Safety Management

SH&E Strategic Planning

A maturity-criticality approach to continuous improvement

By David Steinbacher and Anthony Smith

EVERY SH&E PROFESSIONAL FACES some tough questions each year. What SH&E processes and programs must be improved in the coming year to improve safety and health performance and reduce risk? What new programs need to be developed to address new regulatory requirements? What will benefit this organization the most? Are the SH&E plans aligned with business needs? What are the primary areas that warrant attention and how can the efforts be prioritized? These are just a few of the many types of questions an SH&E professional will likely deal with each year when formulating improvement strategies, initiatives and functional or business goals for an organization.

The process of formulating SH&E strategy and setting goals is typically a function of the performance management system unique to an organization. Because processes may range from informal to highly formal, an SH&E practitioner's freedom, with respect to SH&E planning, is often organization dependent.

For example, a professional working within a culture where company-wide functional goals are formally cascaded down from the corporate level to divisions or individual locations may enjoy less flexibility in strategic planning and goal setting than a practitioner in a smaller organization or in an organization whose individual operating units have greater freedom. This leads to SH&E plans designed more from a corporate perspective with less emphasis on local needs or culture. Conversely, professionals working in cultures that allow more autonomy may have considerable latitude in setting SH&E direction and improvement strategies.

Regardless of the planning process used, SH&E plans must ultimately consider, and be in alignment with, the needs of all levels of the business and its stakeholders if they are to be effective. Rancour (2005) emphasizes this when reporting the benefits of using Malcolm Baldrige quality framework criteria in SH&E strategic planning. He asserts that SH&E professionals need to be more attuned with, and play an active role in, the business planning process if overall business excellence is to be achieved. This starts with integrating SH&E planning with business planning to add overall value to the organization.

Care and thought should be given to the methodologies used to identify and prioritize those programs and processes that will have the greatest impact on the SH&E system and the company as a whole. Unfortunately, reactionary "firefighting" strategies are often the focus in the interest of finding a quick fix. While one must respond to historical trend information, the organization's vision and long-term initiatives to get there should remain the focal point from a planning perspective. To transform SH&E attributes in a manner that reflects business needs, one needs a clear strategic roadmap.

In designing an SH&E planning framework within a biotechnology research and commercial manufacturing organization, the authors designed a systematic approach for assessing and prioritizing

