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Improving Safety Outcomes Through Digitally-Enriched Operational Excellence

How to Apply Smarter Risk Mitigation and
Safety Practices to Your Business

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My Call-to-Action for Smarter Risk Mitigation with Process and Technology

February 1, 2003, marked the Columbia Disaster, where seven crew members aboard the Space Shuttle Columbia lost their lives when re-entering Earth's atmosphere. At the time of the accident, I worked at NASA's Johnson Space Center in the famous Building 30, a historical landmark of great triumph, and on that day, tragedy.

The Columbia Disaster left an indelible mark on all of us at NASA. It also resulted in a defining realization in my life: if an organization as competent, capable and driven as NASA could fall victim to commonly understood precursors to disaster, any organization could. I've turned this into a call-to-action to help organizations become much smarter about their risk mitigation decisions by using technology intelligently, and by adopting a safety culture that is anchored in data-driven operational excellence.

Paramount to an evolved understanding of safety is a recognition that strong EHS&S (Environmental, Health, Safety and Sustainability) – which I'll refer to as "safety" from here on – does not have to be at odds with achieving business outcomes. In fact, the precursors to good business performance and safety performance are the same: *both require establishing a culture of operational excellence enabled by technology.*

What do we mean by operational excellence? While there is no single agreed-to definition, operational excellence includes:

- a (good) process-driven approach to deliver value while minimizing variation from expectation

- a culture of continuous improvement and the reduction of non-value-added activities

- the measurement of data and management using the resulting quantifiable facts (observations)

- the translation of observations into facts through a rubric that sorts what is real and what is not

By focusing on achieving operational excellence, organizations can increase revenue and reduce costs through efficiencies, and are far more likely to achieve good safety outcomes as well. To put it simply: An efficient organization is generally a safe organization.

This whitepaper will explore how your organization can apply operational excellence and technology enablers to safety practices, and shares our approach for understanding and preventing serious workplace incidents through digitally-enriched operational excellence. This will be exemplified in our Digitally-Enriched Continuous

Improvement Cycle. You'll also learn why limitations of existing processes and technologies in place hinder an organization's ability to attain timely, actionable insights for safety-related decision-making.

After reading this whitepaper, you should have a better understanding of how to attain digitally-enriched operational excellence within your organization and how to employ the best available safety thinking to your data to reduce safety incidents, identify patterns and change future outcomes.

In the spirit of continuous improvement, I want to hear our readers' thoughts and feedback on this whitepaper. Client experiences and challenges have shaped this perspective for improving safety performance, and must continue to do so. You can find my contact information below.

I hope you enjoy the read.

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Process, Technology & Cultural Challenges

Today's Safety Landscape

The truth is: Industrial safety performance is as good as it has ever been. On the whole, however, the marginal improvements to safety performance diminish every year.

In the developed world, the "easy" improvements to safety have largely been institutionalized by industries. Safety management systems have become the norm, the value of leading indicator collection is understood, and safety awareness and training programs are mandated. Incidents have fallen as a result. However, emerging technologies have been slow to improve safety practices to allow for operational excellence and, in turn, safety performance. This is evident when reviewing the limitations of current safety processes.

Poor work safety and health practices cost 4% of global GDP per year. - International Labour Organization.[1]

In the U.S., more than $1 billion is paid by employers every week to compensate workers for workplace injuries and illnesses. - Liberty Mutual Research Institute.[2]

Those injured or sick as a result of their job could earn 15% less in wages over ten years. - International Labour Organization.[3]

Improving safety in the workplace impacts the bottom-line. For every $1 spent on improving safety, organizations can save $4 to $6 as illnesses, injuries and fatalities decline. - U.S. Occupational Safety & Health Administration.[4]

The Limitations of Current Health & Safety Practices

Frontline workers play the most critical role in improving safety – they are the ones at risk and have the most direct impact on the mitigation of that risk. Yet, a deeper look into the efforts by field workers to provide safety leaders with data show the limitations of the processes and technology in place by many organizations to shape future outcomes.

