supermajors leading the way. Today, business process improvement programs are more common and exist in a variety of forms. More mature programs have centers of excellence with dedicated staff, formal training and certification programs, and verified benefits totaling in the hundreds of millions.

Regardless of where companies are on their journey for continuous process improvement, a mentorship model should be incorporated into their approach. The Department of Labor estimates that 50% of the industry's workforce will be up for retirement within the next five to 10 years.[13] Without investments in training or in mentorship programs, companies may risk losing process improvement capabilities as skilled employees leave the workforce.

**Example**

After several years of sustained growth, a refining and marketing company began to see the limitations of its current processes and systems. Having seen the benefits of Lean Six Sigma at other organizations, the CEO retained Deloitte to develop a Business Improvement department to increase the organization's process improvement capabilities. In the initial design phase, Lean Six Sigma methodologies, tools, and trainings were developed to support project delivery. In the implementation phase, Deloitte "Black Belts" were paired with functional business leads to provide real-time training and coaching on the application of these tools to communicate to the broader team. This "train-the-trainer" approach was used to deliver eight core projects throughout the enterprise, including projects in the refining, commercial, logistics, and marketing functions. As a result of their project experiences, many core team members have earned a "Green Belt" certification. They are now leading a new set of projects continuing the spread of Lean Six Sigma principles across the organization.

[12] http://www.isixsigma.com/implementation/teams/how-effectively-coach-green-belts-and-black-belts/

[13] Jill Tennant, "Making informed human resources decisions based on workforce outlook," World Oil Online, September 2012, http://www.worldoil.com/September-2012-Making-informed-human-resources-decisions-based-on-workforce-outlook.html

# Intelligent process improvement: Back to the future

Oil & Gas companies need to be increasingly agile to achieve results as the industry continues to experience commodity price volatility, technological innovation, and regulatory uncertainty. Process improvement efforts can be deployed quickly and return results in the near term. However, companies that do this can also take a long term view and recognize the need for continual process improvement efforts to address evolving market conditions.

If ever there was an ultramarathon in business, process improvement is likely it. It requires discipline, patience, consistency, and lots of hard work, and the mindset is foundational to any level of change an organization needs to make. When process improvement methodologies first came into vogue in the 1980s and '90s, they challenged 50 or more years of conventional manufacturing wisdom, enabling companies to improve manufacturing quality, reduce production waste, eliminate bottlenecks, streamline processes, and cut costs. Twenty or more years down the path, many variations of standard process improvement techniques and tools have been introduced. Along with them have come many opinions about which techniques and tools are most effective. However, one incontrovertible fact remains: Lean Six Sigma continues to be one of the most prevalent and consistently productive approaches to process improvement. By following the six tenets described in this paper, companies can continue to leverage Lean Six Sigma for solid results in the modern ultramarathon that process improvement represents.

# Case Study
# Crude trucking optimization

Crude oil trucking is a lifeline that many refineries depend on to maintain high utilization and low production costs per barrel. The primary focus for trucking operations has always been continuity of supply, since transportation costs pale in comparison to the cost of slowing or stopping refinery production. In the midst of an expansion project, one refinery expected an increase in crude trucking volumes by 60% and management questioned how best to meet this demand. Historically, the company supported operations through its proprietary fleet of crude trucks, but as crude demand increased, so did reliance on third-party common carriers. With limited visibility into costs and the available capacity of regional third party carriers, the company engaged Deloitte to help determine the most cost-effective way to scale its trucking operations.

The first goal was to develop a cost baseline for the proprietary and third-party fleets, but the team faced a series of data gaps. Mileage and transit time data were missing for more than 10,000 unique transportation lanes. Shipment records were captured on hand-written tickets and third-party carrier invoices were saved in ".pdf" form creating a significant manual effort to manipulate the information for functional use. By working with accounting and operations stakeholders, the team closed these gaps and calculated a trucking cost per barrel metric used to compare across carriers. At first glance, the use of their proprietary fleet appeared cheaper. Yet, the team identified a savings opportunity when they observed significant variances between third-party carrier rates.

However, the team's further investigation into third-party carrier contracts revealed a new set of challenges. Contract structures were unique to each carrier, making cost comparisons for individual lanes prohibitively time consuming. In order to standardize contract terms and rate structures, the team conducted a strategic sourcing event and was able to reduce third-party costs by 23%.

With the updated carrier rates in hand, the team now had the visibility to develop a dispatch optimization tool. A master rate sheet was designed to calculate the individual cost of 10,000 plus lanes across all carriers. Once producers communicated the daily orders, a dispatcher would input the orders with each carrier's available capacity and run the linear optimization program within the tool to determine the allocation of loads with the lowest overall cost.

This project ultimately achieved savings of more than $1 per barrel through the standardization of processes and application of intelligent tools. These results demonstrated the importance of following a rigorous data-driven approach in which the company will continue to benefit from its strengthened culture of continuous improvement. Opportunities in preventative maintenance, custody transfer, and IT system integration were identified in this effort and have since been spun off into their own projects.

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Special thanks to **Jason Clark** and **Ashleigh Dodd** for their contributions to this article.