Organisational Safety Management Systems

Rethinking Safety Management in Aviation

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Abstract

Safety Management Systems (SMS) are becoming increasingly important in the aviation industry due to the need to address organisational safety. National aviation safety regulatory authorities have used the International Civil Aviation Organisation's(ICAO) conventional SMS framework worldwide for the development of their own SMS frameworks. Critical analysis against literature revealed a number of flawswith ICAO's SMS framework. These were summarised into two distinct categories: flaws stemming from a lack of consideration for organisational management, and flaws stemming from misconceptions of key SMS concepts. Some of these flaws were addressed in existing SMS frameworks, whilst some remain unaddressed. A new SMS framework is proposed that corrects the flaws in ICAO's framework and rethinks the very concept of SMS. This is achieved through the addition of elements that would otherwise have only been implicitly, rather than directly, managed as part of ICAO's SMS framework. The proposed SMS framework is the first to suggest the categorisation of elements by their output (i.e. the result of performing each element and which level in the organisational hierarchy would be responsible for its implementation) rather than by their function (i.e. the concept of each element without regard for how it is implemented).

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Abbreviations

AC	Advisory Circular
ACI	Airports Council International
ACRP	Airport Cooperative Research Programme
CAANZ	Civil Aviation Authority of New Zealand
CAA-UK	Civil Aviation Authority of the United Kingdom
CAR	Civil Aviation Rule(s)
CASA	Civil Aviation Safety Authority
CEO	Chief Executive Officer
ERA	European Railways Agency
FAA	Federal Aviation Administration
HRM	Human Resource Management
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
ISO	International Organisation for Standardisation
NSW	New South Wales
OSH	Occupational Safety and Health
QMS	Quality Management System
QTA	Queensland Trucking Association
SMS	Safety Management System

Introduction

A number of aviation accident investigations have highlighted the potential for organisational factors to contribute to accident outcomes. Such examples include the Erebus and Kegworth Disasters (Office of Air Accidents Investigation, 1980; Air Accident Investigations Branch, 1990). Safety Management Systems (SMS) are an organisational management tool aimed at lowering organisational risk. SMS are part of certification requirements in a number of countries, and in many other countries provisions are being made to make them a requirement. The International Civil Aviation Organisation (ICAO) released Annex 19 to the Chicago Convention in 2013 advising signatory states on how to develop SMS. This has resulted in a number of countries developing different SMS frameworks based upon ICAO's conventional framework.

This dissertationhighlights the need for change of this conventional framework, as it does not address many organisational considerations. After explaining the basic idea of SMS, the fundamentals of organisational management, human resource management, and organisational culture will be outlined. These aspects form the basis of organisations and are highly relevant to the development of an organisational SMS. To complete the literature review of SMS, a number of internationally recognised SMS frameworks will be analysed for differences with ICAO's conventional framework and the relevance of each framework will be outlined.

After reviewing SMS and organisational management literature, this dissertation offers an alternative to the conventional framework of SMS. This framework has additional elements and is categorised by output rather than by function.

Literature Review

To better understand SMS it is crucial to review generic business management principles as well as existing SMS frameworks. The literature review has been split accordingly. The first section outlines exactly what an SMS is and what can be considered a "conventional" SMS. The second section concerns organisational management. This section will outline the importance of organisation profiles, organisational hierarchy, and competitive strategy. Because these are management systems, they are closely related to SMS. The third section will address the area of human resource management. This has major implications for SMS implementation, as it is only through humans that safety can be improved (or compromised).The fourth section will outline the importance of organisational culture, and in particular, safety culture. Cultures can act to reinforce or counter SMS initiatives, and for this reason, the organisation's culture must be effectively managed. The final section of this SMS will provide an overview of some of the SMS frameworks that are supported in the transport industry. Each framework will be compared to ICAO's conventional framework and the relevance of each framework will be clearly outlined.

What is an SMS?

ICAO (2013, xii) defines a Safety Management System as “a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures”. An SMS integrates these into a centralised and risk-based system. The system aims to identify hazards and manage the associated risks in order to enhance the safety performance of an organisation. The means of risk management and mitigation are constantly monitored and assessed to ensure continued effectiveness and improvement.

The CAANZ (2012a) explains that the concept of SMS evolved from Quality Management Systems (QMS).SMS have a greater safety focus and provide additional benefits relating to regulatory and legal compliance, cost reductions and workplace safety. ICAO (2013) defines QMS as the organisational structure and associated accountabilities, resources, processes and procedures necessary to establish and promote a system of continuous quality assurance and improvement while delivering a product or service.