The Process Today – Challenges Gathering & Analyzing Data

Frontline workers are tasked with key safety-related activities at the worksite:

1. Job Safety Assessments (JSAs), Pre-Hazard Assessments (PHAs) and the like are created to think through the steps of an activity, the hazards associated with each step, and the mitigations that must in place for each hazard.

2. Safety Observations, Hazard Observations and the like are generated to collect leading indicators related to behaviours or conditions that are amiss during execution.

In many cases, worksite safety specialists are tasked with verifying that jobs were done correctly once completed and assuring jobs are done properly during execution. These specialists may use checklists and free text fields to record areas of non-compliance with expected practices or results.

The data collected by both frontline workers and Safety Specialists is then shared with Safety leaders who must understand it, gather insights and take action to improve health and safety performance. You may know this process as a Deming Wheel or PDCA (plan–do–check–adjust).
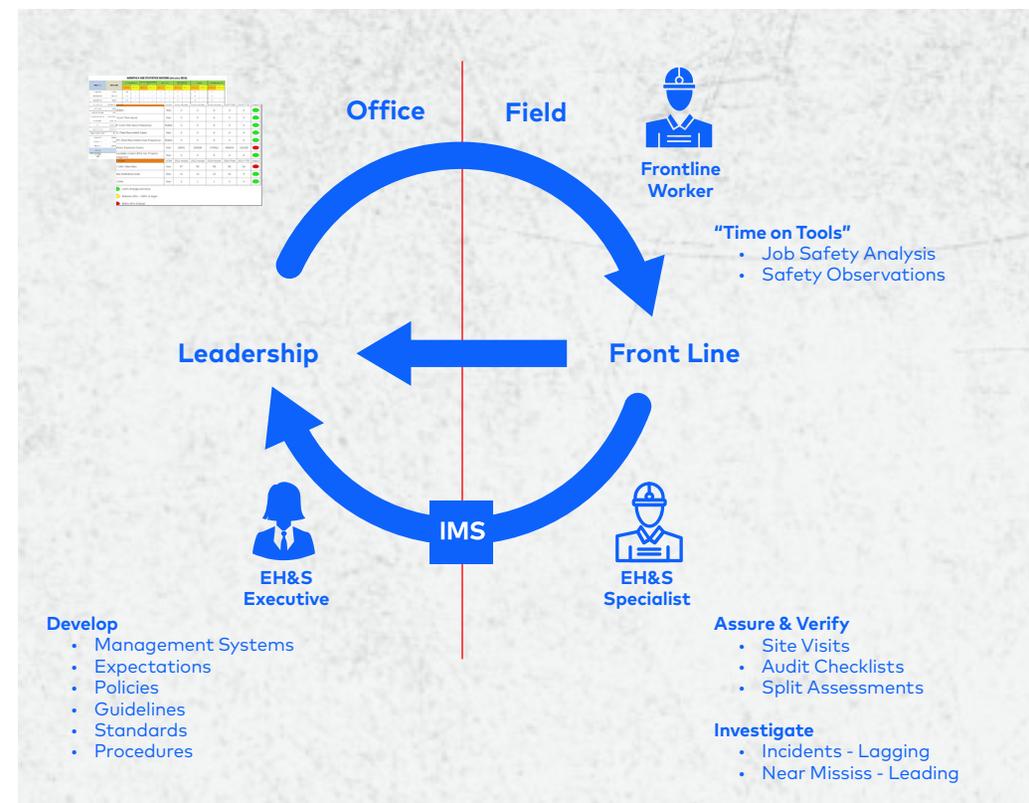
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1. Job Safety Assessments are not always done well. In certain industries and geographies, they are done poorly more often than they are done correctly (if they are done at all).

2. Safety Observations are typically written on paper, then dropped in a box or handed to a shift supervisor – it could be weeks before it is in front of someone to analyze, if ever. Hopefully, they are manually keyed into an Incident Management System where they are reported on, but this practice varies greatly.

