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Author(s)

Karanikas, Nektarios

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Defining the Interrelationship between Safety and Quality Management Systems

Nektarios Karanikas

Head of Safety Research and Statistics Department
Human Factors Expert, Hellenic Air Force Flight and Ground Safety Centre, Greece

Abstract:

The evolution of quality management from a mere technical inspection requirement for a holistic management, addressing the quality control and quality assurance processes, lead to the formulation of general principles that have become universal and can be applied in every management system. The fundamental quality Plan – Do – Act – Review cycle has been the basis for any team or individual activity that seeks continuous improvement and sustainability achievement. Safety management also has become an area of high concern since it is tightly related to the integrity of organizational resources, including human, equipment – infrastructure and the environment, and the avoidance of adverse implications for the society and the business, the latter potentially threatening the organizational sustenance. Despite these two management systems common philosophies, they are based on individual guidance and standards published by international organizations, and they have not been aligned in a common approach so far. The current review through the discussion of quality and safety management fundamentals, of the references regarding their possible integration and of the experience accumulated until now regarding such integration incentives and practices intends to comprise stimuli for organizations that seek to search the quality and safety managements induction under a common policy and to motivate the relevant agencies and authorities towards issuing specific and distinct advice on the subject.

1. Introduction

Stranks (1994, 2006b and 2008) and Gogliaet al. (2008) stated that management in general refers to the effective use of resources in the pursuit of organizational goals and it follows the process of problem review, qualifying and quantifying possible outcomes, listing options for problem confrontation, formulation of recommendations based on the available resources, decision making for the most effective solutions to be acted, informing the personnel to be affected by the decisions made, implementation of the solutions, monitoring of the performance and finally review; ultimately, the authors connected effectiveness with the balance of the operational risk and the cost of managing these risks.

Reason (1990) argued that organizations actually allocate their resources between production and safety goals, which in the long term are fully compatible; however, in the short term reference, conflicts may arise since the resources shared are definite, leading to temporary and alternating diminishes between safety and production targets. Also, Stranks (1994, 2006a, 2006b and 2008), the TC (2002 and 2004), the UK CAA (2002a and 2002b) and Waring (1996) presented safety management as similar to other management forms, with a more specific goal towards setting of policy, procedures and accountability, measuring safety performance and motivating managers to improve health and safety standards in their responsibility area.

Although it seems that present and past research and professional experience have addressed the relation between safety and quality management systems, in the international regulatory and standardization context, there is no clear guidance or recommendation for their interrelationship and their borders remain indiscernible. The current review presents the fundamental concepts of quality and safety management, cites the prospects of their interrelationship, presents their contemporary integration guidance and experience and discusses the trends in the professional field so far in order to provide the reader with a holistic

viewpoint of the specific subject and to stimulate standardization authorities into a clear definition of their relation and the limits between them.

2. Literature Review

2.1. Quality Management

The meaning of quality was adequately presented by Hoyle (2007) who discussed the three basic quality truths: the internal and external to the organization requirements constantly change; organizational performance must be constantly changing to keep pace with requirements; quality is the difference between the standard required, meaning the stated, implied or obligatory need, requirement or expectation, and the standard achieved, meaning the performance level measured. The latter truth according to Godfrey & Juran (1998) reflects the control process that intends to provide stability and to prevent any adverse change during the operations; the control process includes the stages of defining the control subject, establishing the measurement and standards of performance, measuring the actual performance, comparing the performance measured by the standards and implementing remedial actions in cases of difference. The specific procedure is widely known as the Plan – Do – Check – Act (PDCA) quality circle.

Moving from the partial quality processes implementation including the performance monitoring, the quality control and the quality assurance, to a holistic approach of quality as expressed by the contemporary establishment of Quality Management Systems (QMS) Morgan & Murgatroyd (1997) stated “TQM is a total organizational approach for meeting customer needs and expectations that involves all managers and employees in using quantitative methods to improve continuously the organization’s processes, products and services”, and Dale (1999) stated “TQM is the mutual co-operation of everyone in an organization and associated business processes to produce products and services, which meet and, hopefully, exceed the needs and expectations of customers. TQM is both a philosophy and a set of management guiding principles for managing an organization”.