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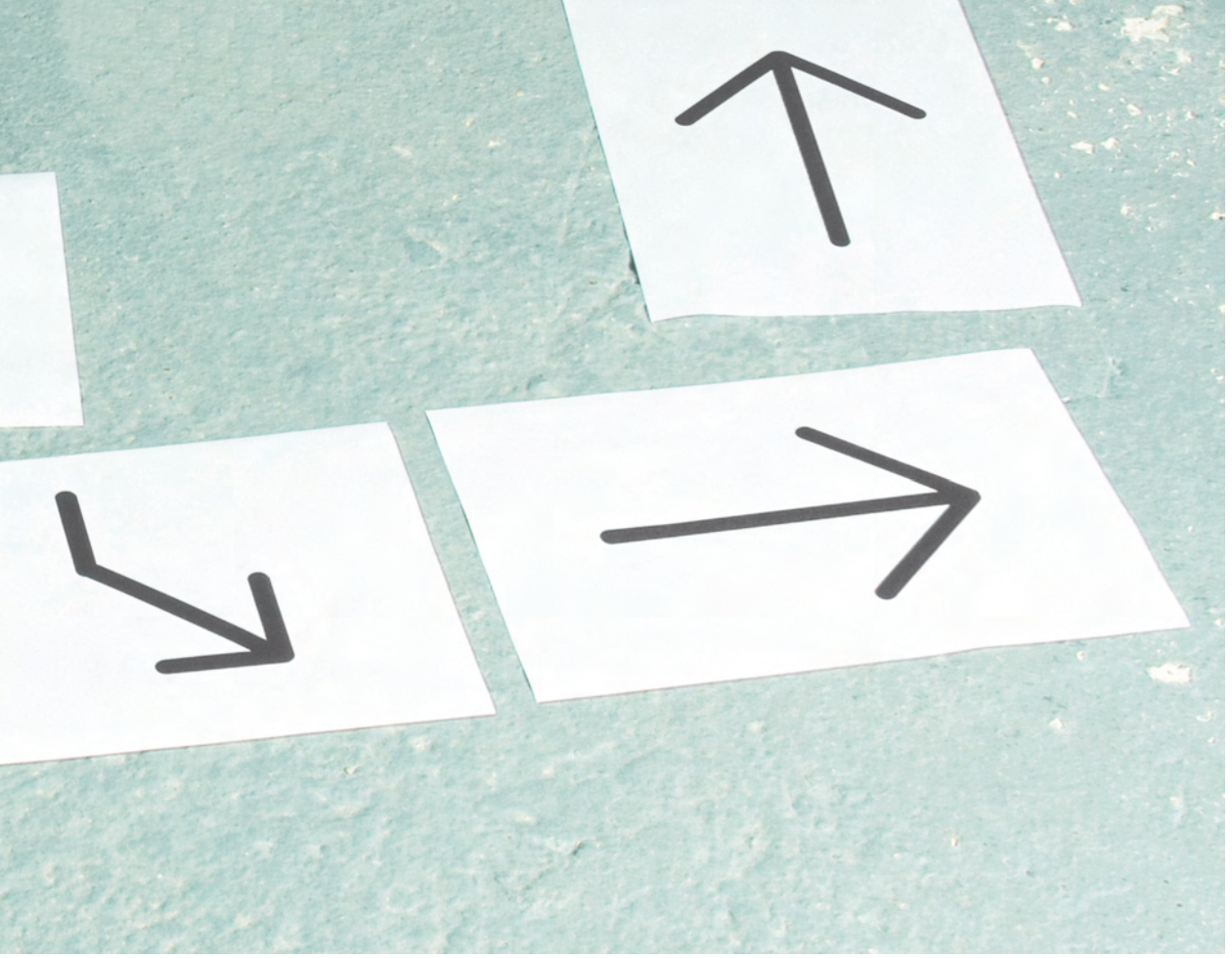


Abstract: *Effective SH&E planning plays a vital role in an organization's efforts to attain near-term goals and its vision of the future. A systematic, quantifiable approach was designed and implemented to target specific SH&E program aspects for improvement. Using this methodology, the authors assessed the maturity of SH&E system elements, as well as their potential impact on or criticality to the organization, to more effectively prioritize SH&E improvement actions. The usefulness of this approach within the context of SH&E strategic planning is discussed.*

SH&E system aspects. This easily deployed methodology takes into account system maturity and the critical nature of each of its essential elements. It can be a useful tool for those seeking to determine which improvement areas to tackle. The benefits of this methodology are explored within the overall context of SH&E strategic planning.

Begin With a Vision

To plan, one must first have a clear vision of the desired future organization. Ackoff (1999), a pioneer in interactive planning, emphasizes that a picture of the organization's aspirations and where it ultimately wants to be is essential. Creating a vision is an integral part of the *ends planning* stage of interactive planning, where the current system is redesigned to create a future idealized design.

The planning process then seeks to reduce the gaps between the desired design and the system's current state in an attempt to make the vision a reality now. This contemporary approach has significant positive implications for SH&E strategic planning. Leemann's (2002) effective application of interactive planning at DuPont led to dramatic improvement in SH&E functional design that increased overall value to the business.

Putting a vision into something tangible for an organization normally begins with the creation of a mission statement. A mission statement is unique to an organization; when well written, it provides inspiration and a visualization of the organization's ideals (Ackoff, 1999). With respect to SH&E aspirations, this may involve adding specific attributes to the system to support the business and its stakeholders. These could entail ideals such as creating a work culture in which safety is viewed as a value, establishing industry-leading SH&E programs and processes, or achieving benchmark performance levels.