3. Checklists and other reports from Safety Specialists can experience the same problem. Unfortunately, they are rarely analyzed in aggregate to identify systemic areas of non-compliance.

4. Safety Specialists will create records in the Incident Management System – this is typically done well with a richness of data that could be mined for insights, but even some of the most prolific (and expensive) systems tend to be like a black hole - information goes in, but limited to zero intelligence comes out.

5. Much of the context and actionable information in leading and lagging indicators is recorded in free text, but Incident Management System reporting and manual spreadsheet processing focuses only on structured data.

6. Observations themselves affect the results. The more arduous the act of observation, the more likely the observation will be inaccurate, thus increasing the potential that the action taken on that observation will be wrong.

In turn, this process and the existing technologies used make it difficult to mitigate emergent risks, uncover systemic areas of non-compliance and influence future behaviours. How can an organization act to continuously improve if they're no longer able to make improvements?

A new approach is required to facilitate change and improvements in safety performance – and it requires establishing a culture of operational excellence enabled by technology.

The Key to Operational Excellence & Making Smarter Decisions

Digitally-Enriched EH&S Operational Excellence

As outlined in the introduction, operational excellence requires the following:

- a (good) process-driven approach to deliver value minimizing variation from expectation

- a culture of continuous improvement and the reduction of non-value-added activities

- the measurement of data and management using the resulting quantifiable facts (observations)

- the translation of observations into facts through a rubric that sorts what is real and what is not

When applying operational excellence to safety, organizations must implement the EH&S Continuous Improvement Cycle.

EH&S Continuous Improvement Cycle
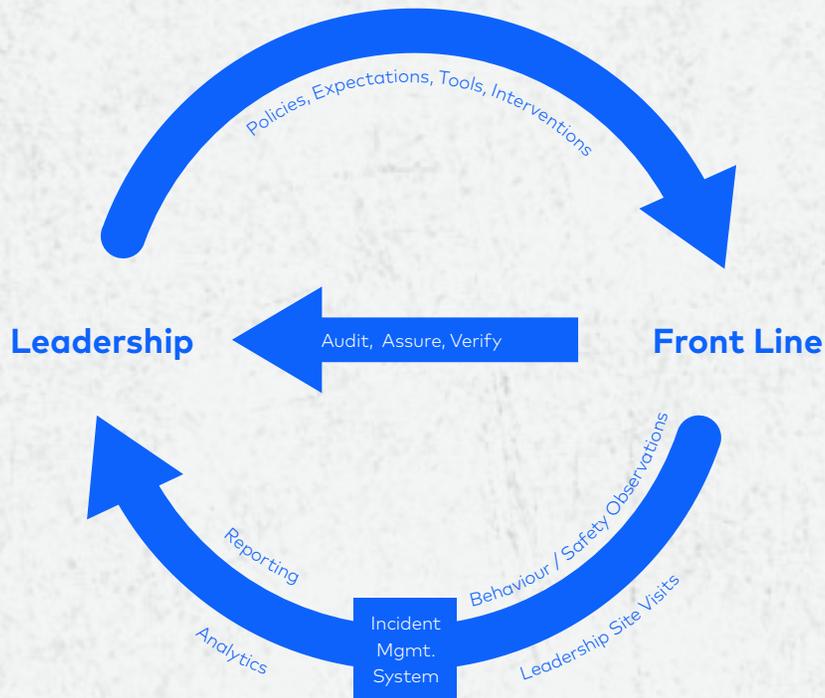
EH&S Continuous Improvement Cycle

The EH&S Continuous Improvement Cycle is a process-driven approach that focuses on the systematic flow of information between those who are at risk, those who affect risk, and those tasked with ensuring compliance with expectation.

Since information can flow quickly, leading indicators surface and can be addressed proactively. This includes both near real-time mitigations as well as institutional deficiencies, as they become evident over time.