One of the fundamental targets that the quality process is based on the needs of the customers, either the external or the internal ones (ILM 2003a and 2003b, Gangemi 1993 and Knowles 2011). External customer is defined as any person that directly enjoys the product or service offered or may profit from the product success, such as company shareholders, suppliers and the society. Especially the society may in the aggregate withdraw support for an organization, protest or invoke legal action; this is mostly concerned by the regulators, who demand society’s safety and protection regardless of the product’s compliance to the rest external and internal customer needs (Hoyle, 2007). Internal customer is everyone who comprises part of the system processes, such as managers, supervisors and operational personnel; the employees are aware of their working conditions and their reputation deriving from organization’s place in the market and society, and, in addition, they are a basic and variable resource that must be also satisfied in order to offer their labour.

External and internal customer needs are the top priority (Cavanagh et al., 2000); Hoyle (2007) presented with a pyramid shape the hierarchy of needs that the managers must always consider in order to lead their organization in sustainability; the physiological needs comprise the base of the pyramid, followed by the safety, social, esteem and self-actualization needs. Another classification of needs was discussed by Coletti & Early (1998), who distinguished the perceived needs, meaning the statement of needs by customers according to their perceptions, and the cultural needs, which are mostly related to the internal customers and include job security, self and mutual respect and other cultural values.

Quality policy comprises the fundamental and the high level expression of quality management requirements and commitment to continuous improvement. The policy determines the form and the nature of the quality objectives, processes etc. And must be aligned with the overall business vision of the organization (Bass & Lawton, 2009); the organization’s goals, resources and activities must be aligned with the overall strategy (Godfrey, 1998). Moreover, following the highest level quality policy, mission statements must be prepared for every partial project and the project goals must be specific, measurable, agreed upon, realistic and time specific (Coletti & Early, 1998); these partial mission statements provide legitimacy since any project becomes official, and confers rights for holding meetings, requesting data, asking for employees attention and assistance etc. (Juran, 1998).

Interactively, quality performance reflects the organizational structure and culture; in order to achieve quality both management and operational team commitment and involvement are required (ILM 2003a and 2003b). Hoyle (2007) reported two additional dimensions of quality that are directly related to its human aspects: the “business quality dimension”, meaning the outward view of the stakeholders regarding the organization, and the “organization quality dimension”, or “system quality dimension” declaring the inward facing view in terms of efficiency (productivity, motivation etc.) and effectiveness that is related to the proper utilization of knowledge. Consequently, it is apparent that QMS is related tightly to the management of resources, the human ones, the infrastructure resources and the working environment.

Human resources include education, training, experience, qualifications and skills for any task assigned to the operational and administrative levels. The corresponding needs must be derived from the highest organizational policy; each organization shall keep records of the employees’ competence in order to monitor their adherence to the basic requirements and shall manage personnel allocation and promotion; in addition, as Zhang (2000) emphasized, recognition and reward for quality improvement efforts are essential for quality enhancement. Infrastructure consists of buildings, workspace, hardware and equipment, software including documentation, literature and computer programs, and any supporting mean and device. Although the working environment includes the needs for adequate lighting, reduction of noise, temperature control and the manipulation of every physical factor that affects the personnel’s comfort, these are usually included in the infrastructure area; the specific domain is more related to the psychological aspects of the environment such as staff satisfaction, trustful culture, productive communication, sense of ownership etc.

Obviously, people, either managers or operators, comprise the most critical element for achieving and maintaining quality. This is the reason why Knowles (2011) placed psychology in the cycle of “Profound Knowledge System”; the human reaction to change, their feelings about their work, the stress imposed and the behavioral effects sourcing from system process variation, the need for motivation and pride, and employees’ trust in the organization’s environment constitutes issues that every management level has to consider.

2.2. Safety Management

According to ICAO (2012) safety is defined as “the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management”. Roland & Moriarty (1990) require that each employee must work in an environment where hazards are identified and controlled to an acceptable level. The specific objective may be achieved by establishing standards and safe production, climate under the constraints of operational effectiveness, cost, time and other resources.

As presented by Reason (1990), in every productive system safety lies in the following basic elements: senior executives, who set the goals, direct the organization in the strategic level and allocate money, equipment, people and time; line managers, who implement the organizational strategies in specific areas such as technical support, logistics, operations, safety, personnel etc.; Preconditions, including equipment reliability and usability, convenient physical and technological environment, and workforce skills, motivation, knowledge and awareness; productive activities that comprise the actual coordination of machines and personnel towards production goals; defenses preventing the damages or injuries caused by exposure to hazards in the workplace. In the spirit of the aforementioned safety elements, SHELL (L) model (ICAO 2002, 2004 and 2012, Gogliaet al. 2008 and CAA 2002c), as presented in Figure 1, comprises the pillar for safety problems and latent conditions research, since it considers the interrelationships among the basic components of an operational system: “S” for software (e.g. Procedures, support, training, etc.), “H” for hardware (e.g. means and equipment), “E” for environment (e.g. working conditions, infrastructure etc.) And “L” for liveware (e.g. Human, physical, physiological, psychological and psycho-social factors); the “L” feature is placed twice in the model since it plays the most vital role in safety; once as a sole component and secondly as the central interaction point with the rest components, including the relation among humans (“L” – “L”).

