

The Challenge of Safety Metrics

Leading indicators
in real-world applications



Executive Summary

As safety strategies evolve from reactive to preventive, leading indicators have become essential tools for improving performance. Yet while much has been written about what to measure, less is known about how to make those metrics work in practice.

This white paper, developed through a collaborative effort between the National Safety Council (NSC) and Campbell Institute members, explores the real-world conditions that influence whether leading indicator programs take root and deliver lasting value. Drawing on insights from professionals across logistics, aviation and manufacturing, the report highlights the organizational, cultural and strategic factors that shape success.

Key findings include:

- Leadership engagement is the single most critical enabler. When leaders model expectations and align on goals, metrics gain traction.
- Cross-functional collaboration and site-level ownership help ensure indicators are relevant, actionable and embedded in daily operations.
- Data quality and usability matter more than quantity. Organizations that focus on meaningful metrics see better results than those overwhelmed by data.
- Reporting structures, including non-punitive reporting and shared accountability, support sustained use of indicators.

This report also features a case study from DSM-Firmenich, detailing how the company unified its Environment, Health, and Safety (EHS) metrics during a global merger. Its experience underscores the importance of aligning systems, engaging local teams and continuously reassessing which indicators truly matter.

Ultimately, this research reinforces a central truth: metrics don't drive change; people do.



Background: leading vs. lagging indicators

For decades, safety performance has been measured primarily through lagging indicators such as injury rates, lost workdays and incident counts that reflect outcomes after harm has occurred. While these indicators remain important, they are inherently reactive and offer limited value in preventing future incidents.

In contrast, leading indicators provide a proactive lens into safety performance (Hohn and Duden, 2009; Toellner, 2001). These metrics offer early signals of potential risk. When implemented effectively, they allow organizations to identify and address deficiencies before they result in harm, supporting prevention efforts and continuous improvement.

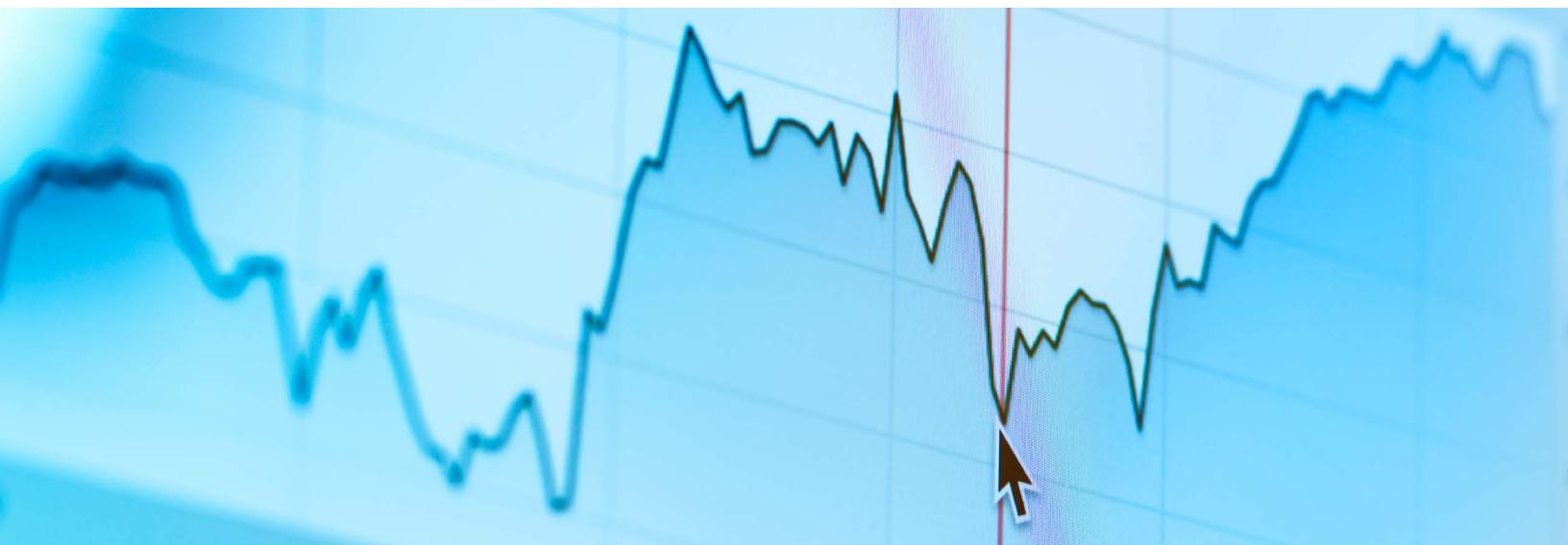
Over the course of four foundational white papers, the Campbell Institute has progressively advanced the understanding and application of leading indicators in EHS systems:

1. The first paper, [Transforming EHS Performance Measurement through Leading Indicators](#) (2013), established a definition and outlined the critical characteristics of effective indicators.
2. The second, [Practical Guide to Leading Indicators](#) (2015), introduced a categorized matrix of indicators and metrics, supported by case studies from member organizations.
3. The third, [Elevating EHS Leading Indicators: From Defining to Designing](#) (2015), explored implementation strategies and organizational journeys using a Plan-Do-Check-Act framework.
4. Finally, [An Implementation Guide to Leading Indicators](#) (2019) provided benchmarking tools to assess organizational maturity and complexity, helping organizations select and refine metrics based on readiness and strategic goals.

While the Campbell Institute's prior research has laid a strong foundation by defining leading indicators, categorizing them and offering implementation strategies, there is still more to learn. Specifically, questions remain about the organizational conditions that enable leading indicators to be successfully adopted, sustained and embedded into safety management systems.

To explore these dimensions, the Campbell Institute facilitated a collaborative discussion with safety leaders from a range of industries, including logistics, aviation and manufacturing. This qualitative inquiry focused on real-world experiences with leading indicators, emphasizing not just what metrics were used, but how they were implemented, supported and refined.

Participants shared insights on leadership engagement, cross-functional collaboration and data system usability. The discussion also surfaced common enablers and barriers, such as the role of site-level ownership, the importance of non-punitive reporting systems and the challenge of managing data overload. This approach provided a rich, contextual understanding of how leading indicators function within complex organizational environments.



Results

The current effort brought together safety leaders offering a candid look into their organizations journeys with leading indicators. While their industries and organizational structures varied, the discussion revealed a surprising amount of common ground, particularly around implementation challenges, the complexity of data systems and the importance of leadership support.

Several types of leading indicators were mentioned throughout the investigation. These included:

- Overtime and scheduling metrics
- Absenteeism and turnover rates
- New hire and new-to-role percentages
- Corrective action closure rates
- Schedule attainment and escalation metrics
- Risk assessments and risk reduction targets
- Ergonomic risk scores
- Incident investigation quality (e.g., number of root causes, type of controls implemented)
- Training participation and hours
- Employee engagement surveys
- Anonymous safety reporting systems
- Weather-related operational risk indicators
- Reporting of hazard IDs
- Use of facilitators in incident investigations
- EHS observations per FTE (Full Time Employee)
- Lifesaving rules status
- Timely follow-up of EHS actions

Enablers of Success

Cross-functional collaboration and engagement (e.g., HR, operations, safety)

Customization of indicators to specific business units or sites

Inclusion of site-level staff in tool development and goal setting

Non-punitive, anonymous reporting systems

Regular communication and review of metrics with leadership to support continuous improvement

Intentional selection of indicators that reflect the organization's highest safety risks and are actionable at the operational level.

Use of data analytics and dashboards to track leading indicators, for visualization and reporting

Use of facilitators to improve the quality of incident investigations

The members offered a rich, complementary view into how leading safety indicators are being implemented, refined and challenged across industries. A central theme was the critical role of leadership, in which the message is clear: when leadership sets the tone, aligns on goals and actively engages with metrics, safety initiatives gain traction. Conversely, when leadership is disengaged or inconsistent, even the best-designed metrics struggle to take root.

Another shared insight is the tension between data abundance and data utility. Some organizations emphasized that they track dozens of metrics, sometimes too many. Participants voiced concern about distinguishing meaningful signals from background noise, especially as artificial intelligence (AI) and predictive analytics become more integrated into safety systems.

Reporting structures themselves were identified as a critical enabler of metric effectiveness. Systems that support timely, accessible and non-punitive reporting enable organizations to capture more accurate and actionable data. As one member stated, in mature systems, reporting is seen not as a compliance burden but as a proactive, even rewarding, behavior.