Simply put: Data is collected, validated as real, correlated with other data, and insights are surfaced so that stakeholders can make the best safety decisions at all times.

However, we must rely on technology to collect, analyze and disseminate the data to those who can act on it in order to enable this continuous improvement process. This means a whole-scale shift is needed, from a traditional paper-based acquisition of information and Excel-based consumption of it into a flow of information utilizing 21st-century technology.
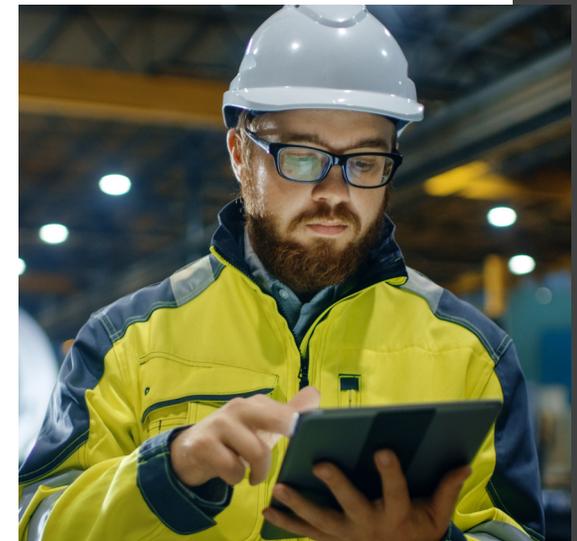
How to Achieve Digitally-Enriched EH&S Continuous Improvement

On the journey to digitally-enriched EH&S Continuous Improvement, the following framework can be used to understand and advance the process. This framework borrows from the Bradley Curve but applies it to technological maturity instead of safety culture maturity.

The goal is to become descriptive, predictive, prescriptive and reflective.

This means understanding and answering:

1. What is happening? (descriptive)
2. What will happen? (predictive)
3. What can we do about it? (prescriptive)
4. What about this continuous improvement process can itself be improved? (reflective)

The illustration shows the safety performance of an organization improving as data quality input and analytics output capabilities grow in breadth and functionality.

There is a stark difference between an organization that has reactionary, flat data reporting capabilities versus an organization that has visibility into their data sets. Data visibility can help answer business questions that are imminent and position future strategic initiatives to affect systemic deficiencies. Self-service analytics can enable a department to garner actionable insights into operations and make decisions towards better performance.

To achieve digitally-enriched EH&S maturity and attain descriptive, predictive and prescriptive capabilities, it necessitates the following four technologies to be implemented over time for data quality to increase and mature:

Achieving Digitally-Enabled Continuous EH&S Improvement

Data Visualization

Digital Acquisition of Leading Indicators

Natural Language Processing

Machine Learning & Predictive Analytics

Incident Rate

Digitally-Enabled EH&S Maturity

Descriptive	Predictive	Prescriptive	Reflective
"what is happening?"	"what will happen?"	"what can we do about it?"	"what can be improved?"
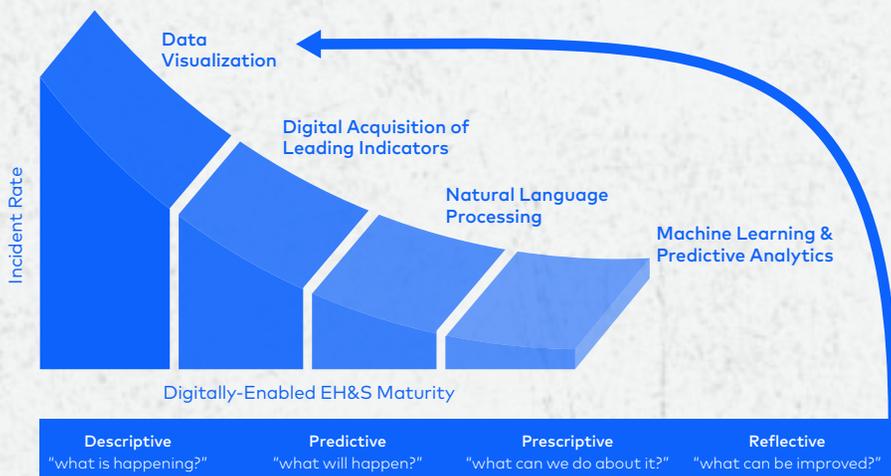
1. Data Visualization

Many incident management systems in the market are unable to visualize or give context to data well. Using data visualization for large data sets allows organizations to see outlying data points, recognize the trends of leading and lagging indicators, and overall give safety data context to tell a story.