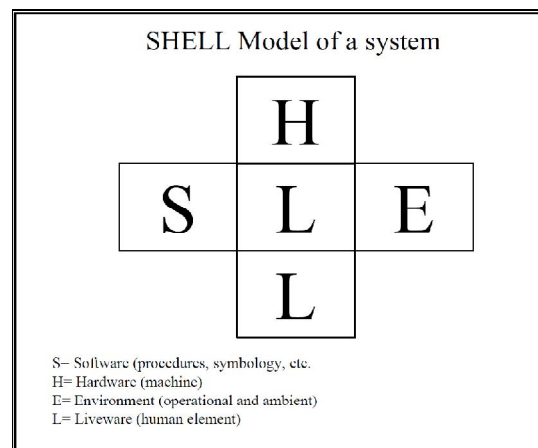


Figure 1: The SHELL (L) Model (Quoted from FAA, 2000)

Gogliaet al. (2008) described Safety Management Systems (SMS) as a framework of safety philosophy, tools and methodologies, which intends to improve organizations’ performance through the development and management of proactive safety systems. Discussing the systems approach to safety, the US FAA (2006) outlined that the accomplishment of the mission’s and goals’ in a prescribed environment may be achieved by the integration of staff and resources in an operational network. Safety objectives according to the FAA (2000) include design of safety in consistency with operational requirements, risk reduction to a level predetermined by management, conduction of safety analyses and assessments, use of historical safety data, timely inclusion of safety features towards the minimization of retrofit actions, accepted risk level maintenance after each system change, and documentation of safety related data. As Reason (1990) argued SMS targets to every organizational activity, lying from the core operational ones (e.g. Production, service delivery, etc.) to the supportive ones, such as maintenance, logistics, and training.

Expressing the contemporary view of safety’s place in the general organizational operation context, ICAO (2012) stated that safety management comprises an organizational core process that assists in achieving business objectives by effectively allocating the available resources. The implementation of a safety system, according to Roland & Moriarty (1990), requires sequentially, top management approval for the adoption of the concept, appropriate staff requirements, coordination and cooperation with other organizational departments, development and documentation of the safety system, top management approval for the initial plan, distribution of the plan to other departments and collection of feedback, implementation of the plan, and assessment – revision of the system.

Management styles affecting safety were acknowledged by Della (2007); participative management that encourages employees' formulation of opinions, whereas high level management keeps the authority and accountability for final decisions, which are usually expected of high quality (also supported by Easter et al., 2004); quality circles consisting of a few competent members (at least trained in communications, group processes and problem solving), which meet regularly and solve local work environment problems; management by objectives that settles a hierarchical structure of missions, goals and objectives, starting from the overall organizational mission statement and continuing to subordinate branches, departments, offices and operational units statements.

Manuele (2003) argued that safety performance rating could be used as an element of overall organizational performance and an influential criterion for salaries, bonuses and promotions. The same author, apart from the view that employees' involvement in safety develops positive attitudes (e.g. trust, confidence, enthusiasm etc.), discusses the role of designers and engineers in implementing safety principles on the specifications of new or modified products, processes, equipment and infrastructure.

In the discussion about safety pro-activeness and re-activeness Stranks (1994) stated that proactive strategies include safe place strategies (e.g. safe premises – plants – processes – materials – working systems – access and egress from work, adequate supervision and competent and trained personnel etc.) and 'safe person' strategies (e.g. care of vulnerable groups such as novice workers, disabled persons and pregnant women, personal hygiene, personal protective equipment, safe behaviour promotion, timely cautions of dangers etc.); Reactive strategies refer to emergency response planning, feedback through reporting and investigations, and ameliorative procedures after accidents. Bhagwati (2006) inducted the Permit-to-Work System, meaning the requirement for machinery certification prior to its use by the workers, which is a fundamental quality management component, as a proactive measure; Davies et al. (2003) explained the predictive validity of near-misses data collection and analysis, and Manuele (2003) notified the important positive effect of preventive maintenance towards hazard control and physical dangers' management.

