Integration of Quality, Environmental, and Health & Safety Standards Optimizing Business Improvement and Minimizing Risk: Recent Trends

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Over the last several decades, companies managed their quality, environmental, health and safety (QEHS) requirements through traditional hardcopy means, via a collection of disparate systems, or via closed, proprietary, client-server management systems.

Due to several market factors companies will have to develop strategies and systems to accomplish more efficient QEHS management. Technology innovation and a merging of QEHS regulatory philosophies now allow companies to achieve business improvement through the integration of their QEHS requirements throughout the enterprise.

This paper discusses the available technologies allowing integration of the QEHS standards within an enterprise, the benefits of the integration, and the various success criteria and pitfalls of integrating these standards within an enterprise.

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Introduction

Over the last several decades, companies managed their quality, environmental, occupational health and safety (QEH&S) requirements through traditional hardcopy means, via a collection of disparate systems (point solutions), or via closed, proprietary, client-server management systems. This proliferation of individual systems throughout an organization was not a deliberate means to foster compliance silos within a company, but rather the natural response to several factors including; disparate timing of the differing regulations, technology limitations for flexibility and integration, bifurcation of core business and ancillary/support functions, and the different philosophies of the EH&S prescriptive-based, command-and-control regulations compared to the continuous improvement cycle and performance based underpinnings of the ISO quality standards.

Due to several market factors, including increased competition, globalization of the marketplace, increased visibility of corporate governance, and regulatory influences, most companies will have to develop strategies and systems to accomplish more efficient QEH&S management throughout the enterprise in order to maintain profitability and market share. Technology innovation and a merging of QEH&S regulatory philosophies now allow companies to achieve business improvement through the integration of their QEH&S requirements throughout the enterprise.

The following sections will discuss the available technologies allowing integration of the quality, environment, health & safety standards within an enterprise, the benefits of the integration, and the various success criteria and pitfalls of integrating these standards within an enterprise.

Specifically, the sections discuss:

- The similarities and the differences between the standards that will provide enablers and barriers to the integration.
- Recent trends and evolution of systems in the industry.
- The various levels and scope of integration and how these differ from the points of integration.
- The potential for optimization of risk management, compliance tracking, business improvement and efficiency enhancement, and strategic business planning through integration.
- Key success factors for planning and implementing an integrated system.

Standards Comparison

The International Organization for Standardization (ISO) has developed several families of standards through its technical committees for the standardization of quality management systems (QMS), environmental management systems (EMS), and occupational Health and Safety management systems (OSHAS) across the global community. Although these international standards are not intended to be used to create non-tariff trade barriers or to increase or change an organization's legal obligations, neither do they diminish the requirements affecting an organization. Rather they promote a methodology or a system that organizations can follow to enhance their quality, environmental, or H&S processes.

The Occupational Health & Safety Management Systems (OHSAS 18000) series of specification was originally created from the British Standard for Occupational Health and Safety Management Systems (BS8800;1996) and is comprised of two parts; the 18001 specification and the 18002:2000 specification. The first provides the standard for which an organization can be certified against for their OHS management system. The second provides guidelines for the implementation of 18001. It should be noted that the OHSAS 18000 specification is not yet a standard. For simplicity, this paper will refer to the quality and environment standard and the health and safety specifications collectively as "Standards".

ISO14000 family of standards, developed by ISO Technical Committee 207, was developed to ensure that companies doing business globally would carry out their operations in a way that did not diminish the environment. These standards provide organizations with the elements of an effective environmental management system (EMS) that can be integrated with other management requirements to assist organizations to achieve environmental and economic goals.

Since these standards were both patterned off of the ISO 9000 family, there are many common elements between all of the standards. The common elements include:

- Policy
- Defined Organization, Structure, and Responsibilities
- Training
- Standard Documentation
- Document Control
- Control of Essential Operations
- Defined and Documented Standard Practices
- Nonconformances and Corrective/Preventive Actions
- Record System
- Internal Audits
- Management Review

Although the high-level management processes of quality, environment and H&S are comparatively similar, there are a few distinct differences at the detail level, which affect the feasibility of a complete systems integration.

First, the extent and type of downstream stakeholders is different between the quality, environment and H&S processes. Within quality, the stakeholders most affected by the organization's processes include the customers. These customers then drive the requirements back to the organization, an intrinsic stakeholder. The upstream stakeholders in the value chain include the suppliers. Within environment, the downstream stakeholders include various populations, regulatory bodies, citizen groups and other entities. Although suppliers can influence environmental impacts, usually the upstream stakeholders within environmental management are mainly comprised of the organization's operational personnel who are responsible for process and equipment operations. Within H&S, the stakeholders are typically an individual or population within the company itself that is affected by an incident.