Giving safety data context means laying other data sources that allow decision makers to correlate safety performance with other compounding factors. For example, using a data visualization platform, such as PowerBI, the following data can be easily added to safety data within the incident management system:

- Labour hours for employees and contractors to calculate rates such as TRIR, TRIF, LIT and more.

- Miles driven and geographic information system data (such as pipeline length) to normalize incident counts.

- Preventative maintenance data to correlate maintenance or lack thereof when incidents occur.

- Safety culture survey to understand how safety sentiment correlates to safety performance.

- Workforce demographics to see which employees or contractors are the highest risk.

- Project Management data to see how incidents correlate to the project lifecycle.

The visualization platform can then be used to understand and summarize all of this data in a way that allows safety leaders to have visibility into performance, slice-and-dice data to see where problems exist, test hypotheses, and determine what policies or standards are needed to reduce risk.

When it comes to understanding the incidents that occur, companies should not be limited to the data that exists only within their incident management system.

With dynamic visualization, analytics and reporting, organizations can:
- Know what data is good and what data is missing

- Turn incident data into actionable intelligence

- Get real-time insight into leading and lagging indicators

- Enable greater analytical visibility into performance

- Provide leaders with the detail they require to act

2. Digital Acquisition of Leading Indicators

Collection of quality data is crucial to improving safety performance. Deploying mobile technologies and IoT devices is the best way an organization can get a large volume of quality data into their systems. This requires:

- Equipping frontline workers with mobile devices
- Using IoT sensors on equipment

Equip Frontline Workers with Mobile Devices

Paper-based reporting is cumbersome and it often doesn't get done well (if at all), leading to poor data quality. Updating this process by getting mobile devices in the hands of frontline workers allows for the robust collection of information in real-time, or near real-time, when an incident occurs, but also easy tracking of information related to leading indicators. With leading indicators reported on, poor performance can be learned from and changed.

Simply having a device on the worker's person or easily accessible will increase the volume and timeliness of information. But it's not about creating digital versions of paper forms. Organizations must strive for minimally arduous, maximally contextual data entry.

Use IoT Sensors on Equipment

Measuring pressure, temperatures and vibrations on equipment is possible with IoT sensors. Analyzing this data could result in an indication that something is amiss. While it is not always clear what information is useful, the ability to collect it allows decision makers to do something smart with it and start mining it intelligently for correlations. For example, an increase in vibration may result in the failure of a bearing. This could mean a piece of equipment is about to fail which could result in a release of hydrocarbon into the atmosphere. With this knowledge, steps can be taken to correct this before failure happens.

3. Natural Language Processing

Most safety data is free text. But, giving context to this data is often lost because it is difficult to report on a sentence. It's much easier to report on a piece of datum that is number versus human language.