Figure 1

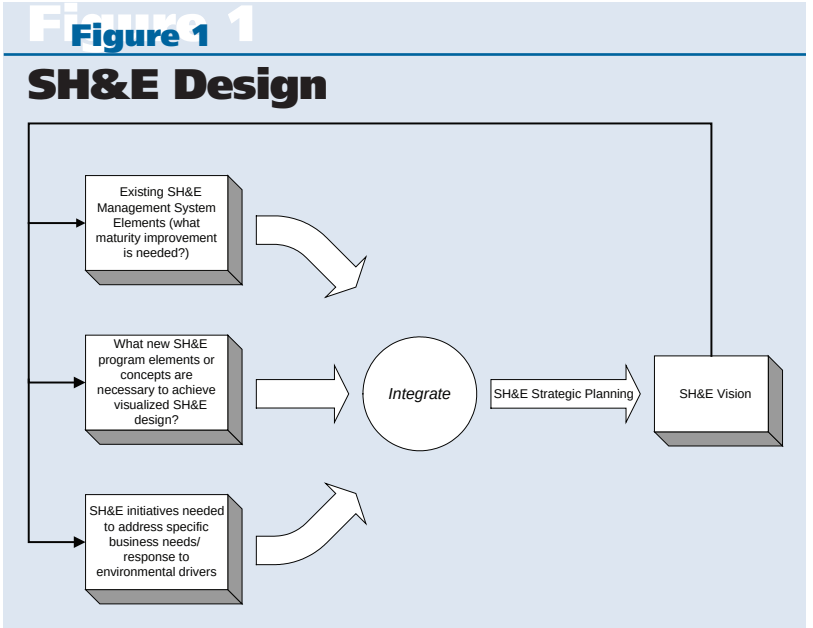


Figure 1: Having a clear picture of the ideal SH&E design or vision is essential. This forms the basis for identifying, evaluating and integrating SH&E program aspects needed to make the SH&E vision a reality.

Figure 2: To be effective, SH&E planning must consider multiple drivers that influence the organization and the SH&E system.

For an organization to realize its SH&E vision, it must identify the system elements that must be created, improved or changed, and establish some prioritization method. This requires a thorough understanding of the current state of the SH&E system, the business environment and the organization's culture. Figure 1 (p. 31) provides a high-level view of the fundamental aspects to be considered and integrated when creating a strategic SH&E plan that leads to vision attainment.

For example, are the current system and its processes effective? Are new programs needed to elevate the system to the desired state? What new technologies can be introduced to bring about the desired change? When considering these questions, one must recognize that the system is not static nor does it exist in a vacuum. Not only must it meet the needs of all stakeholders while fully supporting business objectives, it is also subject to many influential environmental factors to which it must adapt.

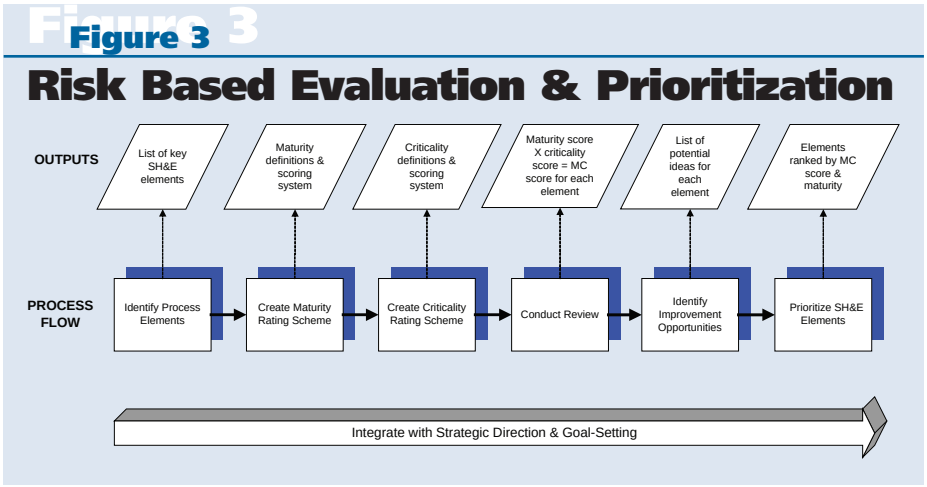


Figure 3: Risk-based evaluation and prioritization can be an effective component in a comprehensive SH&E strategic planning process.