The use of anonymous, non-punitive reporting and an emphasis on lifesaving rules and site-level ownership reinforce the idea that safety is everyone's responsibility. These practices help embed safety into the organizational fabric, making it less about top-down enforcement and more about shared accountability.

The importance of customization and local relevance was another recurring theme. While corporate-level metrics provide consistency, organizations are finding success by allowing business units or sites to define their own KPIs based on local risks. This bottom-up flexibility ensures that metrics are not only tracked but also acted upon. It also fosters a sense of ownership and relevance, which is often missing when metrics are imposed from above without context or support.

Barriers to Success

Competing priorities (e.g., safety vs. performance)

Difficulty in aligning corporate goals with site-level capabilities

Insufficient resources at the site level to implement new tools or initiatives

Lack of clear messaging from leadership on the importance/value of leading indicators

Lack of real-time data for some metrics (e.g., HR data updated monthly)

Lack of training or qualified personnel to evaluate risk assessments

Poor data quality and inconsistencies across systems

Resistance due to past failed implementations

"Too many" metrics being tracked, leading to data overload

Turnover in key leadership roles affecting continuity



Case Study

dsm-firmenich

Following a major corporate merger, DSM-Firmenich began the process of unifying its EHS practices across a newly integrated global organization. With legacy systems, cultures and metrics from both predecessor companies, the organization faced the challenge of harmonizing its approach to leading indicators. This transition presented an opportunity to reexamine how EHS performance is measured and to build a more focused, strategic framework for proactive risk management.

The selection of DSM-Firmenich's global leading indicators was the result of a collaborative process led by the organization's EHS leadership team. This group, composed of regional representatives, business unit partners, and global subject matter experts, evaluated existing metrics and defined a focused set that could be applied consistently across the newly merged company.

The three selected indicators were:

- **Implementation Status of Life-Saving Rules:** DSM-Firmenich introduced a set of ten life-saving rules, deployed in two phases across sites. Each site reports its implementation progress based on standardized criteria, allowing for consistent measurement and completion.
- **Timely Follow-Up of EHS Actions:** This indicator tracks the closure rate of safety-related actions, including those stemming from incidents and risk assessments. With a target of 95% completion, it emphasizes accountability and responsiveness at the site level.
- **EHS Observations per FTE:** This metric encourages observation-based reporting from all employees, helping embed safety into daily operations and fostering a proactive safety culture.

Once the proposed indicators were developed, they were formally reviewed and validated by the Operations Leadership Team (OLT), which includes the heads of manufacturing for each business unit. This step was critical in ensuring that the indicators were not only aligned with strategic safety goals but also grounded in operational reality. By securing buy-in from operations, the organization reinforced the principle that safety performance is a shared responsibility and that leading indicators must be both meaningful and actionable at the site level.

To ensure a smooth transition, DSM-Firmenich prioritized selecting indicators that could be measured reliably within both legacy data systems. This allowed sites to begin tracking the new metrics immediately, even before the rollout of a unified platform. At the same time, the organization launched a major initiative to implement a single global EHS data system that would eventually replace the inherited platforms. The rollout was intentionally designed with overlap, allowing sites to report in both systems during the final quarter of the year. This phased approach gave teams time to adjust, minimized disruption, and provided a safety net for reporting accuracy.

Pilot testing played a central role in the implementation strategy. Sites from various regions and business units were selected to simulate reporting workflows in the new system, offering feedback on usability and functionality. These pilots helped refine the system configuration and ensured that the indicators could be integrated effectively. Training and support were provided throughout the process, reinforcing the organization's commitment to consistency and readiness across all levels.

DSM-Firmenich's experience illustrates how a newly merged organization can strategically navigate the complexities of harmonizing EHS practices across global operations. By selecting a focused set of leading indicators that were both measurable across legacy systems and operationally validated, the company ensured early adoption and credibility. The phased rollout of a unified data system, supported by pilot testing and training, demonstrated a pragmatic approach to change management.

While global consistency was achieved through the three core indicators, business units and sites were also empowered to define additional metrics tailored to their specific risks and maturity levels, ensuring relevance and ownership at every organizational level. Crucially, the organization's emphasis on leadership as a driver of safety performance helped embed these changes into the broader culture. DSM-Firmenich laid the foundation for a resilient and adaptive leading indicator framework that can evolve with the organization over time by positioning safety as a line responsibility and securing executive and operational buy-in.

