OPTIMIZING STO MANAGEMENT TO ACHIEVE OPERATIONAL EXCELLENCE

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➔ **Reid Paquin,** Research Analyst,
Manufacturing, Product Innovation & Engineering (PIE)

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Report Highlights

p3

Over half of all asset intensive respondents indicated that the top reason an STO completed late or over budget can be traced back to poor requirements.

p6

Best-in-Class companies start by having formal processes in place to assess, quantify, and prioritize their STO risks across the enterprise.

p8

Best-in-Class companies are also more likely to equip their managers with the tools they need to plan and distribute their resources and execute that plan.

p9

Changes are inevitable during an outage. Best-in-Class companies make sure that they have the processes in place to manage and communicate these changes effectively.

Based on the experiences of almost 200 respondents, this report will explore Shutdowns, Turnarounds, and Outages (STO) among asset intensive companies. Specifically, how Best-in-Class companies view STOs as enterprise wide events, which are critical to success.

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2

STOs are complex, high risk events that must be managed properly to stay competitive; it only takes one lengthy overrun to cripple a business.

Sector Definition

Asset intensive industries include, but are not limited to: oil and gas, mining, metals and metal processing, energy and utilities, and chemicals.

For the purposes of this paper, all of the "Asset Intensive Industries" data comes from respondents in the oil & gas, energy/utilities, and chemicals industries.

Traditionally, shutdowns, turnarounds, and outages (STOs) have been viewed as siloed events. However, a more realistic perspective recognizes that the impact and scope of STOs extend across an entire organization. STOs command a large portion of budgets, as well as contingency funds. Poorly executed STOs can cost an organization millions of dollars in lost revenue, drive up operating costs, and cause permanent damage to the business. This is without even factoring in one of the largest concerns - the potential lost business from overruns. Considering all the potential ramifications, well-executed STOs can represent a source of competitive advantage for an organization that has this process under control. Successful companies have become more proactive in how they approach this process to outperform their peers.

STOs are Complex and Highly Impactful Events

Most shutdowns, turnarounds, and outages are complex and have a large number of milestones and process checks. There are a wide range of tasks to factor in, such as planning the work to be involved, removing the assets/plant from production, executing the plan, and resarting the assets/plant to "normal performance levels. However, STOs also almost always involve unplanned work resulting from inspection of a machine or asset not being able to occur until it has been shutdown. All of these processes and tasks must be managed effectively in order to deliver an outage successfully on-time and under budget.

The impact to the business if a STO is late or over budget can be devastating. There is the sheer cost to the business of performing these complex projects, each day that a critical asset is shutdown results in lost production. However the real impact comes from any extended overruns, which results in the loss of future business and has the potential to put a company out of business. To make improvements in the process it is important

3

to understand the most common reasons a STO performs poorly (defined as late or over budget).