What Are the Environmental Drivers? Who Are the Stakeholders?

To design an effective plan, one must develop a clear picture of the current SH&E system and compare it to the long-term strategic vision. This requires understanding the key environmental factors that influence the organization and affect the SH&E planning process. Steiro and Hokstad (2006) note that environmental stressors play a significant role in influencing planning priorities involved in controlling risks. They underscore the fact that multiple perspectives must be considered during the planning process to enable appropriate prioritization and management of risk initiatives.

Therefore, many factors, both internal and external, must be considered during the SH&E planning process (Figure 2). Internal factors that influence a company's strategy include organizational culture, historical SH&E program performance, operational risks, specific business needs and strategic direction.

Organizational stakeholder needs must also be considered. Typical stakeholder groups include employees and managers at each organizational level, the board of directors, shareholders, the community, union organizations and regulatory agencies.

Gathering & Evaluating Data

Data must be obtained that accurately reflect the current environment and the anticipated challenges stemming from implementation of planned business objectives. Many methods can be used to obtain information needed to evaluate a system.

For example, perception surveys assess safety climate and cultural aspects as well as identify potential areas of stakeholder concern (Dingsdag, Biggs & Sheahan, 2008). Incident trend analysis and six sigma analytical tools can be used to identify potential safety process weaknesses (ReVelle, 2004). Inspections and audits provide a snapshot of compliance with applicable regulations while behavioral observation systems have been used to assess behavioral conformance to safety requirements (Sasson, Austin & Alvero, 2007). Vulnerability and security risk assessments are becoming a larger component in SH&E planning as well given the increased focus on safeguarding chemicals (Moore, Fuller, Hazzan, et al., 2006), biological agents (Atlas, 2005) and radioactive materials (Nuclear Regulatory Commission, 2004) from acts of domestic terrorism.

Information obtained from these assessment activities should provide a comprehensive picture of the current SH&E system's effectiveness, its strengths and weaknesses, as well as its alignment with business needs and stakeholder expectations. The challenge then becomes how to integrate this information so that it facilitates planning for necessary future change.

A Maturity-Criticality Perspective to SH&E Planning

Applying a systematic method that looks at the relative importance of SH&E program components helps to guide the direction and prioritization of improvement efforts (Cagno, DiGiulio & Trucco, 2001). For example, one might look at each system element from the perspective of program development, or maturity, as well as its relative degree of importance to the SH&E system and the business. Unlike informal planning activities, taking a systematic approach that incorporates a maturity-criticality perspective helps to build a more logical rationale for planning decisions, functional objectives and individual goals.

In developing such an approach, the authors con-

sidered criteria that could be easily adapted and applied by SH&E professionals regardless of organization type or size. The authors determined that the method must:

- be simple to use and not involve a major commitment of time to perform;
- provide a systematic method that makes sense to management;
- align SH&E initiatives to business needs;
- make functional and individual goal setting faster and easier;
- include visual indicators to monitor process improvement.

The result was an approach that entails maturity and criticality assessments of individual SH&E program elements to arrive at a quantitative, maturity-criticality (MC) score. This information was then used to help establish priorities for planning system improvements and allocating resources. Figure 3 provides an overview of the primary steps involved and their associated outputs.

SH&E planning activities are typically scheduled to integrate with an organization's business planning cycle, which is when organizational and functional objectives are formalized and budgets are established. Therefore, activities associated with this approach should be performed in advance to allow sufficient time for quality analysis. This helps to ensure alignment with organizational goals as well as to adequately determine the budget needed to support critical initiatives.

Because of the dynamic nature of many organizations, business strategies and objectives may change during the year as a result of internal and external influences. Therefore, SH&E planning should be flexible and adaptive to allow for periodic adjustments. This will ensure that SH&E priorities remain aligned with the organization's needs. Also, depending on the organization, the budget planning process may not occur at the same time that organizational objectives are established. Thus, periodic SH&E planning reviews may be warranted.