Second, there are several articles that differ between the standards. For example, a major element of the 14001 standard is for the organization to determine aspects of their activities, services or products that may significantly impact the environment. The H&S standard's focus is on hazard identification,

whereas, the quality standard contains a clause for the evaluation of suppliers and their products and services.

Third, the continuous improvement cycle and performance based underpinnings of the EMS and OHSAS standards differ philosophically from the prescriptive-based, command-and-control regulations promulgated by US EPA and OSHA over the last several decades. Thus, an effective environmental and H&S system is inherently more complex in that it must also address a myriad of specific regulatory driven requirements.

Relation of Regulations to International Standards

Over the last several decades regulations have been promulgated in accordance with federal, state, and local laws that generally control releases of various pollutants to the environment via the different media (air, water, land). The result has been a myriad of individual requirements that each organization must meet for controlling and tracking its releases into the environment. Consolidation of these requirements (air, water, etc.) has been done under some permitting programs. However, the goal of these programs has been the compliance of emissions with limitations. As such, the focus of most organizations over the last several decades has not been management system centric (e.g., EMS, HMS, QMS), but rather management information system centric (e.g., EMIS, HMIS, QMIS). The MIS, a subset or component of a management system, was developed to specifically store volumes of data and produce prescribed reports, with less emphasis on continual improvement cycles.

Within the last few years, the US EPA has joined states and businesses in experimenting with new approaches, patterned off of the ISO standards, which will achieve levels of environmental protection beyond compliance levels. From this work, the National Environmental Performance Track program was developed. The Performance Track is a voluntary program intended to reward and recognize facilities and organizations with a proven record of regulatory compliance, an operational EMS, and a demonstrated commitment to continued improvement and outreach to the local community and public. The agencies increasing align with the standards philosophies making a more comprehensive integration of all standards and requirements possible.

Like ISO standards, the Performance Track program is not intended to diminish an organization's responsibility to comply with all applicable regulations and requirements. Therefore, any integration in standards must also be inclusive of all regulations and requirements promulgated apart from the standards.

Recent Trends and Advancement of Systems in the industry

Because of the vast amount of information that an organization must track, analyze and report, and because the whole concept of standards integration centers around a common and consistent framework for housing all of the organization's information, it is apparent that an electronic information management system is intrinsically tied to the concept of standards integration.

Advances in information technology over the last several years now make it more appealing and feasible than ever to utilize an electronic solution to assist with standards integration. Some of the more important changes are:

- Migration to the Web. The World Wide Web has quickly become one of the most effective mechanisms at reaching large populations with real-time information. For example, it took a span of 38 years from the inception of the radio to reach 50 million users, the number generally regarded as the widespread acceptance threshold.[1] The same number of users was reached by personal computers and the World Wide Web in 16 and 4 years, respectively.

  As a result of the widespread proliferation of the Internet, this mechanism has quickly become one of the best ways of accessing and using quality, environmental, health and safety information. OSHA and the EPA have spent millions of dollars web enabling regulatory standards, guidance documents and compliance data for use by the general public. They have established a link path conformity that allows an organization to insert regulatory information within documents.

  The advancements in web technology are allowing organizations to move away from client-server technology to web-based solutions that allow:

  - Faster startup of use of a system due to a minimal installation process.
  - Higher accessibility by professionals: Anyone who has Web access, a Web browser, and the system's password can generally access the system. No special software is needed on the professional's machine.

- Evolution to ERP II: Enterprise Resource Planning (ERP) solutions have been available on the market for several decades. A term coming into vogue recently is ERP II that denotes the second generation of ERP solutions. These are ERP solutions that extend beyond just essential business functions into all aspects of a company's activities. An example is an ERP that tracks EHS information as well as HR information.

- Up-To-Date: Version enhancements are simply made on the central server, not needing to be sent to each individual PC. This also reduces the total cost of ownership due to reduced maintenance costs.

- Focus on integration: With the advances on the web and the need to be more competitive globally, more organizations are requiring access of information across the enterprise. This means that core systems are being integrated to share business critical data.

- Collaborative: With the higher accessibility of the technology to more of the value chain, the systems are becoming more collaborative in nature.

- Transformation of data-centric to knowledge-centric: Business Intelligence and data mining are also becoming a bigger part of QEH&S solutions, with the ability to pull external and corporate data and analyze, trend, and track the data.

- Wireless technology: Finally, even web-based solutions cannot meet the needs of all stakeholders. Some users within the organization may not have Internet/intranet access or may have transient tasks that make entry of information into a PC infeasible. As such, wireless technology is continuing to be developed and integrated with many solutions. This wireless

technology allows, for example, a person conducting an audit to monitor the questionnaire and track the results on their PDA and transmit the data to the system from the field.