Figure 1: Top Reasons STOs are Poorly Executed

Percentage of Respondents, n = 195
Source: Aberdeen Group, October 2014
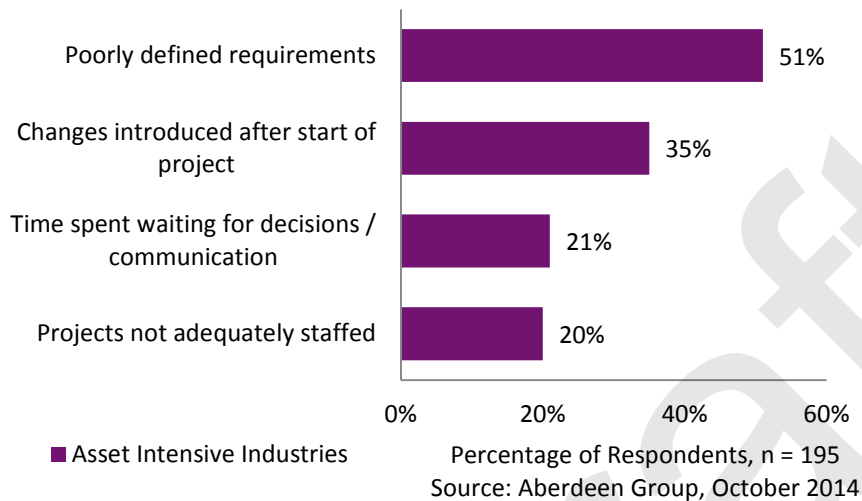
As Figure 1 shows, the top reason for poor performance can be traced back to poor requirements. Defining the scope of any complex project can be a major challenge, but the very nature of STOs makes this task it even more problematic. In most cases the full view of requirements cannot be determined until an asset has been taken offline and inspected. The potential for identifying previously unforeseen or emergent work requirements must be performed within the defined time constraints of the STO. This makes being able to manage these changes throughout the project even more important. To be successful today, asset intensive companies need to improve their troubleshooting and decision-making capabilities. The final reason a shutdown, turnaround, and outage can perform poorly is from a lack of resources. Most companies rely on the tribal knowledge and past experience of their senior employees to execute STOs. However, as recent Aberdeen research has shown, 60% of companies feel they are understaffed in their high skill positions. This is starting to increase risk in the business,

4

Top Risks Impacting the Organization

Asset Intensive companies operate in a unique environment that has increased risks to the business around asset uptime, compliance, and safety:

Failure/Downtime of Critical Asset:
Asset Intensive Industries – 57%
All Other Industries – 40%

Non-Compliance:
Asset Intensive Industries – 47%
All Other Industries – 39%

Environment, Health, and Safety:
Asset Intensive Industries – 37%
All Other Industries – 24%

Asset Safety:
Asset Intensive Industries – 19%
All Other Industries – 26%

especially as more senior employees get closer to retirement age.

On top of all of these concerns, asset intensive companies face the harsh realities of operating in highly competitive markets and dealing with critical assets and equipment where each failure is disruptive and costly. At the same time, they must also adhere to stringent Environment, Health, and Safety (EH&S) regulations (see sidebar). Operating in such an environment is causing companies to rethink their approach to STOs. These organizations have no choice but to work smarter and focus their attention on better control over the STO process.

Defining the Best-in-Class Among Asset Intensive Companies

Table 1: Top Performers Earn Best-in-Class Status

Maturity Class	Mean Class Performance
Best-in-Class: Top 20% of aggregate asset intensive performance scorers	90% of projects delivered on-time or early 96% of projects are delivered within budget 24% decrease in time-to-decision over the past year 10% increase in project length when a project is late +15% operating margin vs. corporate plan
Industry Average: Middle 50% of aggregate asset intensive performance scorers	61% of projects delivered on-time or early 69% of projects are delivered within budget 13% decrease in time-to-decision over the past year 28% increase in project length when a project is late -1% operating margin vs. corporate plan
Laggard: Bottom 30% of aggregate asset intensive performance scorers	40% of projects delivered on-time or early 57% of projects are delivered within budget 4% decrease in time-to-decision over the past year 39% increase in project length when a project is late -6% operating margin vs. corporate plan

Source: Aberdeen Group, October 2014

Aberdeen used five key performance criteria to distinguish the successful asset intensive organizations. Aberdeen categorized participants as Best-in-Class (top 20% of performers), Industry

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5

Average (mid 50%), or Laggard (bottom 30%)… we also refer to a fourth category All Others (Industry Average and Laggards combined). Table 1 summarizes the aggregate performance of each category. The primary goal of any STO is to complete the projects on-time and under budget. In addition, Aberdeen also factored in for those projects that are late, how late are they and the speed at which these companies are able to make decisions. The final criterion is an overall metric to determine the success of the business, operating margins.