Table 1

Maturity Rating Scheme

Maturity score	Maturity level	Definition
1	Introduction	System element does not exist or is in early stage of development. Major gaps exist between vision/idealized design and current state.
2	Informal	Early stages of a formal system. Moderate gaps still exist between vision/idealized design and present state.
3	Functional	Formal system established. Functions in well-managed and controlled fashion. Minor or no gaps exist between vision/idealized design and present state.
4	Model	Model process that is a benchmark for others.

Table 2

Criticality Rating Scheme

Criticality score	Criticality level	Definition
1	Business critical	Required for sustained business operation. If lacking, potential for significant regulatory noncompliance, fatality or serious injury, penalties and fines, major adverse event, adverse public relations.
5	Core	Key element or required process essential for proper management of SH&E functional aspects.
7	Improvement oriented	Element part of ongoing process improvement to enhance the SH&E management system.

Tables 1 and 2: Defining program maturity levels and scoring them is an important means of assessing the capability of those systems essential for safety achievement. A criticality score provides perspective on the relative importance of each specific element and the risk the organization faces if the element is not adequately developed or controlled.

Identify SH&E Management System Elements

With a clear vision of the desired SH&E system and an understanding of environmental drivers and stakeholder needs, SH&E system elements are evaluated to determine a baseline for improvement. Various approaches can be taken to achieve this. An organization using structured management systems such as OHSAS 18001 or OSHA Voluntary Protection Programs has well-defined management system components that receive periodic review. Other organizations may need to spend some time to determine what key aspects comprise their SH&E systems.

Once identified, an organization can break these major elements into subcomponents as appropriate to obtain the desired level of detail. Consider this biosafety program example. A biosafety program system element could be evaluated in its entirety or divided into subcomponents for evaluation, depending on need. Subcomponents would include aspects such as institutional biosafety committee, biosafety risk evaluation process, biological material importation/exportation, permitting of select agents, biological containment and biosafety levels, biosafety procedures and protocols, biosecurity and biological emergency response. Again, the level of element detail should be based on the organization's needs and specific vision for improvement or growth.

Identify a Maturity Rating Scheme & Assess Each Element

Once SH&E system elements are identified and broken into subcomponents, a rating system is designed to determine the maturity level of each element. This will provide a baseline from which quantifiable improvement can be ascertained and tracked.

Defining program maturity levels and scoring them is an important means of assessing the capability of those systems essential for safety achievement. Strutt, Sharp, Terry, et al. (2006) provide a design capability maturity model that defines five maturity levels—initial, repeatable, defined, managed and optimized—that are scored on a five-point scale to assess an organization's overall maturity.

They report that maturity-scoring approaches have been used by other systems as well. One example is ISO 9004 (2000), which looks at five maturity

levels (no formal approach, reactive approach, stable formal system approach, continual improvement emphasized, best-in-class performance). Each level is scored on a five-point scale as well.

For the purpose of this project, the authors designed and defined a simplified four-point scoring system (Table 1, p. 33). This scheme consists of four distinct maturity levels: introduction, informal, functional and model. Each level is assigned a numeric score ranging from 1 to 4 for use in ranking maturity.

At the introduction level, a program element is either absent or in the earliest stage of development. Considerable gaps exist between the current and desired states. This is characteristic of new business ventures that require SH&E interventions. New processes present new potential hazards that may warrant extensive safety programs or controls. An organization may also wish to explore a new technology to improve its performance or establish programs to address new regulatory requirements. As noted, many factors may precipitate the need to create new programs to achieve the SH&E vision.

At the informal level, system elements are beginning to take shape. Initiatives have been undertaken and progress is being made to establish a formal program; however, it still lacks formal structure. At this level, moderate gaps may exist with respect to written operating procedures, training and performance execution. Additionally, required stakeholders may not be participating to the extent necessary for overall program success.