Natural language processing is a form of artificial intelligence that enables computers to analyze and understand human language. Using natural language processing lets an organization gather insight from free text in order to uncover common causes (or themes) that are mentioned in free text of incident reports. Safety leaders can use these insights to understand the root causes of historic incidents better and make changes to mitigate risk.
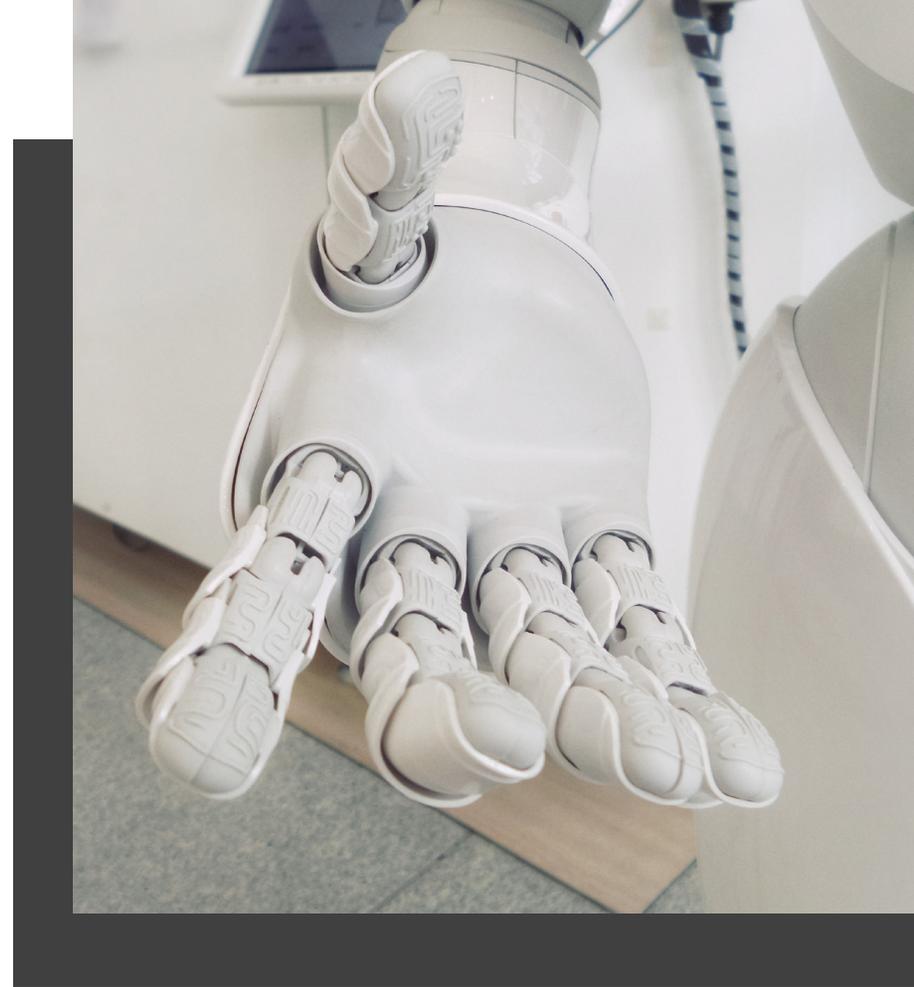
4. Machine Learning & Predictive Analytics

Data visualization, digital acquisition of leading indicators and natural language processing are all efforts organizations can use to create hypotheses and evaluate if the data supports the theories.

Leveraging predictive analytics and machine learning allows software to do the work itself. Predictive analytics is used to evaluate current and historical facts to make predictions about future or unknown outcomes, and machine learning provides systems with the ability to learn and make correlations and flag anomalies automatically.

These technologies can be applied to safety data:

- Predictive analytics can determine leading indicators by identifying which data points from existing reports and audits are significant leading indicators of historic incidents. As a result, safety leaders can develop additional safety procedures to prevent incidents from occurring in the future.
- Machine learning can identify new risks through algorithms which flag anomalous activity within different data feeds. Safety leaders can use this analysis to identify situations where audit scores are "trending red" or are unusual compared to BAU.

As an organization works to achieve EH&S Continuous Improvement, the process begins to look as follows:

The result is process improvements coupled with 21st-century technology solutions that mitigate risk, promote an interdependent safety culture between safety and the business, and translate data into actionable intelligence so that leaders can act to improve safety performance. Operationally excellent companies are safe companies.