The core difference between an SMS and a QMS is neither in theirlogic nor in the structure of their processes; it is in their objectives and goals. QMS focuses on optimisation of processes through policy and operational controls and has little regard for safety management. The objective of QMS is to ensure quality is delivered through the value chain in the production of any good or service, providing the end user with fulfilment of their needs. Praeg and Spath (2011) define quality as being the total characteristic of a product or service concerning its suitability to fulfil predefined requirements, this refers to the optimisation of the total utility of a finial product or service. ISO (1999) defines safety as the freedom of unacceptable risk, were risk is a combination of the probability of occurrence of harm and the severity of the harm, which refers to the minimisation of risk and mitigation of associated consequences. This, by logical deduction, introduces conflicting objectives between QMS and SMS as quality may come at the expense of safety or vice versa. Therefore, to develop SMS as an extension of QMS raises concerns over the compatibility of the two systems as they serve two different purposes.

CAANZ appear unaware of this potential conflict and claim that SMS may be thought of as an enhanced and expanded QMS (CAANZ, 2012). This exemplifies their lack of any acknowledgement of any conflicting objectives between the two systems. SMS should not build upon QMS, rather, QMS should be integrated with SMS to realign thier objectives towards safety. SMS is an entirely different organisational management tool that has different objectives to QMS; the similarities between QMS and SMS are limited to the structure of the management methods and techniques they incorporate. The FAA (2014) supports this by stating that the main objective of QMS is customer satisfaction, whereas the main objective of SMS in aviation is organisation-wide safety. The FAA (2014) also claims that if a QMS and SMS both exist in an organisation, they must not conflict, as an organisation can have a quality product or service as defined by Praeg and Spath (2011), but still not have a safe product or service. Therefore, logic would suggest that developing SMS upon existing QMS framework creates a potential conflict between safety and quality. Overlooking the incompatibility of the two systems has resulted in a conventional SMS framework that lackscrucial safety management elementsthat are

not traditionally included in QMS frameworks. CAANZ (2012) and Transport Canada (2009) state that QMS can be incorporated within an SMS to maximise the effect of resource allocation. This is an appropriate incorporation of QMS with regard to SMS development.

The Conventional Standard of SMS

There are 191 countries that are signatory members to the Convention on International Civil Aviation. Therefore, given the international significance of ICAO (the organisation responsible for the implementation of the Convention on International Civil Aviation), it is appropriate to use their SMS framework as an industry benchmark for a conventional SMS framework. For the purposes of this dissertation, conventional SMS refers to the framework presented by ICAO (2013). ICAO's framework includes four components and twelve elements. ICAO (2013) defines a component as a fundamental concept of an SMS and an element as a subdivision of a component that outlines the processes or activities it encompasses. The ICAO SMS framework is as follows:

1. Safety policy and objectives:
    - Management commitment and responsibility
        - Management outlining their commitment to safety through policy, action and communication of policy throughout the organisation.
    - Safety accountabilities
        - Accountability of personnel in senior management and throughout the organisation. Note that accountability cannot be delegated, whereas responsibility can.
    - Appointment of key safety personnel
        - Clearly defined and documented roles and responsibilities of all key safety related members of the organisation.
    - Coordination of emergency response planning
        - An emergency response plan that considers all possible emergencies an organisation may face. The plan must also be compatible with the plans of other organisations that it may interface with.
    - SMS documentation
        - SMS documentation that specifically outlines the SMS objectives in relation to the overall safety goals of the organisation, the procedures required to meet these goals and the actual output of the SMS once these goals have been met.
2. Safety risk management:
    - Hazard identification
        - Procedures for safety reporting and the development and maintenance of formal processes that identify hazards in the operating environment of the organisation.
    - Safety risk assessment and mitigation
        - Requires a structured system that incorporates assessment and control of safety risks associated with identified hazards. This process involves collection of data, analysis of

risk, mitigation of the risk (avoidance, reduction, isolation), and on-going management the risk.