Optimization of Business Practices

Due to several market factors, including increased competition, globalization of the marketplace, increased visibility of corporate governance, and regulatory influences, most companies will have to develop strategies and systems to accomplish more efficient QEH&S management throughout the enterprise in order to maintain profitability and market share. Technology innovation and a merging of QEH&S regulatory philosophies now allow companies to achieve business improvement through the integration of their QEH&S requirements throughout the enterprise.

Figure 1 shows just a few of the multi-faceted benefits that can be realized throughout an organization from the utilization of an information management system for standards integration. The results of accurate, consistent data across the enterprise that is accessible at the right time for the right individuals means that an organization can experience Enterprise Improvement through reduced costs (less time looking for facts and data), better productivity (not having to key in data twice), and reduced liabilities (being able to track who has accessed what information when, and making sure the most current information is available). According to Gartner Group, 50 percent of an organization's information may be lost with a common framework.

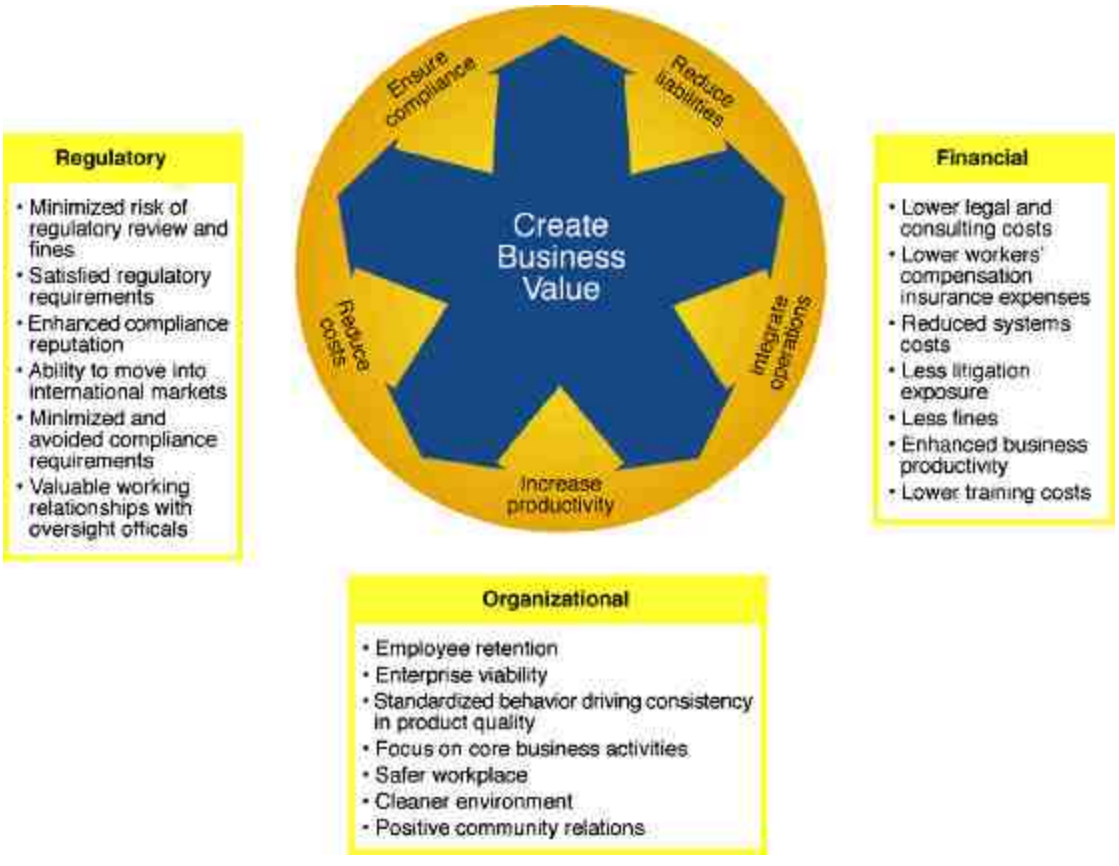

Figure 1: Multi-faceted Business Value

The aforementioned benefits can be grouped into four general categories as shown in Figure 2. This matrix identifies two key scales, the timing scale and the perceived importance scale that delineate the four categories of benefits. The horizontal axis shows the activities that are more responsive or urgent in nature (tactical) to those which are important but more proactive in nature (strategic). The vertical axis indicates activities that an organization must perform to stay in business (integral) or at least remain competitive (functional). A task that is responded to on a day-to-day basis falls on the tactical end of the timing scale. A task that occurs on an as-needed basis falls to the strategic end of the timing scale.

Tasks, whose level of performance may affect the ability of the organization to *operate,* fall on the business integral end of the perceived importance scale. Tasks, whose level of performance may affect the ability of the organization to operate *competitively*, fall on the business functional end of the perceived importance scale. Based on these scales, the categories for QEH&S system benefits fall into compliance, risk management, efficiency, and strategic business planning aspects.