Program elements at the functional maturity level have been fully implemented and are characterized by well-managed and controlled processes. If viewed from a regulatory perspective, noncompliance situations would be rare. All stakeholders embrace these programs and few gaps exist between the present state and the SH&E vision.

A model system element stands out as a benchmark for other organizations. It typically incorporates cutting-edge technologies or management approaches that offer benefits for a broader range of organization types and industrial sectors.

When assessing program maturity, keep in mind that maturity levels are not static and could change in either direction over time. While the intent is to continually improve the maturity level of all SH&E elements, stakeholder needs and environmental drivers may warrant program expansion or additional program attributes. These, in turn, could result in a lower maturity rating until improvements are made. Programs may also slip over time due to management inattention or lack of employee participation. Therefore, one must maintain a critical perspective and incorporate all available data when assessing and scoring program maturity.

Table 3: Sample of SH&E elements ranked by MC score. Additional subranking and prioritization based on maturity and criticality scores may also be considered in determining appropriate areas of focus.

Table 3

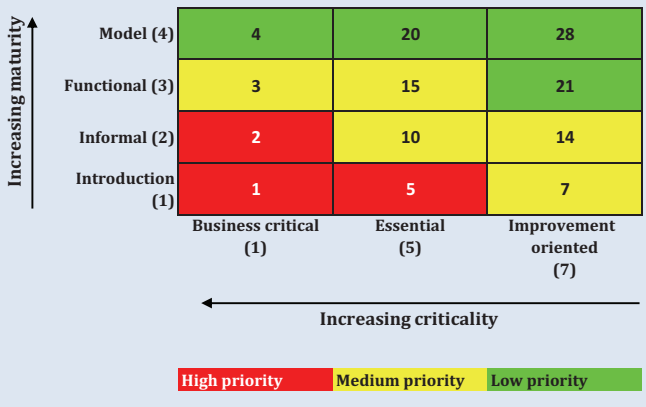
Sample of SH&E Elements Ranked by MC Score

Element	M	C	MC	Improvement opportunities
Driver safety	1	1	1	Vehicle safety and driver training program for sales force.
Radiation program	4	1	4	Improved procedures for internal distribution of materials.
CAPA system	1	5	5	Needs analysis/vendor review for implementation next year.
Safety six sigma, 5-S	1	7	7	Introductory training on concepts.
Contractor safety	2	5	10	Online contractor management database.
Leading indicators	2	7	14	KPI tracking system.
Ergonomics	3	5	15	Discomfort survey tool to identify at-risk employees.

Figure 4: A matrix diagram can provide additional visual guidance in determining appropriate priority levels.

Figure 4

MC Decision Matrix



Identify a Criticality Rating Scheme

Rating the maturity of key system elements provides a meaningful perspective on how developed a program is as compared to where it ultimately needs to be. However, it is difficult to establish priorities when a long list of programs are at relatively low maturity levels. For this reason, combining a criticality score with the maturity level score allows for more rational and justifiable prioritization. A criticality score provides perspective on the relative importance of each specific element and the risk the organization faces if the element is not adequately developed or controlled.

Again, the scoring system should be based on organization-specific needs. The authors designed a three-point system rating (Table 2, p. 33). Criticality categories were defined as business critical (score = 1), core (score = 5) and improvement-oriented (score = 7). This scheme's broader range allows for greater differentiation of scores. Added weighting was given to business-critical programs to account for the severity of the adverse outcome of failing to effectively implement that system element.

Business-critical are those character-

ized as having the potential to create a significant negative impact on the organization if not effectively implemented. In addition to physical catastrophes (e.g., serious business interruption, loss of life, significant property damage), the organization could suffer regulatory and legal challenges, negative publicity, and damaged public image and lower shareholder confidence. These also include aspects essential to business operation, including the ability to secure appropriate licenses and permits.

Core system elements are fundamental processes needed to effectively manage the SH&E system. These would include training, risk evaluation, incident investigation and analysis, ergonomics, occupational health programs, audits and inspections, and corrective and preventive action systems.

Improvement-oriented programs are those necessary for ongoing continuous improvement of the SH&E system. Examples include development of key performance indicators to monitor and track performance, management review processes, and implementation of 5-S or safety six sigma programs.