3. Safety assurance:
    - Safety performance monitoring and measurement
        - Assignment of measureable safety performance indicators to assess the effectiveness of safety processes and risk controls. These performance indicators must then be assessed in relation to the safety performance goals and safety targets of the SMS.
    - The management of change
        - Management of safety changes brought about by changes in the organisation or in its operating environment. This is undertaken by assessment of performance measurements in relations to established goals.
    - Continuous improvement of the SMS
        - The organisation must continually monitor the performance and effectiveness of the SMS, and then relate to targets and goals to allow for continuous improvement.
4. Safety promotion:
    - Training and education
        - Training and educating personnel to ensure that they are competentin their roles and understand the SMS. Engraining safety concepts within the culture of the organisation through training and education is key to achieving an effective safety culture and SMS (Lewis, 2008).
    - Safety communication
        - Communication that ensures safety-related information is conveyed and ensures widespread understanding of the SMS and its relevance to each individual's role within the system. This involves organisation-wide dissemination of information organisation wide and ensuring all organisation members have access to safety related information.

(Source: ICAO, 2013)

Gap Analysis and Implementation Plan: Core Utilities of SMS

According to ICAO (2006), each signatory state to the Convention on International Civil Aviation is expected to comply with the standards set by ICAO. These standards are adapted by each national regulatory agency to its specific environment. The most widely accepted and conventional means of meeting compliance with national SMS regulations is for operators to develop gap analyses and implementation plans (CAANZ, 2012; CASA, 2013; CAA-UK, 2010; Transport Canada, 2009). The gap analysis and implementation plan are core utilities of an SMS. The gap analysis assesses the safety elements and components that an organisation currently has in place and identifies any additional elements or components that are required to meet regulatory compliance (Transport Canada, 2009). An implementation plan prioritises tasks identified in the gap analysis as being required for regulatory compliance and assigns timeframes for the implementation of these tasks (CAANZ, 2012). Both the gap analysis and implementation plan are crucial tools for ensuring continuous improvement of the SMS,

identifying any elements that are performing sub-optimally and ensuring appropriate rectification (CASA, 2013). Both tools should be developed and utilised by a person who is appropriately qualified and/or experienced. This could either be achieved through contracting a suitable organisation or person to develop and/or undertake the gap analysis and implementation plan, or by providing professional development in SMS to an existing staff member.

Limitations of Conventional SMS

ICAO (2013) states that SMS may indirectly include other organisational activities that support operations or production, such as finance, human resources and legal and that it is essential to involve all internal and external system stakeholders that may have a potential impact on the organisation's safety performance. This presents a weakness in the conventional SMS framework, as when the goals and time pressures of an activity are explicit and easily understood there is a greater propensity for members of an organisation to engage in that activity (March and Simon, 1993). This is subject to a moderating factor, which is the complexity of the goal. According to Schiebener, Wegmann, Pawlikowski and Brand (2014) explicit goals trigger cognitive processes that improve decision-making performance and are advantageous for low-to-moderate complexity goals. In this context, complexity refers to the ease of attainment or achievement of goals. This enhances the need for a gap analysis and implementation plan to compartmentalise the higher complexity elements into easily manageable questions and tasks. Additionally, Rowley and Jackson (2012) claim that if lower level strategies, such as human resource management, are implicit then they will be ambiguous and unlikely to be part of, or align with, wider organisational strategies.

ICAOs SMS framework is very strategic and policy oriented with little consideration for how policy is to be implemented. Such policies are worth little to an organisation until humans enact them, highlighting the poor oversight of ICAO in not explicitly addressing SMS in other means. (Fitz-enz as cited in Rowley and Jackson, 2012). To fulfil organisational strategies and policies the organisation must ensure that it has the right staff, the right number of staff, and the right job descriptions for staff. Therefore, in order to actively manage these people and in turn policy implementation, the SMS should be separated by the output of each organisational level, something not considered by ICAO. ICAO's lack of consideration for other aspects of organisational management will be addressed in later sections of this dissertation. This dissertation will continue to benchmark against ICAO's framework, as it is the most widely accepted and conventional SMS framework in aviation.

The Effectiveness of SMS

The effectiveness of SMS is questionable. A review undertaken by the Australian Transport Safety Bureau (2012) found that out of 2009 articles on SMS, only 37 were within their inclusion criteria, and out of these 37 articles no conclusive results could be deduced. The only results available were deemed as subjective, and the conclusion of the report was simply that Australia was in line with international best practice. In terms of occupational health and safety management systems, which are broader than the aviation context;Haight, Yorio, Rost and Willmer (2014) reported that there had not yet been any statistical analyses to verify the efficacy of safety management measures in reducing the number of safety occurrences. Peer-reviewed studies that have useful findings are often limited by their lack of generalisability across different organisational profiles (Robson *et al.*, 2007).