Figure 2: Perceived Importance Scale

Generally, the benefits an organization achieves with an Information Management System progresses with the maturity of the system. An organization almost always starts to use a system to demonstrate their in-compliance status. Focuses on integration, reporting, and an easy-to use graphical user interface move the organization into efficiency. Focuses on evaluation, business intelligence, and verification priorities move the organization into risk management. And finally, focusing on total value chain integration provides a powerful strategic business planning platform.

Standards Integration

With the enhanced promotion of EMS through EPA's performance track and the addition of the OHSAS standard, the concept of "standards integration" is being utilized more widely throughout the industry and proliferated in the literature. Even so, there remains some confusion on the precise definition and implications of standards integration throughout an organization. The confusion stems mainly from the fact, that at face value, standards integration seems to be a single concept. However,

there are several levels at which the standards can be integrated. These levels are distinguished by the stakeholders affected by the integration and by the conceptual granularity between the levels.

Levels of Integration

The five levels of standards integration are:

1. Common Programs
2. Common Policy
3. Common Platform
4. Common Process
5. Common Parameters (data)

The **first level** of integration involves a different group of stakeholders, namely the standards organizations and regulatory bodies. For integration to be successful at this level, it is incumbent upon these organizations to formulate standards and regulations with common elements across all processes. Where this is not possible, the organizations must align like processes as much as possible. This allows an organization to develop a consistent policy across quality, environment, and H&S without a significant amount of varying elements.

In the **second level** of integration, the organization establishes a policy that reflects general goals and objectives of the organization related to quality, environment, and H&S. These general goals mean that the organization is all essentially 'running in the same direction' most likely to meet a compliance objective. The common philosophy or policy will dictate essentially how many more successive levels of integration that the organization will participate in. A common policy or a general mandate from corporate is generally needed before the next level of standards integration, platform integration, can be achieved.

The **third level** of integration involves a common systems platform. This entails the organization centralizing and standardizing the framework for the collection, evaluation, and distribution of QEH&S data throughout the enterprise, most effectively done through the use of an information management system or a group of information management systems with common architecture or data exchange interfaces. The platform integration should not only considers traditional EMS component but also EMIS reporting functionality. A common platform promotes the accessibility and transfer of information within the application among the stakeholders in the organization. Web based technology is one of the mechanisms allowing organizations to deploy their applications more extensively throughout the enterprise.

The **fourth level** of integration is standardization of management processes across the enterprise, meaning that the form, style, order, and transmission of data relating to quality, environment, and H&S are all handled in a similar manner. Quite simply, templates for data entry, data viewing, data analysis, and reporting are constructed and are used throughout all of the various processes.

It should be noted that this is the level where the greatest integration may occur. The singular most important commonality in the quality, environment and H&S standards is that they are all based on a continual improvement process that is comprised of smaller subprocesses such as policy determination and training. As shown in Figure 3, the general processes are comprised of

subprocesses that are comprised of activities, which are comprised of a series of steps. Each of the three standards has, for the most part, a similar overlying process and subprocesses. The commonality at the most granular level is that the activities and steps needed to carry out each of the processes in the organization, whether quality, environment or H&S is linked with the task management. The ability to integrate the processes and subprocesses across quality, environment and H&S at the higher level is tied to the ability to provide a common process mapping and workflow engine across all areas. In fact, because the ISO 9001:2000 standards rely heavily on process mapping, much of this work is completed for the implementation for environmental and health & safety requirements through the implementation of the quality requirements.

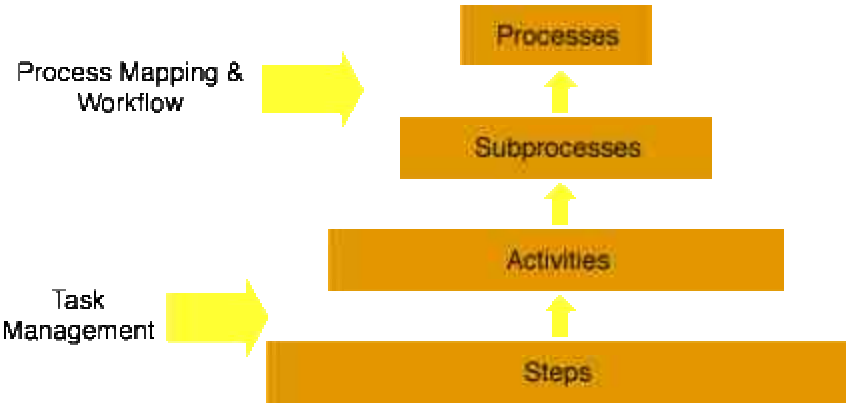

Figure 3. Hierarchy of Processes

Examples of some of the similarities between the QEHS processes are shown in Table 1.

Table 1. Similarities between Quality, Environmental, and H&S standards processes.