Clearly the asset intensive Best-in-Class companies are doing something right, nearly every one of their projects are delivered within budget with 90% on schedule or early. The industry average and laggards cannot say the same. One alarming finding is that the majority of projects for laggards result in overruns and for those that are late, there is a 39% increase in length. Every day of downtime for an asset intensive industry can result in millions of dollars of lost production. This also in turn increases maintenance costs and leaves the company more susceptible to compliance concerns. All of this poor performance shows up on the bottom line for Laggards, as they report -6% operating margin vs. corporate plan. As we will see, there are five main areas where Best-in-Class companies focus to outperform their peers: risk management, scope definition, plan optimization, real-time execution, and controlling change.

Building the Foundation for STO Success

With the nature of asset intensive industries and the environment they operate in, the first step every company should take is getting a full picture of all the risks across the enterprise. Best-in-Class companies understand this and have formal processes in place to assess, quantify, and prioritize their STO risks across the enterprise (Figure 2).

Further Metric Performance

Beyond the maturity framework metrics, Best-in-Class companies are outperforming their peers on critical operational specific metrics:

Unscheduled Asset Downtime:
- Best-in-Class – 4.3%
- All Others – 10.2%

Maintenance Costs (year over year):
- Best-in-Class – 8% Decrease
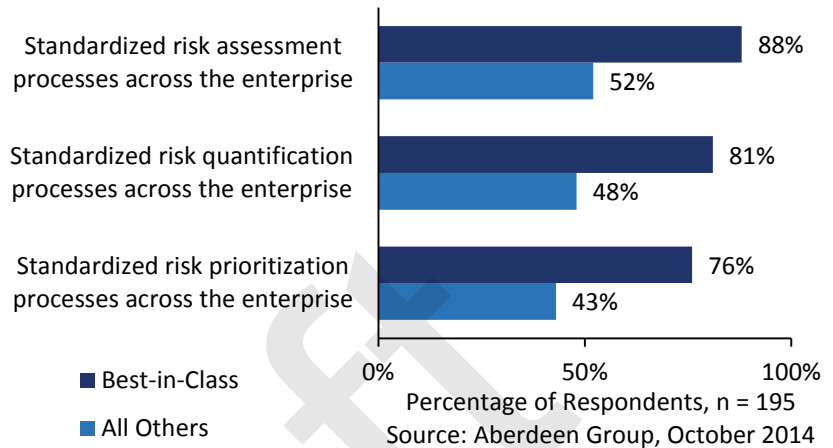- All Others – 4% Increase

Recordable Injury Frequency Rate (per 100 employees):
- Best-in-Class – 0.7
- All Others – 1.6

Compliance-related costs in the past 2 years:
- Best-in-Class – 5% Decrease
- All Others – 6% Increase

Figure 2: Risk Management is Critical to Success

Best-in-Class: 88% — Standardized risk assessment processes across the enterprise
All Others: 52%

Best-in-Class: 81% — Standardized risk quantification processes across the enterprise
All Others: 48%

Best-in-Class: 76% — Standardized risk prioritization processes across the enterprise
All Others: 43%

■ Best-in-Class
■ All Others

Percentage of Respondents, n = 195
Source: Aberdeen Group, October 2014

The risks of the organization must be clearly understood to build a long term plan to determine which assets should come offline, at the appropriate time. By not possessing these risk capabilities, the Industry Average and Laggards rely on guesswork to determine the long range planning for their STOs. This will result in increased production loss, poor use of available resources, and less flexibility to changes that may occur throughout operation. Once a long term plan has been put in place, asset intensive companies must focus on executing their STOs in an efficient manner.

To do this, companies must have formal processes in place to define the requirements of a shutdown, turnaround, and outage. Defining the scope of an STO involves defining work activities, determining work packages, and the resource requirements needed to carry out this work. Best-in-Class companies realize the importance of this phase and as a result focus on early collaboration with all stakeholders (maintenance, project managers, contractors, etc.) across the outage project (Figure 3).

Proper Scope Definition:

The STO scope should not overlook defining work in areas such as the restart process. The restart process itself is an area often under planned and under assessed by STO teams, which in turn leads to poor production efficiency for extended time periods after assets are returned to production.