EH&S Specialist **Frontline Worker**

1. Mobile Field Data Entry
(Baised towards free text)
- Incidents
- Inspections
- Audits
- Job Safety Analyzers

Data Blending

2. EH&S Analytics Engine
- Text Mining
- Predictive Analytics
- Anomaly Detection

3. Data Visualization
- Correlation
- Causation
- Anomaly Highlighting

EH&S Executive

4. Leadeship Action
- **Improve:**
  - Policies
  - Guidelines
  - Standards
  - Procecdures
  - Mgmt. Systems
- **Investigate**
- **Provide Expertise**
- **Intervene**

Real-World Examples of EH&S Continuous Improvement

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A Global Oil & Gas Company Acquires and Analyzes Data to Improve Safety Performance

Challenge

Required its leaders to perform regular Leadership Site Visits (LSV), however, not all leaders had the knowledge of what to look for on-site and there was no system in place to record areas on non-compliance during the visit.

Reporting required manual analysis of free text, limiting the actionable insights and completely missing many opportunities for health and safety improvements.

Solution

Slalom developed a "risk taxonomy" (a collection of related risks and controls required to prevent risks from becoming incidents of consequence).

Using simple forms on smartphones and other mobile devices data was collected to log areas of non-compliance.

Data was then analyzed and displayed through a self-service visualization tool.

Benefits

Increase in the number of LSVs made

Increase in the value and quality of data upon which critical decisions are made.

Reduction in health and safety incidents

About the Customer

A global independent oil and gas exploration and production company. This client has multiple field operations where staff are required to work in rugged conditions and where the potential for health and safety incidents are high.

"This solution has allowed the company's Health, Safety & Environmental experts to analyze data acquired through their Leadership Site Visits in order to identify areas of systemic non-compliance. With the Slalom Health & Safety Adaptive Engine solution, they are now developing evidence-based interventions to mitigate the areas of highest risk and keep their employees and contractors safe."

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A Global Manufacturer Gets Ahead of Their Incidents

Challenge

- Needed to develop visual and predictive insights on its Health, Safety and Environmental (HSE) incident data to help prevent employee injuries.
- Previous HSE data efforts focused on lagging indicators (incidents that had already occurred) and basic trending against location and product lines.

Solution

- Developed visualization dashboards atop the client's existing HSE incident data systems.
- Combined HSE data with other HR, GIS and project extractions to normalize data and identify issues.
- Led deployment and adoption efforts for hundreds of HSE and operation leaders.

Benefits

- Users are able to drill down into the data, test hypotheses, and seek correlations between leading and lagging indicators.
- Leaders have used insights garnered from the dashboards to make proactive decisions about improving safety performance at the front line.

About the Customer

The most complete energy infrastructure company in the world, focused on EPC (Engineering, Procurement & Construction).

"The client has now deployed the Slalom Health & Safety Adaptive Engine dashboards across the globe, which serve as the primary means of analysis and reporting for health, safety and environmental experts, as well as operations professionals. As a result, users can drill down into the data and leaders can be proactive when making decisions about safety performance."

Slalom's Health & Safety Adaptive Engine

Getting Started with EH&S Continuous Improvement

On your journey to digitally-enabled EH&S continuous improvement, we can help you apply the methodology outlined in this whitepaper to your organization. Slalom has successfully worked with clients to implement these process and technology improvements to mitigate risk and enable leaders to make smarter, data-driven decisions.

Our Health & Safety Adaptive Engine aims to understand and prevent serious incidents through an end-to-end data-driven solution that utilizes natural language processing, machine learning, and data visualization.

Incident Reports

Dip Check Reports

Safety Obs.