ISO-related Process	Common Elements	Quality	Environmental	H&S
Process Mapping	Workflow Processes Activities	System Workflow		
Task Management	Workload Task Tracking	Tasks from Action Plans		
Audit	Questions Questionnaires Scheduling Audit Findings and Observations Links with Action Plans	QMS Audits	EMS Audits Environmental Audits	OHSAS Audits H&S Inspections
Training Management	Required Training Training Tracking Course and Instructor Class Scheduling Results Tracking Skill Level and Experience Tracking	Management Requirements	EPA Program Requirements	OSHA Required Training
Nonconformance (N/C)	Detection Investigation Decision Completion Verification	Out of Spec (OOS) Process Failures Record Keeping Violations Deviations	Emission Exceedances Emission Violations Recordkeeping Violations Audit Findings	Incidents Audit Findings Medical Surveillance Results
Risk Assessment	Detection Root Cause Assessment Criteria Links with CAPA Affected Entities	Process Changes	Site Assessment Risk Management Plans Disposal Option Assessment	Job Hazard Assessments Process Safety Assessments Ergonomics
Evaluations	Evaluation Criteria Evaluation Results Evaluation History Links with N/C Links with CAPA	Supplier Evaluations Customer Complaints Training Evaluations	Training Evaluations Significant Aspect/Impact Evaluations	Training Evaluations Root Cause
Investigations	Investigation Criteria Investigation Results Investigation History Links with N/C Links with CAPA	Process Failure Investigations	Spill Investigations Release Investigations	Accident Investigations
Corrective Action/Preventive Action	Action Plans Status Tracking	From Quality Audits Process N/C Etc.	From Env. Audit Site Evaluations Emission Violations	From H&S Audits JHA PSA Accidents
Document Management	Approval Review Cycles Controlled Access/Distribution	Quality Programs and Policies	Environmental Programs Policies Plans	H&S Programs and Policies and Permits (Confined Space)

ISO-related Process	Common Elements	Quality	Environmental	H&S
			Permits	
KPI	Parameters and Limits Tracking of Performance over Time	Quality Criteria	Targets	Targets
Project Management	Project Plans Project Resources Project Tasks Project Status	Quality Plans	Environmental Project Plans NEPA Tracking	Health & Safety Projects Construction Projects
Business Intelligence	Analytics Trending	Customer Complaints	Emission Levels Over Time Compared to Industry	Accident Rates Compared to Bureau of Labor Statistic Rates EMR
Calibration	Instrument Specifications Calibration Results Links to CAPA	Quality Systems Calibration	Ambient Monitoring Calibration Monitoring System Calibration	Indoor Air Quality Instrument Calibration
Measurements and Monitoring	Monitoring Data Specification Data Collection Scheduling Data Collection Results Analysis Results Trending	Batch/Lot Testing Laboratory Testing O.O.S Samples	Continuous Emission Monitors Outfall Monitoring Waste Profiles Stack Testing	Indoor Air Quality Testing and Monitoring Hearing Respirator
Alerts	Escalation Imminent Requirements Open Requirements Overdue Items	Document Approval N/C CAPA	Permit Requirements Emergency Response	Regulation Requirements Policy Changes Incident Investigations
E-mail connectivity	Alerts Task Closure Document Routing	Policy and Programs	Policy and Programs	Policy and Programs
Management Review	Reports Trending Anomalies	N/C Customer Satisfaction Supplier Histories	Significant Impacts Emissions Permit Violations	OSHA Violations Incident Statistics Hazards ID

As stated previously, the actual content of the data will be dependent upon the application to quality, environmental, or H&S processes. Because of the differences in the standards, the data utilized within the quality, environment and H&S processes will not completely overlap. Therefore, there will be slightly less integration in the fifth level of Parameter Integration.

The **fifth level** of integration involves the normalization and accessibility of common data throughout the enterprise. This means that data collected for quality would be available for environmental management and vice-versa. The data would be input in one location but available throughout the enterprise. Because there are differences in the standards as noted previously, not all data collected for quality will be utilized for environmental or H&S standards. So data at the most granular level may not be utilized across all processes. However, those data should be available across all the processes

for utilization if and when necessary. Some of the integration points between the quality, environment, and H&S standards are provided in Table 2.