7

Figure 3: Defining the Scope

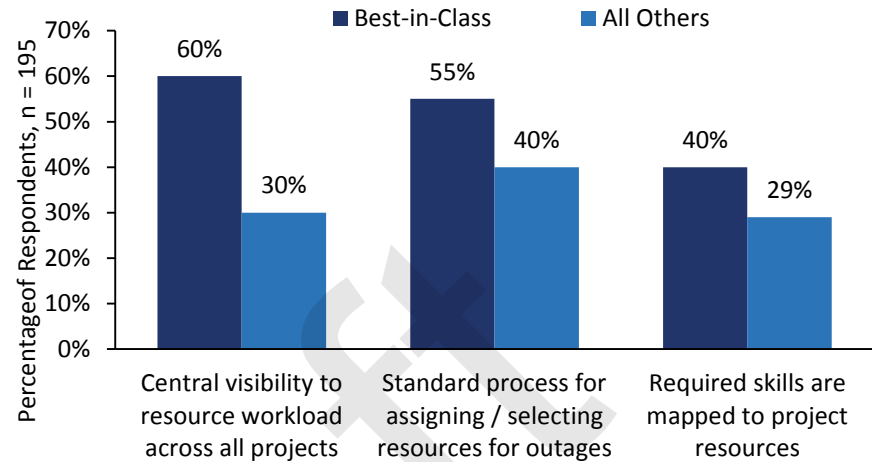Source: Aberdeen Group, October 2014
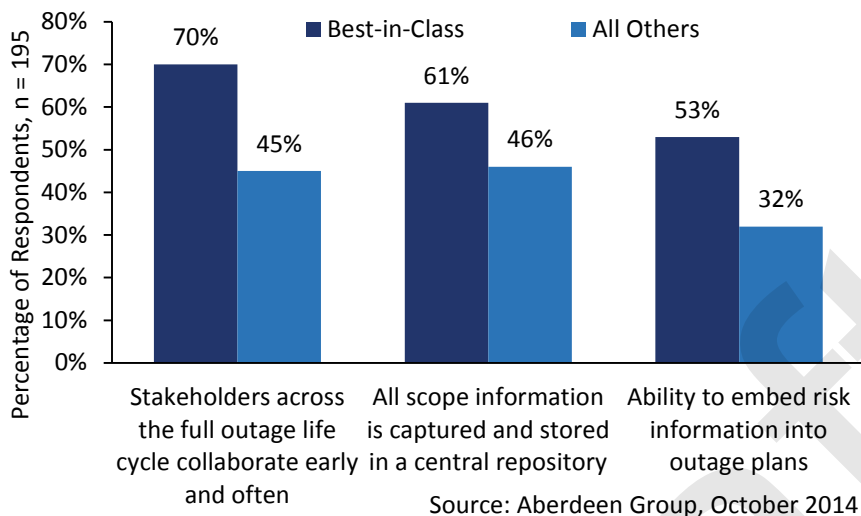
Perhaps the most important capability that Best-in-Class companies are more likely to possess is their use of a centralized repository to capture and store all of the information needed for a project. This improves an organizations ability to collaborate and ensure the scope gets defined and approved in a faster manner.

Building and Executing the Plan

Now that the scope of the outage is firmly set, the next step is developing a plan, optimizing it, and then executing it. With the lack of resources that is being experienced, utilizing what is available becomes even more important. Best-in-Class companies overcome this challenge by providing managers with visibility into not only the resource workload across all projects in the enterprise, but also the proper skill sets of the resources available (Figure 4). Half the battle of resourcing an outage is getting the right skillsets to work on the project and ensuring that these resources have the time to work on the project. These types of capabilities can have a profound effect towards optimizing an outage plan.

Embedded Risk Information:

Best-in-Class companies are 43% more likely than their competitors to embed risk information into their project plans. This allows a company to be more capable of reacting to unforeseen issues, like changes in scope, environmental issues, public relations, etc.