Discussion

This research reinforces a central truth in organizational safety: metrics alone do not drive improvement; people do.

One theme emerged consistently across diverse industries and organizational structures: leadership accountability is essential. When leaders set clear expectations, engage with data meaningfully and model the behaviors they wish to see, leading indicators become more than performance tools: they become instruments of cultural alignment. Crucial for leaders is establishing a defined way of making the metrics visible and easy to communicate in processes like shift huddles, site leadership meetings and business unit meetings.

Achieving meaningful progress with leading indicators also requires a deliberate balance between top-down direction and bottom-up ownership. While executive leadership plays a critical role in setting expectations, allocating resources and modeling safety priorities, the frontline workforce often holds the most immediate insight into operational risks.

Empowering site-level teams to define, adapt and act on metrics relevant to their context ensures that indicators are not only aligned with strategic goals but also grounded in day-to-day realities. When both levels are aligned, leading indicators become not just a management tool, but a shared language for safety improvement.

An intentional design of reporting environments is a foundational component to ensuring balance between leadership and site-level leadership metrics efforts. What sets these organizations apart is not how much data they collect, but how intentionally they design reporting systems to support learning, recognize contributions and reinforce shared accountability. In these environments, reporting is not a risk but a contribution recognized, rewarded and integrated into the rhythm of daily operations.

This mindset is supported by the Human and Organizational Performance (HOP) philosophy, which emphasizes the importance of building systems that account for human error. By focusing on resilience, organizations can better respond to unexpected challenges and reduce the likelihood of incidents.

"HOP is an operating philosophy that recognizes error is part of the human condition and that an organization's processes and systems greatly influence employees' decisions, choices and actions, and consequently their likelihood of successful work performance." (NSC, 2021)

While anonymous and non-punitive reporting systems can serve as transitional scaffolding, the long-term goal of HOP principles is to shift toward systems thinking, which acknowledges human error as a natural part of work and designs processes to anticipate and mitigate its impact. In such environments, transparency becomes normalized, and safety ownership is distributed across all levels of the organization, enabling resilience and continuous learning rather than blame.

Yet the promise of data can quickly become a burden. Many organizations are grappling with the challenge of too much information and too little clarity. The proliferation of metrics, while well-intentioned, can dilute focus and obscure the very risks they are meant to illuminate. Grabowski et al. (2007) emphasize the importance of distinguishing between objective and subjective indicators, a distinction that becomes increasingly relevant in data-rich environments. This simplification also supports better data quality, which is essential for future AI-driven safety modeling.

Some of the most effective organizations are finding value not in measuring everything, but in focusing on metrics that reflect meaningful progress on their most significant safety risks. This approach doesn't reject comprehensive data collection but emphasizes the importance of clarity and relevance. It requires both technical discernment and a willingness to periodically revisit, refine and, when necessary, retire indicators that no longer provide actionable insight. As one member stated,

“Don't assume the metrics you start with will still be the same metrics in 12 months. You will find some metrics you thought were meaningful will not be worth tracking or aren't aligned with the organizational objectives.”

When chosen thoughtfully and supported by leadership, culture and systems, they can transform safety from a reactive function into a proactive, participatory practice. The challenge ahead is not just to adopt more metrics, but to ensure that the ones we choose truly matter.

Practical Applications

To translate insights into impact, organizations must take deliberate steps to embed leading indicators into their everyday operations successfully. Building off the Campbell Institute's body of work on leading indicators and the findings of this research, organizations may consider:

- ☐ Engaging stakeholders at all levels to champion the use of proactive safety metrics and foster a culture of shared responsibility
- ☐ Ensuring transparency and ownership by encouraging open reporting, communicating results through proper leadership channels, and following up consistently
- ☐ Prioritizing a focused set of meaningful indicators that reflect the organization's highest safety risks and are **actionable** and clearly **understood** across all levels
- ☐ Investing in systems and training that support continuous learning, adaptation and improvement of safety practices

While the value of leading indicators is well established, their success ultimately depends on an organization's readiness to implement them. Defining better metrics is only part of the equation: building the cultural, structural and strategic foundation to support their use is what turns potential into performance.

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Campbell Institute Leading Indicator Resources

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