The psychology of safety was discussed by Geller (2001), who acknowledged the determinative contribution of humans to safety achievement (also stated in Management Extra, 2006). The author introduced fifty (50) principles, which include the notions of safety culture, leadership, responsibilities, commitment, improvement, empowerment, ownership, involvement in safety processes, human nature effects in achieving safety, safety data feedback, behavior-based safety, intervention impacts, people motivation, reactions to change, biased perception on safety issues, dominant norms, and safety coaching. Especially focusing on stress at work Stranks (2006b and 2008) claimed that organizations may produce stressful situations due to changes in the working environment, standards and practices, or mismanagement of violence at work; moreover, costs of stress-related ill (e.g. anxiety state, depression, nervous breakdown) may be extremely high; hence, stress reduction strategies and adequate response to stress must be planned and operated when relevant cases are spotted by the monitoring procedures.

Special reference was made by ICAO (2012) in culture influences since the values shared among the members of a group (working team, department, office, organization etc.) define the way that individuals or groups behave and react during normal or emergent situations. The culture actually affects the total organizational performance, including safety and quality areas, and according to ICAO (2002 and 2012) and Gogliaet al. (2008), it takes the form of national culture, referred to nations' characteristics, professional culture, attributed to the values of specific professional groups, and the organizational culture that defines the behavior of an organization in comparison with other organizations.

2.3. The Relation Between Quality and Safety Managements

Hoyle (2007) in the discussion about the relation of quality, reliability and safety, recognized the strong relation among their management forms and placed safety as a determinant of quality (Figure 2).

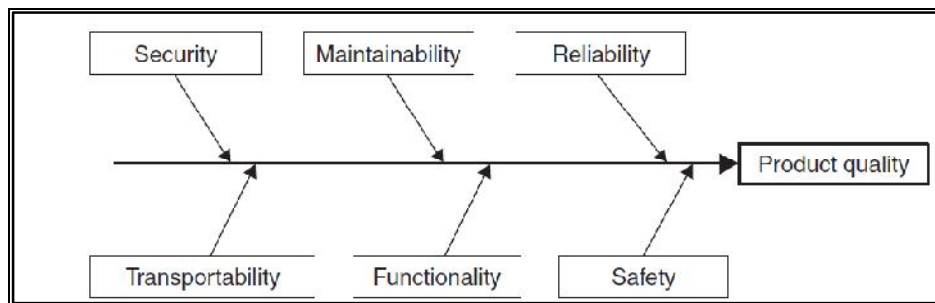


Figure 2: Determinants of Product Quality (Quoted from Hoyle, 2007)

Moreover, Schneiderman (1998) stated that there is a "fading distinction between Total Quality Management, total management and management itself"; Kemp (2006) equated quality management with error management and Juran (1998) included safety as a parameter of quality improvement. The TC (2005) in its SMS assessment protocol framework included quality assurance as a component to be audited, indicating the close connection between quality and safety notions. The TC (2002) noted that quality assurance in the SMS context actually includes the entire operation in the organizational context and addresses the design and documentation of procedures, the inspection and testing methods, the calibration and measurement of equipment, the internal and external audits, the monitoring of corrective and preventive actions, and the use of statistical analysis; therefore, according to the

specific authority, SMS must adhere to the eight fundamental management principles of ISO 9000:2000: customer focus, leadership, people involvement, process approach, system approach, continual improvement, factual approach to decision making and mutually beneficial relations.

ICAO (2012) noticed the commonalities between SMS and QMS since both require planning, measurement, monitoring, involvement of every function, process and person, and are continuous improvement driven; in the performance measurement sections of ICAO manual, the need for a quality assurance system is clearly required. The specific agency supports that QMS efforts regard the final products and services, whereas it delegates SMS procedures to human and organizational aspects of safety; the specific argument, which was supported by the Australian CASA (2005) as referred above, also comprises the perspective of professionals as cited in Williams (2002). In the same context, the FAA (2006) briefly described SMS as the quality approach to risk control and distinguished between the quality’s focus on customer satisfaction and the objective assessment of safety with quality management principles.

However, at the same time ICAO (2012) accepted the possibility of SMS and QMS complementary relationship, based on the facts that SMS is developed on QMS principles, and SMS should include QMS policies and practices. Furthermore, in the discussion of the major influences on the practice of safety, Manuele (2003) recognized “quality management principles and safety management principles have a remarkable kinship”; on this base, the author suggested safety professional’s engagement in sound quality management initiatives in order to broad their views of safety events causation and embrace the need for continuous improvement. The synergy between Total Quality Management and SMS practices, as seen by Hui& Pun (2002), is presented in Table 1.