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8

Figure 4: Putting an Optimal Plan in Place

Source: Aberdeen Group, October 2014

Real-Time Visibility and Execution

Aberdeen also examined the execution process for STOs. It was found that real-time visibility into project information was a key differentiator for Best-in-Class companies:

Real-time visibility into all project milestones and schedule status:
- *Best-in-Class – 66%*
- *All Others – 39%*

Real-time visibility to project data and information for organizational stakeholders (internal):
- *Best-in-Class – 57%*
- *All Others – 35%*

Real-time visibility to project data and information for partners / contractors / suppliers (external):
- *Best-in-Class – 50%*
- *All Others – 23%*

Through the combination of these resource allocation capabilities, Best-in-Class companies are able to construct outage plans that are more likely to finish on-time and under budget. However, having an optimal plan in place is not a fool-proof method, delays and unforeseen incidents are bound to occur. Asset intensive companies need to be able to adapt on the fly and "re-optimize" based on any deviations from the original plan. This is why successful companies also stress the importance of being able to capture and view critical project information in real-time (see sidebar). This increased visibility allows a company to look forward and discover potential problems before they become issues throughout STO process. All Others (the poor performers) rely solely on reacting to problems as they arise, which has a severe impact on the cost and time targets for their outages.

Further, limiting access to project data to only select stakeholders restrictions the ability of the business to respond cohesively to challenges throughout the STO process. To be successful, managers must have all project information on hand to make effective decisions. Providing access to project data to

9

all stakeholders (internally and externally) at every level in the organization will enable better project decision making needed to contain costs.

As was shown earlier, changes occurring mid-project were the second highest reason for a STO to perform poorly. This is a direct result from the fact that sometimes inspection is only possible when an asset is shutdown. Whether it is a revision to materials or project phasing, the addition/subtraction of work, or a cardinal change, Best-in-Class companies make sure that they have the processes in place to manage and communicate these changes effectively (Figure 5).

Figure 5: Changes are Bound to Occur
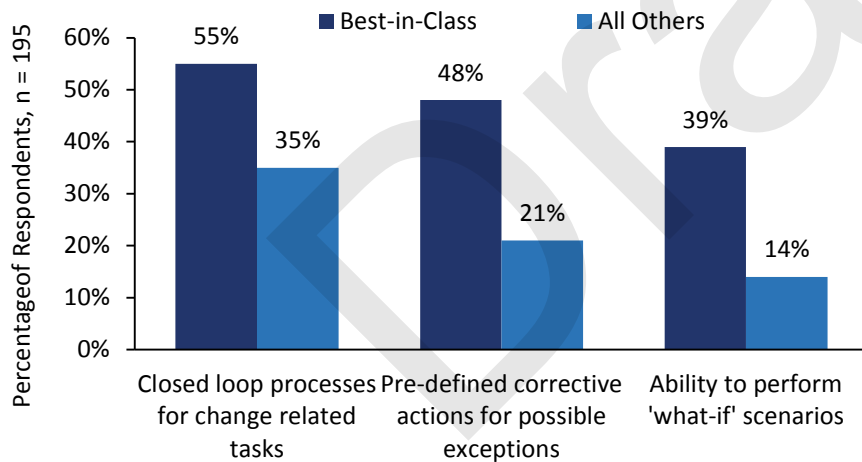
Source: Aberdeen Group, October 2014

Best-in-Class companies also take this management of change a step further and conduct "what if" scenarios. This allows stakeholders to see how any changes will impact (positively or negatively) budget and schedule progress for an outage. This allows Best-in-Class asset intensive companies to be more proactive in how they approach shutdowns, turnarounds, and outages. Only 14% of poor performing companies have the ability to conduct these "what if" scenarios, leaving them stuck

Software to Support the STO process

Best-in-Class companies are more likely than their peers to rely on software to standardize processes and improve STO performance:

Project Scheduling:
- *Best-in-Class – 88%*
- *All Others – 67%*

Project Costing:
- *Best-in-Class – 81%*
- *All Others – 73%*

Project Management and Reporting:
- *Best-in-Class – 77%*
- *All Others – 58%*

Collaboration Tools:
- *Best-in-Class – 42%*
- *All Others – 38%*

in following out their plans as scheduled, even if it is not the most optimal. Managers need prioritization and change management tools to help them make better decisions on managing emerging work to stay within plan and budget targets.