Table 2. Integration of Elements of Quality, Environment, and H&S systems*

Element	Common Fields	Quality	Environment	H&S
Organizations	Names Locations Contact Information	Suppliers/ Customers	Agencies Citizen Groups	Agencies Work Compensation Groups
Organizational Structure	Name Hierarchy Assigned Persons Person Profile Roles	Assigned Processes	Assigned Equipment Responsibilities	Assigned Work Group
Locations	Name Hierarchy Coordinates	Processes	Release Points	Industrial Hygiene
Equipment	Name Type Supplier, Vendor, etc Installation/Operation Dates Responsible	Guarantees Calibration Information	Production Schedules	Lock-Out Tag Out Confined Space
Materials	Name Location Receipt Supplier Related Process	Product & Services Quality Specifications	Hazard Ingredients Tier II Waste Tracking TRI NESHAPs	FMPA Ratings PPE
Inventory	Name Quantity Location	Expiration Dates	Maximum Quantities onsite Quantities recovered	Storage
Global Picklist Categories	Name Description	UOM	UOM	UOM
Parameters	Name Assigned Equipment Assigned Materials Assigned People Limits	Targets	Pollutants	Safety Indicators
Requirements	Name Tasks Due Dates Responsible	Policy Requirements	Permit Requirements Plan Requirements	Regulatory Requirements Policy Requirements
Training	Name Courses Instructors Class Dates Due Dates Results fields Participants	None	Regulatory Citation	Regulatory Citation

* Table 2 includes a sampling of the fields that are shared across quality, environment, and H&S processes. It is not a comprehensive list.

Element	Common Fields	Quality	Environment	H&S
Employee/User	Work Profile Position Gender Date hired	Skills Experience	Certification Status (Responsible Official, etc.) Emergency Contact	Lost time Disability Accidents Illnesses WCI Claims
Questionnaires	Questions Question Criteria for Evaluation Question Answer selections	Different Processes Affected	Different Processes Affected	Different Processes Affected
Action Plans and Tasks	Task Responsible Due Date Progress Status	Related CAPA N/C etc.	Related Permit or Requirement	Related CAPA
Cost Management	Cost Category Costs	Training Costs Product N/C Costs	Permit Filing Fee Permit Application Fee Emissions Fee Disposal Costs	WCI Costs Accident LTI Costs Medical Costs
Incident Management	Incident Incident Date Source Factors Affected Population/Equipment	Customer Affected Supplier Implicated Process affected	Amount of Chemical Spilled	Severity of Accident
Program Objectives	Program Name Objective Related Documents Reevaluation Date Responsible	Quality Program	Environmental Program Ties to Aspects	H&S Program Ties to Hazards
Measuring & Monitoring	Parameter Measurement Date Measurement Type Measurement Location Person measuring Results Measuring Method Margin of Error	Process Affected	Frequency Type of Sample Flow Weighted Level of Detection	Work Area Area or Individual

The thoroughness of the standards integration is dependent not only upon "what" is being integrated (i.e., the levels of integration) but also the "extent" that the integration is occurring (i.e., the dimensions of integration). The integration of standards across the processes (quality, environment and H&S processes) is only one dimension of the integration. There are at least two other dimensions that must be considered. These are discussed in the following section.

Three dimensions of integration

As stated previously, the dimensions of integration refer to the extent within an organization that the elements of the standards are integrated. Figure 4 shows the three dimensions that must be considered in order for the organization to optimize their standards integration. These dimensions include integration throughout the enterprise (the organizational structure and physical locations), integration throughout the business processes (including quality, environment, H&S), and integration throughout

the complete value chain (stakeholders). As shown in the figure, the expansion of integration along these three dimensions is bounded by the organization's resource limitations, driver constraints, and tactical needs. For example, resource limitations may not make it possible for all data captured within an inventory system be fed real-time into a quality system. In this case, only certain critical fields may be integrated.

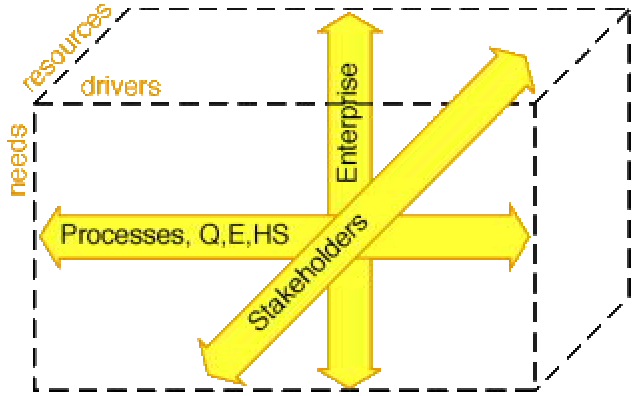

Figure 4: Integration Expansion

In order to more effectively evaluate corporate performance in all areas of the company, including QEH&S, it is imperative that a management system be accessible throughout the enterprise and not just at a site level. As a specific example, compliance with many environmental regulations is demonstrated through reports that roll-up data on a site level. As a result, the management systems have been site-focused rather than enterprise-wide, specific to each process, and not accessible throughout all levels of the organization. These silos of information increase the amount of redundant and inconsistent data thereby reducing efficiency and elevating compliance risks.

Enterprise data does not mean that all personnel will have access to all company records. A technically robust security system can limit records that are restricted to just the personnel who need to view, add, edit, and delete them. This means that a corporate official with appropriate security privileges can compile enterprise-wide reports and analytics quickly from one common framework. Trending analyses could then be conducted for the entire enterprise instead of by one site at a time.