Common concepts of TQM	SQM Practices
1. Product/customer focus	Safety is the product, employees the customers. A vital focus of activities, planning and culture is on employees and safety. Employees determine safety expectations and satisfaction.
2. Leadership and commitment	Senior executives are visibly committed to safety and work.
3. Company culture	Values and behaviours that promote worker safety are established.
4. Effective communication	Effective safety communications are fostered via training, meetings, memos and posting.
5. Employee knowledge	Employees understand the programme and have the skills to work safely.
6. Employee empowerment	Workers are prepared for and empowered by management to fully participate in work planning and safety.
7. Responsibility and excellence	All employees share the responsibility for a safe work environment and strive for excellence in performance.
8. Management by fact	Safety management is based on valid, predictive performance measures such as employee satisfaction, safety improvement achievement and the cost of poor safety.
9. Long-range view	Planning for employee safety and development has a strong future orientation.

Table 1: Synergy of TQM and SMS Practices (Quoted from Hui & Pun, 2002)

2.4. Systems’ Integration Prospective

The UK CAA (2002a and 2002b) in the description of SMS, stated “...a similar argument applies to comparison with Quality Management, which would interface with Safety Management as part of the organization’s core management system”, and “Companies establishing an SMS need to take a pragmatic approach, building where possible on existing procedures and practices (particularly Quality Management)”.; Under the same concept, FAA (2006) and Della (2007) suggested the integration of safety risk management and safety assurance (Figure 3).

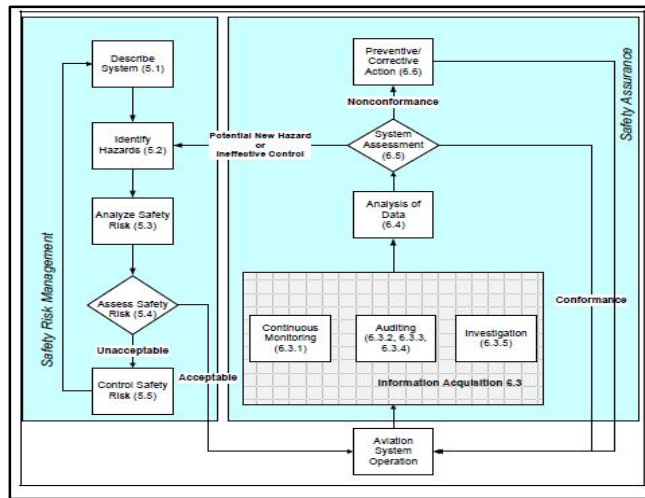


Figure 3: Integration of Safety Risk Management and Safety Assurance (Quoted From FAA 2006 and Gogliaet Al. 2008)

The integration of SMS, including Health and Environmental Management, and QMS was described by Coelho & Matias (2002), Hansen (2006) and Domingues et al.(2012), who emphasized the shared elements of policy leadership and accountability, organizational infrastructure, and strategic planning; the authors noted that, in the regulatory framework, such progress would be feasible after the integration of various national Health and Safety Standards with ISO 9000 and ISO 14000 standards; however, the former authors prompted companies to proceed to an appropriately adapted form of integration, based on their size and characteristics. The ASNZS (2008) also noticed that although ISO standards do not describe any compatibility requirements with other management systems, such as environment management, financial management, risk management and health and safety management, organizations are enabled to align or integrate their management systems. An illustration of the proximity among the aforementioned standards regarding their fundamental elements may be found in Table 2, according to the comparison conducted by Hui& Pun (2002).