Provide the Tools to Execute

Clearly there is a lot of information to consider when performing STO's, which is why Best-in-Class companies turn to software to automate their processes (see sidebar). Inefficient or manual processes are the number one challenge that asset intensive companies are facing today when it comes to outages. Top performers use project management solutions to better manage the numerous moving parts of an outage, whether it's scheduling resources, reviewing the impact of change, or developing mitigation plans.

The alternatives to these applications are desktop tools, spreadsheets, and manual processes, which do not allow decision making from a single source of data. Software enables asset intensive organizations to gain central insight, control, and accountability into their operational processes. This level of control contributes to the ability of these organizations to accurately quote, source, and deliver their work, generating greater consistency and predictability in how they do business. This is particularly important for those companies taking on complex shutdowns, turnarounds, and outages. The one area that all companies need improvement is in the adoption of collaboration tools. Over half of the asset intensive companies surveyed said they do not have any automated tools for collaboration in place.

STOs and Continuous Improvement

One item that cannot be overlooked when it comes to STOs is taking a continuous improvement mindset to the process.

11

Continuous improvement is a concept with its origins from the plant floor but is being injected everywhere in an organization today. Not only are Best-in-Class companies seeing where in current projects they can improve, they are applying lessons that have been learned to all future projects (see sidebar).

Continuous improvement is being embraced as the engine to transform the business; this plays a direct role in the superior metrics that the Best-in-Class have seen over the last year. It is this continuous improvement approach that demonstrates the maturity of a company, if All Others don't embrace this approach they will be left behind.

Key Takeaways and Recommendations

Completing STOs on time and on budget all while dealing with stringent environmental and safety standards are some of the unique challenges that asset intensive companies must deal with. STOs are complex, high risk events that must be managed properly to stay competitive; it only takes one lengthy overrun to cripple a business. Leaders in the industry are focusing on five key areas - risk management, scope definition, plan optimization, real-time execution, and controlling change - to optimize their outages and achieve operational excellence. Those companies looking to optimize their STO performance should:

➔ **Assess, quantify, and prioritize all of the associated risks to develop an effective long term plan for outages.**

➔ **Get all stakeholders collaborating early and often. The top reason an STO performs poorly can be traced back to requirements**

There is Always Room for Improvement

An important fact to remember is that there is always room for improvement. Because of this, it is no surprise to see Best-in-Class companies inject continuous improvement thinking into their STO process:

Continuously monitor status of in-process progress to approve / continue / optimize outages:
- *Best-in-Class – 68%*
- *All Others – 39%*

Apply lessons learned to future outage projects:
- *Best-in-Class – 43%*
- *All Others – 24%*

➔ **Equip managers with the tools to plan and distribute their resources and execute the plan.**

➔ **Stress the importance of real time visibility (both internally and externally) to reduce time to decision and streamline execution.**

➔ **Put a formal change management program in place to reduce the risk of delays and overruns from unplanned work.**

➔ **Implement a project management solution to standardize processes and support the execution of complex STOs.**

➔ **Inject continuous improvement thinking to optimize current and future outages.**

For more information on this or other research topics, please visit www.aberdeen.com.

Related Research	
Closing the Talent Gap in Asset Management; March 2014	_Asset Management: Building the Business Case for the Executive_; December 2012
Operational Risk Management: Building a Framework to Identify, Assess, and Remediate; February 2014	_Project Management: Putting the Pieces Together_; March 2012
Author: Reid Paquin, Research Analyst, Manufacturing, Product Innovation & Engineering (PIE) (reid.paquin@aberdeen.com)	

13

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