Not only must the system be deployed throughout the many locations and companies of a organization for trending purposes, but also throughout the stakeholders within the company and the stakeholders in the business's value chain. As an example, suppliers may want to have access to the supplier evaluation history, performed on their company. This may enhance their performance against the criteria by evaluating trends in their performance.

Key Success Factors for Integration

No two organizations will have identical processes, organizational structures and goals. Therefore, a successful integration strategy at one company may not work well at another. However, there are some elements that are common to successful integrations. These elements include:

1. Need-centric approach. With a need-centric approach, the organization focuses on those aspects where a true gap exists between the goals/requirements of the organization and the current performance. The gaps are assessed in the areas of compliance, efficiency, risk minimization, and strategic business optimization to determine true needs versus wants. This approach is based on a careful balance of drivers versus resources and includes prioritization of all the identified needs. A good needs assessment will follow the "reciprocal funnel" approach. The reciprocal funnel, shown in Figure 5, is the approach whereby the subset of highly visible needs are expanded through brainstorming, investigations, and other analyses to consider the totality of needs in the organization, including all strategic objectives. Once the needs are identified, the requirements are determined by filtering the needs based on priorities and objectives to produce a requirements matrix. Final prioritization is based on tactical considerations, namely resource feasibility, to determine the 'must-haves' versus the lower priority items.

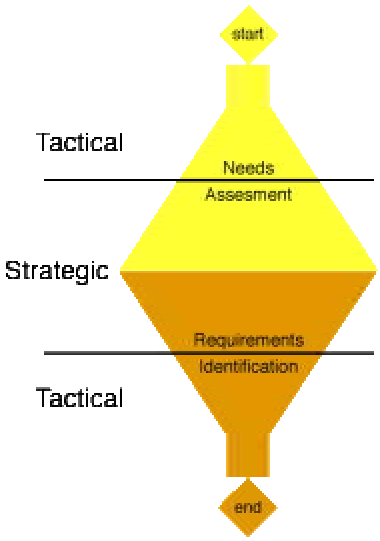

Figure 5: Reciprocal Funnel Approach to Requirements Determination

2. Well-planned process. In the global environment, most organizations want standardization across their enterprise, including standardization in their solutions and data feeding the solution. The temptation with any project that utilizes commercially available software to fulfill its system integration needs is analogous to the purchase of a new car without the permission to drive it until the owner's manual is read. There is the desire to begin immediately loading the data into the database after the application is installed. However, the standardization of the data going into the solution can be an issue because of the differing regulations, languages, data collection and reporting processes, and organizational structures across the enterprise. Therefore, even with commercially available software, the organization must carefully plan the implementation process to ensure that there is sufficient stakeholder input, consolidation of data, clearly defined roles, and a traceable process. The planning and documentation phases of the integration should constitute the majority of the time spent on the project.

3. Holistic approach. The approach must not only be need-centric but also holistic. This type of approach refers back to the discussion of the dimensions of integration. A successful integration will consider all of the processes and entities within and outside of the organization in the integration strategy. This does not mean that the entire integration project is rolled-out at all of the sites in the organization in parallel. It does mean that all of the dimensions of the

organization be considered during the planning process to ensure that integration in one area does not diminish the value of the integration in another area. For example, a materials management system may be integrated to a QEH&S management system to provide information on the inventory located at each site. Without consideration of environmental and H&S regulations, the system may not be set up to accept hazardous chemical data or personal protective equipment (PPE) information, respectively. These data would be critical in performing essential environmental and H&S functions within the company.

4. Phased deployment approach. A phased approach involves deployment of the integrated solution at a selected group of locations prior to the rollout over the entire enterprise. The phasing can be done by location, by system functionality, by stakeholder groups, or by a combination of all three. This allows the organization to identify any revisions that are necessary to their planning process and approach prior to the general release of the solution. It also allows for better management of resources because the first phase of the project can be used to scale resources for the remaining phases. Finally, the phased approach promotes a "train-the-trainer" methodology that allows a greater resource pool of trained professionals to be available onsite during the major deployment.

5. Stakeholder buy-in. A key success factor is to ensure stakeholder buy-in throughout the process. Don't assume that just because a solution meets the needs of the organization, everyone will adopt it, even if it is a *homegrown* solution. All of the stakeholders need to be involved throughout the process, especially through the planning and training phases to ensure acceptability throughout the organization. Figure 6 shows the organization broken simplistically into three user groups. Each of these groups has widely varying expectations for an integrated system. For the browser users (those users that will view and occasionally enter data into the system, the most important acceptability criteria is often the graphical user interface (GUI). For the group of users that will use the application more extensively, the main focus is often the reports and the capability of the system to track action items and delinquent items through alerts and notifications. The derived value of the system for the corporate user is its capability to produce trends and analytics. Thus, the system must have the capability to satisfy the needs for the entire range of stakeholders. The flexibility in the functionality allowed to the various stakeholders must also be controlled so that the corporate officials have the greatest flexibility in the manner that they see the data presented with less flexibility for the occasional or browser user.