Dimensions	ISO 9001:1994 Standard	ISO 14001:1996 Standard	OHSAS 18001:1999 Standard
Purposes	Effectively documenting the quality system elements to be implemented or in place, needed to ensure an ability to perform. Voluntary registration by an accredited third party.	Assist organizations to achieve environmental performance by managing and evaluating environmental aspects of operation. Third party registration and/or self-declaration.	Assist organizations to develop an OHS management system to protect employees and others whose health and safety may be affected by the organization's activities.
Emphasis	Validate supplier ability and capability to perform according to contract.	Establish environmental management systems (EMS) to foster environmental protection and sustainable development.	Establish occupational health and safety management system to link with other management systems standard and sustainable development.
Eligibility	This is generic and independent of any specific industry or economic sector. It is applicable to all types and sizes of organizations.	Any organizations (regardless of size, type and level of maturity) that are interested in the development, implementation and maintenance of their EMS.	Organizations of all sizes and regardless of the nature of their activities.
Participants	Organizations who wish to develop their quality systems and to meet the vendor requirements as specified in contracts, especially those wishing to have trades with E.C. countries and the USA.	Organizations desiring to certify their environmental performance to an audit client. Organizations may include companies, divisions operations and facilities.	Organizations wishing to develop an OHS management system based on the guidance of OHSAS 18002. Organizations may include companies, divisions operations and facilities.
Evaluation	Specification for design, development, production, installation and servicing. It contains 20 principal clauses that include Management Responsibility, Quality System, Contract Review, Design Control, Document Control and others.	Does not state specific environmental performance criteria, five basic elements (Environmental Policy, Planning, Implementation and Operation, Checking and Corrective Action and Management Review) are required.	Does not lay down specific OHS performance criteria. Six elements (Initial Status Review, OHS Policy, Planning, Implementation and Operation, Checking and Corrective Action and Management Review) are required.
Orientation	Process plus management and administration. Heavy on quality assurance initiatives and conformity of clauses.	Share common management system principles with ISO 9001. Heavy on continual improvement and compliance with legislation.	Share common management system principles with ISO 9001 and ISO 14001 standards.
Mechanics	Select registration/certification agency, choose standard, submit a Quality Manual, conduct external audits and obtain certification.	Select registration/certification agency, commission EMS audits, perform onsite assessment and obtain certification.	This contains guidance and recommendations, perform self-assessment and for certification purpose.

Table 2: Comparison among ISO9001, ISO14001 and OHSAS 18001 (Quoted from Hui& Pun, 2002)

In the exploration made by Pojasek (2008), he recognized that all forms of environmental, occupational, health and safety management share the same principles of leadership by example, focus on the stakeholders' and market's interests, on the involvement of workforce, on the organizational and personal learning through adequate and disseminated information and knowledge, on the sustainable operability, on the sustainable development, on the sustainable results production, on the sustainable performance criteria, and above all on the effective strategy and planning; hence as the author claimed organizations should proceed to an integrated business management system in the scope of their overall business sustainability. Such models picturing the Quality, Safety, Health and Environmental Management integration were introduced by Winder (2000) and Hui& Pun (2002) as presented in Figures 4 and 5 correspondingly.