The criticality of an SH&E system element is entirely organization dependent and should reflect the potential hazards and risks inherent within the business and its operations. What may be considered improvement oriented by one organization may be deemed more critical for another organization and vice versa.

Evaluate & Rank Critical Elements

With the desired rating system defined, each program element is reviewed and discussed. To review a biotechnology research environment, the authors used a brainstorming approach. It encompassed SH&E professionals, employee feedback through a safety climate survey, and data derived from various vulnerability and safety assessments to provide perspectives and insights for each system element. Additional stakeholders can also be asked to participate to gain additional input and perspectives.

The evaluation of each system element:

- determines maturity and criticality scores;
- calculates MC score by multiplying the maturity and criticality scores;
- identifies and leads to discussion of improvement opportunities;
- determines cumulative mean maturity score;
- ranks elements according to MC score (lowest to highest) followed by maturity level to assist in prioritization.

The process of ranking and prioritization becomes easier once each element's maturity and criticality are determined. With this information, the SH&E planner can more clearly differentiate the relative importance of the many programs and processes that must be considered with respect to achieving the overall SH&E strategic vision. By ranking system elements by MC score, key programs begin to stand out, which enables more focused improvement efforts (Table 3).

A matrix diagram can be a useful aid in determining priority levels. As Bertolini, Bevilacqua and Massini (2006) illustrate in their use of a failure mode effects and criticality analysis tool, a color-coded criticality matrix provides a visual tool for identifying appropriate action levels based on criticality score. By looking at severity classification and probability of occurrence combinations, recommended actions based on resulting risk scores are more easily identified.

In applying this concept to SH&E planning, a hybrid matrix comprised of possible MC scores was designed to offer additional visual guidance in determining appropriate priority levels (Figure 4). As seen in the MC matrix, those elements characterized by low maturity and high criticality scores should be considered the highest priorities for planning purposes. Conversely, elements with a high

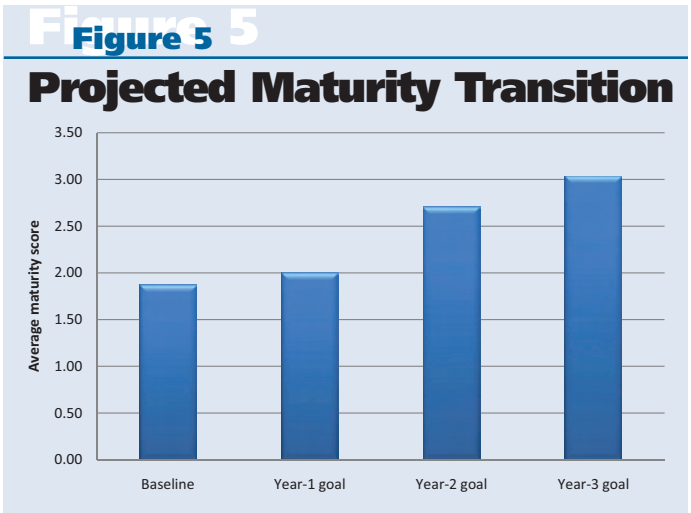


Figure 5: Graphical representations of scores provide an effective means of communicating the evolution of the SH&E system over time. For example, a cumulative score can be used to establish performance targets and gauge overall progress.