Audit Reports

Inspection Reports

Slalom Health & Safety Adaptive Engine

Data Blending

Slalomify

Text Mining

Predictive Analytics

Anomaly Detection

Dashboard
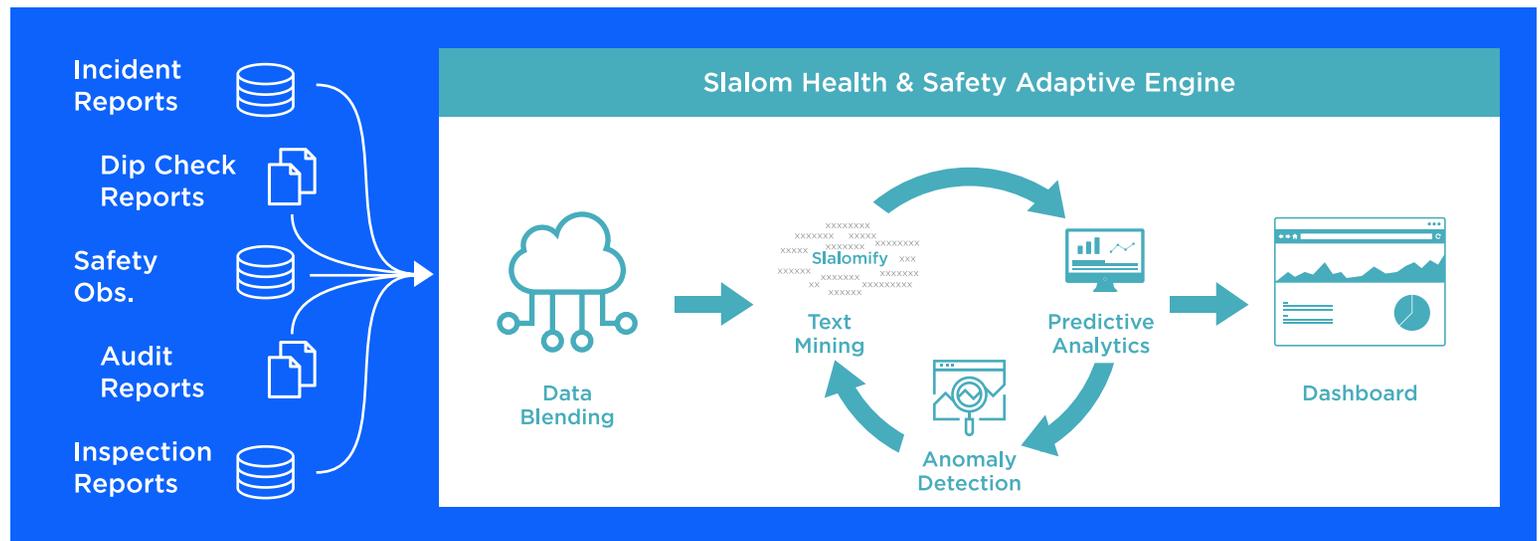
Proof of Concept & Beyond

We can establish a quick Proof of Concept (POC) to create value quickly and begin to lay the foundation to scale the solution within your organization by:

1. Defining the scope – identify priority use cases, data subsets, and more.
2. Mining and analyzing the data – uncover common themes, leading indicators, and new risks.
3. Presenting finding – develop and present a dashboard to visualize the results.

With a successful POC, we can analyze the potential to scale the solution, create an adoption strategy, and deploy the solution as your organization begins to establish a culture of operational excellence.

To get started with your Proof of Concept or to learn more about our Health & Safety Adaptive Engine, get in touch today.

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Details

Steps to Continuously Improve Our Safety Approach

We'd love to get your feedback on our whitepaper. Every approach requires continuous improvement – share with us your thoughts, experiences within the safety industry, and practices that are helping your organization improve safety performance.

Email us at **aaron.butler@slalom.com**

[1] International Labour Organization, Safety and Health at Work, from http://www.ilo.org/global/topics/safety-and-health-at-work/lang--en/index.htm

[2] Liberty Mutual Research Institute for Safety cited in Global Wellness Institute, The Future of Wellness at Work, January 2016

[3] International Labour Organization cited in Global Wellness Institute, The Future of Wellness at Work, January 2016

[4] Occupational Safety & Health Administration, Q&A's for Small Business Employers, from https://www.osha.gov/Publications/OSHA3163/osha3163.html

References