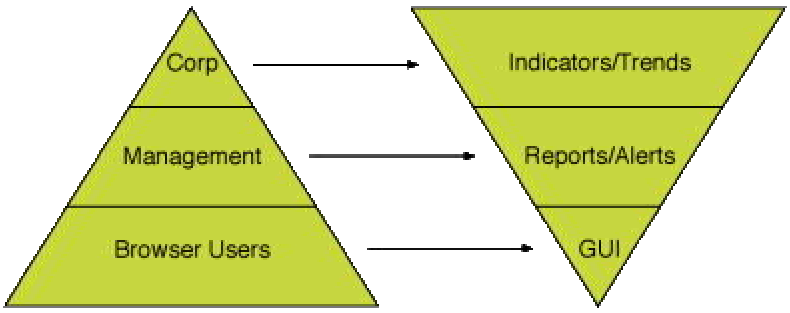

Figure 6: System Users vs. Basic Acceptance Criteria

6. Separation of strategic and tactical IT value. Within organizations having large IT resources, the temptation is often to build a solution from the organization's specific requirements. While

this does provide a benefit of a tailored and customization solution specifically for the needs, it may provide disadvantages from a maintenance standpoint. In some cases, the requirements and resources dictate that a solution should be built rather than bought and integrated. However, a pride of ownership should not be one of the reasons for selecting building over buying.

7. Configuration over customization. From a user acceptance standpoint, each user is more likely to use a system that has an intuitive and familiar user interface; an interface that collects the type of information in a manner that aligns with the user's workflow processes. If the integrated solution does not have a flexible GUI design or dynamic database, then this can only be accomplished through customization. The problem with customization is that it produces numerous "one-off's" that are difficult to maintain. It addition it leads to technology transfer and help-desk difficulties due to the inconsistencies in the system across the enterprise and industry. The solution then is utilization of an application that incorporates both flexibility in the GUI and a dynamic database design so that the users can tailor the application through configuration (the front-end) instead of through coding changes.

8. Integration level balance. The focus of this paper has been on the value and levels of standards integration. Clearly, standards integration provides many valuable benefits to an organization. However, in keeping with a needs-centric approach, when integration is done just for integration's sake, then valuable resources may have been spent needlessly that could have been spent on core tasks. The integration must provide value beyond the combined value of the separate systems.

9. Full level integration approach. With the propagation of web technology on the market and the promotion of "portals", the tendency has been to pull all of the organization's applications under a common web portal interface in order to "launch" the various applications. In short, it creates a one-stop shop for all related activities. However, this approach stops short of integration if the data are not shared between applications. Therefore, all five levels of standards integration must be considered.

Summary

The International Organization for Standardization (ISO) has developed several families of standards, including three separate standards for Quality (QMS), Environment (EMS) and Occupational Health and Safety (OHSAS). With the enhanced promotion of EMS through EPA's performance track and the addition of the OHSAS standard, the concept of "standards integration" is being utilized more widely throughout the industry and proliferated in the literature. Since the EMS and OHSAS standards were both patterned off of the inaugural ISO 9000 family, there are many common elements between all of the standards. The most common underpinnings include similar overlying management processes at the higher level and the tracking of activities through task management at the most granular level. The migration to web technology (web-based solutions) is one of the mechanisms that companies are using to achieve some degree of standards integration across their organization. Web-based solutions are currently available in the market to accomplish much of this integration.

Although the high-level management processes of quality, environment and H&S are comparatively similar, there are a few distinct differences at the detail level, which affect the feasibility of a complete systems integration. Therefore, to optimize the value achieved from standards integration, the integration approach must be based on a need-centric focus and include careful planning where all of the stakeholders are represented. The organization's integration strategy must at least consider all five levels, the policy, program, platform, process, and parameters, in the standards integration with a top-down approach, meaning that the organization will focus on broader policy issues prior to integration of parameters (data).

The thoroughness of the standards integration is dependent not only upon "what" is being integrated (i.e., the levels of integration) but also the "extent" that the integration is occurring (i.e., the dimensions of integration). The integration of standards across the quality, environment and H&S processes is only one dimension of the integration. The other two dimensions include integration throughout the organizational structure (i.e., the physical locations and business entities) and the stakeholders (i.e., value chain).

The results of integration, producing accurate, consistent data across the enterprise that is accessible at the right time for the right individuals, means that the organization can experience enterprise improvement through enhancements in compliance, efficiency, risk management, and strategic business practices.

References

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