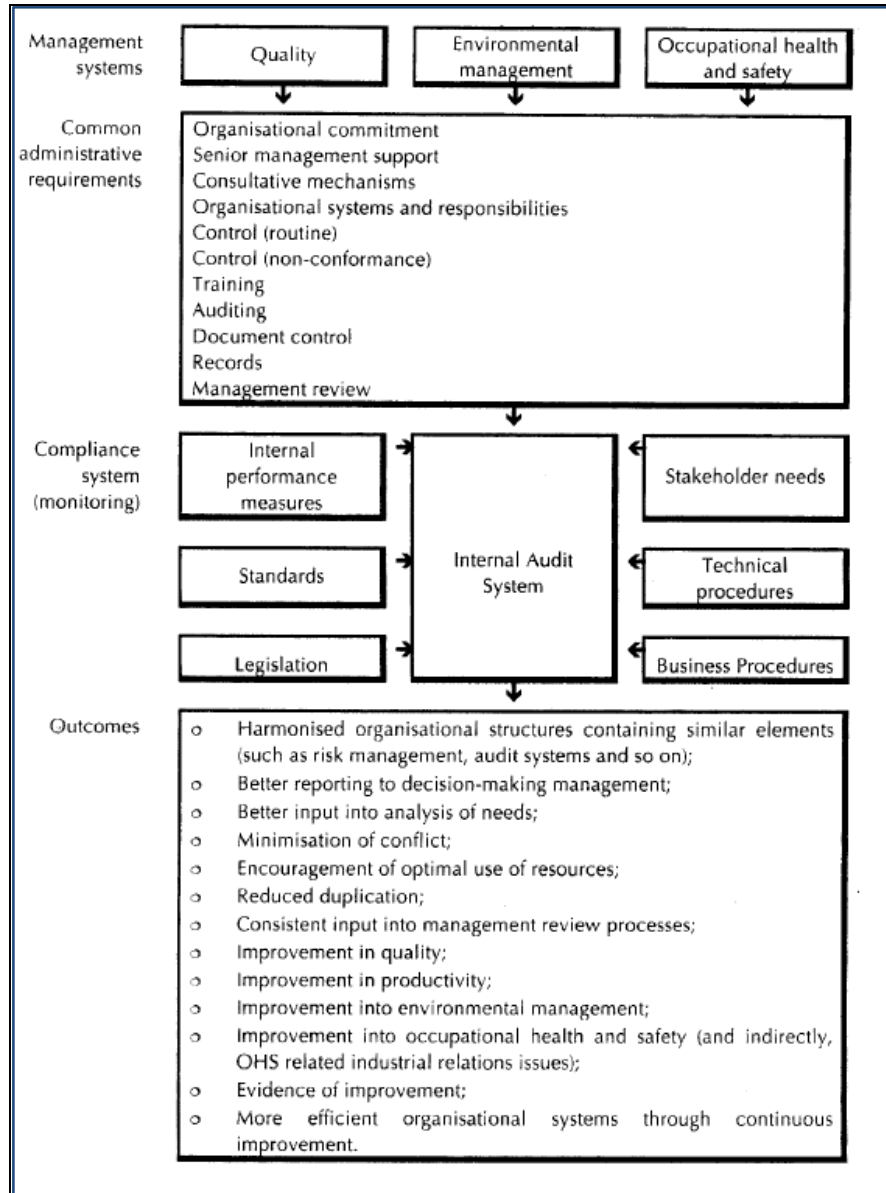


Figure 4: Integration of Safety, Environment, and Quality Systems (Quoted from Winder, 2000)

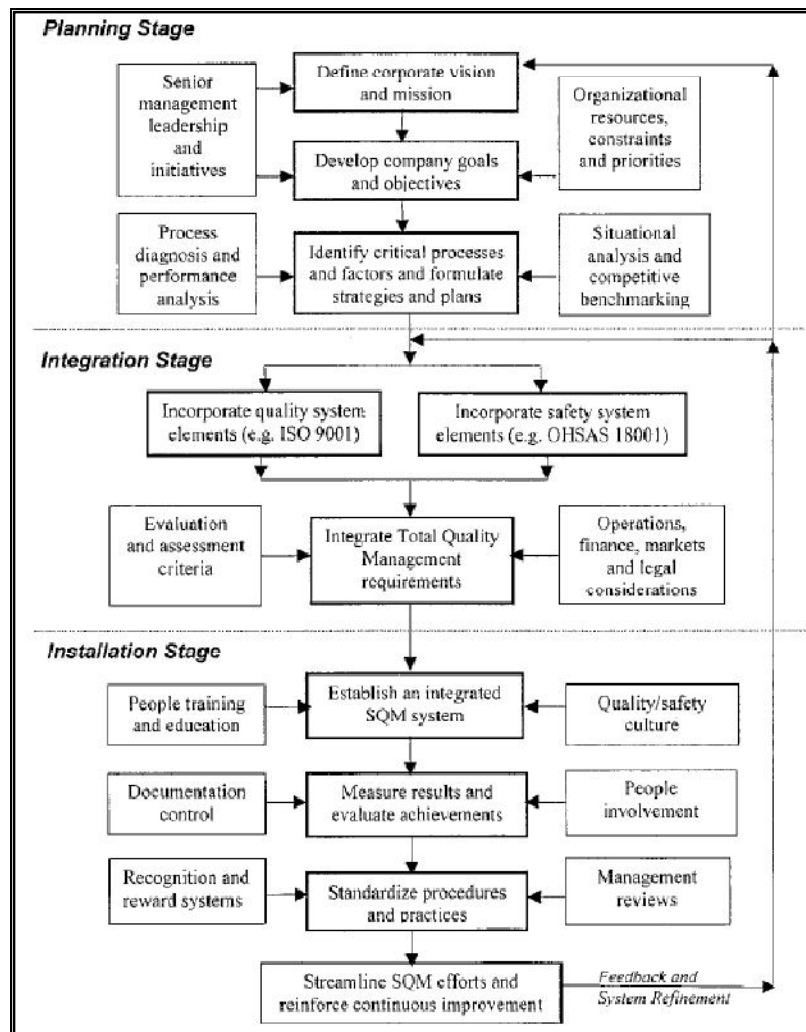


Figure 5: Safety and Quality Management Model (quoted from Hui & Pun, 2002)

Finally, Griffith (2000) discussed the benefits of possible integration: avoidance of processes, duplication, elimination of the efforts' overlapping, reduction in the rather fuzzy borders among individual management systems, more effective information sharing, and one-system certification requirement.