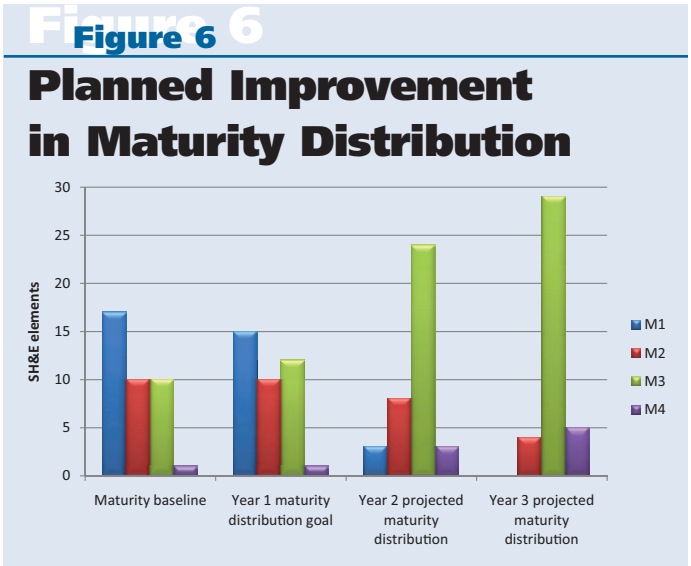


Figure 6: Another way of viewing this transformation is to show the planned change in the ratio of maturity levels. For example, one might depict a 3-year transition of maturity level to bring the organization closer to the SH&E vision.

SH&E professionals need a way to systematically focus their continuous improvement efforts where they will have the greatest impact while also aligning with organizational needs.

state of maturity and low criticality would be assigned the lowest priority ranking.

Generally, the higher the MC scores, the lower the priority. One exception occurs when a business-critical program element has a model maturity level. While the MC score (4) is low due to the highly critical nature of the system element, it would be deemed a low priority for action because of its level of effectiveness. However, business-critical model programs should still undergo periodic evaluation for potential improvement based on their overall importance and to ensure that performance has not degraded.

Establish Goals & Provide Visuals of Progress

Graphical representations of maturity and MC scores provide an effective means of communicating to management the evolution of the SH&E system over time. They also allow for clear depictions of the system's maturity at a future, planned state. Quantifiable goals can be established for individual program elements using MC or maturity scores. Likewise, as shown in Figure 5 (p. 35), a cumulative score can be used to establish performance targets and gauge overall progress.

Another way of viewing this transformation is to show the planned change in the ratio of maturity levels. Figure 6 (p. 35) depicts a sample 3-year transition of maturity level, in accordance with the strategic plan, to bring the organization closer to the SH&E vision. While this provides a visual representation and opportunity for goal-setting, the use of the MC score guides the SH&E planner in determining the order in which individual system elements must be improved to achieve the maximum benefit.

From an SH&E functional perspective, potential departmental as well as individual goals become easier to identify and define using this approach. Because criticality is considered with respect to organizational impact, this provides for easier, more efficient identification and allocation of goals as well as alignment with organizational needs.

Conclusion

SH&E planning can be a daunting task given the complex interaction of environmental drivers and stakeholder factors, ever-changing business needs and requirements, and the emergence of new technologies. Establishing goals and strategies confined to regulatory compliance or a reduction in injury rates will not lead an organization to attain its SH&E vision. Rather, SH&E professionals need a way to systematically focus their continuous improvement efforts where they will have the greatest impact while also aligning with organizational needs. The authors believe that prioritizing SH&E efforts for continuous improvement can be accomplished when the maturity and criticality of system elements are quantitatively determined and incorporated into the planning process.

In designing and deploying this methodology, the authors were able to substantially improve the SH&E planning process. The approach was well-received by senior management because it provided a concise representation of the system's current state in an easily understood format and effectively highlighted system elements that required priority action. This included the need for several new programs in response to emerging business needs. The systematic method also helped senior leaders, who are not SH&E professionals, to clearly see the link between the proposed initiatives and their anticipated contribution to the SH&E strategic direction. This understanding secured critical support and necessary funding for high priority programs.

From a functional perspective, the SH&E organization also strongly benefited from the use of this methodology. Individual goal setting was more easily accomplished and aligned with functional and organizational goals; budget planning activities were simplified; and valuable metrics were created to track ongoing improvement in SH&E system maturity.

While various formal methods and tools can be used to assess and guide process improvement, the authors concluded that more research is needed with regard to SH&E planning. SH&E practitioners would benefit from the development of additional systematic approaches that help identify and prioritize SH&E aspects that need more development. In turn, this will lead to SH&E goals and initiatives that are clearly aligned with, and tailored to support, an organization's strategic SH&E vision. ■

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