2.5. Systems' Integration Experience and Evolution

The detailed study of Winder (2000) suggested that the systems integration will become a requirement of managerial evolution; the author stated that one management system is easier to manage, senior management's commitment is the fundamental prerequisite towards integration, a new system must be developed based on existing systems, integration shall follow a low pace, risk management must be applied to identify potential problem areas in the organization, and finally all the general management principles must be applied (e.g., Planning, policies, procedures, review, competence).

Domingues et al. (2012) found that 54% of the Portuguese companies hold certificates for Quality, Safety and Health, and Environmental Management Systems (ISO 9001, ISO 14001 and OSHAS 18001). However, the same authors referring to a longitudinal study, they noted that only 3% of the certified companies have proceeded to the integration of the aforementioned management systems. The authors having cited a variety of academic sources that have outlined the limitations of non-integration, the expected motivation and benefits, the potential resistances to integration, its assessment, and the implementation strategies, resulted in the proposal of four evolution levels towards full management system integration: documentation integration, management tools integration, common policies and goals, and common organizational structure.

Easter et al. (2004) identified that in small companies, the SMS has already been integrated with Quality Management (QM) functions and that since 1990 there has been a trend towards integrating the areas of quality, safety and environmental management; the authors considered the health and safety personnel as the customers in QM, discussed QM efforts to reveal systemic deficiencies similar to SMS, and presented the fundamental feedback function of quality under the concept of the PDCA (Plan – Do – Check – Act) cycle as an inextricable part of the SMS.

Today, software packages, such as Integrated Quality and Safety Management Systems (<https://www.asqs.net/sms-software/>), provide tools for organizations wishing to achieve a holistic approach. Additionally, the trend in Linked In professional web network (www.linkedin.com) is to link safety and quality contexts either in professional forum groups (e.g., “Aviation Quality & Safety Information Exchange”, “Quality Academy - Quality, Health & Safety, and Environmental Management Systems”, “Health, Safety, Environmental and Quality Professionals”, “International Safety, Quality, and Environment Management Association”) or in job offering groups (e.g., “Health, Safety and Environmental Specialists Jobs Group”, “Health, Safety, Environment and Quality Jobs”, “Quality, Health Safety & Environment Jobs”).

3. Discussion

Apparently, as experience has shown, business and market requirements address the needs of every era and along with scientific research lead evolution; it seems that the areas of QMS and SMS have not been exempted by the specific inevitable process. Following an era of extensive expertise that provoked the emerge of abundant specialists in various domains, it seems that effective and successful management still demands a broad and holistic approach of managing resources that continuously interact and indisputably drive either positive or negative outcomes (profits, losses, accidents, reputation etc.) with implications on the business itself, its external and internal customers and the society.

Under this viewpoint, it may be claimed that QMS comprise the wide organizational basis that sets the principles and procedures of every activity, regardless its focus on human safety, product quality, infrastructure integrity, environmental protection etc. Quality procedures target into the final product or service success, addressing in that way the external customer needs, and simultaneously address the internal customer needs including safety, the latter requirement at the same time referring to the society as well; in any case humans are the determinative factor of improvement, progress and business sustenance. Hence, it may be argued that QM cannot be inducted in the organizational structure as an individual management form; rather, QMS represents the family of processes that are expressed in the highest documented policy and are disseminated into every organizational management activity; therefore, the improvement of final product or service characteristics that fulfil the external customer technological and comfort needs (e.g., Reliability, innovation, user-friendliness) maybe would be better referred by other distinct terms such as ‘technical quality’ or ‘standards conformance’.

4. Conclusion

Conclusively, it may be argued that SMS comprise a management activity that exploits QM processes in order to enhance safety, the latter related to the physical and psychological protection of the internal and external customers and the avoidance of harm to the organizational assets and the environment. Taking into consideration this claim it seems that QMS and SMS are by nature closely related but not identical; training in QM must be provided to every specific activity professional and QM principles must be followed by every management form (e.g., Safety, training, production, maintenance, recruitment) and, therefore, safety experts are still required to address the issues that were cited in the literature review above and inextricably interacting with every organizational activity.

Such clear definition of the interrelationship and the limits between QM and SMS are required to be formulated by the international standardization agencies and authorities in order to support organizations in their decisions regarding their structural development and potential reform towards the most effective use of their resources. Under this framework, it seems that there is no need for integrating the quality and safety standards, but including QM principles in SMS practice as in every management form.

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