The lack of research on the effectiveness of SMS has resulted in axiomatic assumptions that SMS are effective. Some researchers have specifically outlined assumption as a limitation of their studies (Flouris and Yilmaz, 2009). Being in line with international best practice does not validate the effectiveness of an SMS framework and this is a fatal assumption to make when using ICAO's conventional SMS framework. This is because ICAO's SMS framework has never been proven in itself, which by default, questions the validity of any SMS frameworks that are founded uponICAO's framework. Unfortunately, the axiomatic assumption that ICAO's framework will provide safety benefits must be made for the purposes of this dissertation. This does not detract from the strong call by this dissertation for further research into the effectiveness of SMS that conclusively validates effectiveness.

Organisational Management

Organisational management is an important aspect to understand, as an SMS is an integral part of organisational management. Organisations are entities made up of people with a set of common goals. Safety must be one of these common goals for an organisation to be safe. However, an organisation must go further than just having safety as a goal, they must put tangible measures in place to realise potential safety improvements. This is where organisational management comes in. Using effective means of organisational management, managers can manage safety in a meaningful way. An SMS should become part of the organisation's wider management in order for safety policies and strategies to come to fruition.

One concept of organisational management that must be understood is the idea that every organisation has a unique organisational profile and consequently behaves differently. Company profiles are physical manifestations of an organisation's characteristics. Martin (2005) outlines that there are strong interrelationships and interdependencies amongst various aspects of a company profile. The nature of each of these characteristics and their relative interrelationships and interdependencies mean that no two organisations will ever be the same. For this reason, no two SMS implementation plans or gap analyses should be the same, and there must be some flexibility in the framework itself. The following characteristics may be considered the core determinants of an organisation's profile (Martin, 2005):

- Size (the physical size of the organisation, i.e. number of employees and size of facilities)
- Age (how old the organisation is)
- Industry (the nature of the product or service that the organisation makes its income)
- Technology (the type and level of technology used by the organisation
- Management style (the dominant managerial style used within the organisation)
- Structure (how the organisation separates and organises itself according to its various functions)
- Scope of operations (the organisation's role within its industry)
- Management preference (how managers decide to design the organisation)
- Profitability (the amount of monetary resources available to the organisation)
- Culture (beliefs and values which are widely held by the organisation's members)
- Employee characteristics (the characteristics of those working for the organisation)
- Job design (the manner in which work is organised)
- Patterns of employment (the attitudes and conventions of the organisation's members with regard to the length of a working day, the number of days worked each week, holidays, shift working and religious festivals)
- Location (the organisation's national/regional location)

Most regulatory authorities already take into account the size of the organisation, the scope of its operations, and the industry sector it operates within when determining SMS requirements. However, it is clear from this analysis that there are many other manifestations of an organisation that could compromise the effectiveness of an SMS if not also effectively managed. This has been echoed in New Zealand by a report from the Auditor

General's Office outlining that the CAANZ does not change its certification checklists to reflect each organisation's respective levels of risk and complexity (Office of the Auditor General, 2010). One area particularly of concern is the lack of concern for organisational finances, an area almost entirely overlooked by CAA senior person's interviews (Henderson, 2014). This is concerning given that this aspect of a company's profile can result in a lack of investment into any form of safety management, let alone an SMS (Lutchman, Maharaj and Ghanem, 2012). What is more concerning is that ICAO has audited CAANZ as part of its Universal Oversight Safety Audit Programme and found CAANZ to perform favourably with other aviation safety regulatory authorities in developed countries (ICAO, 2006). While this dissertation cannot reasonably generalise that all aviation regulatory authorities are taking a similar stance to CAANZ on these issues, it is worrying that ICAO is allowing such attitudes.

Another core concern regarding conventional SMS frameworks is that they overlook the structure of an organisation. This aspect is peculiar to most organisations as no two organisations separate their functions and structure themselves in the same way. While this may be the case, there are generic levels in a hierarchy which functions can be assigned to. Typically, a large sized organisation will split its hierarchy into five levels: Chief Executive Officer (CEO), executive managers, middle managers, front-line supervisors and operational staff (Martin, 2005). MacKenzie (1972) classified these levels by the ratio of operating (doing) to managing (delegating). The table below summarises his findings:

Table 1

Levels of organisational hierarchy with percentage time managing and operating (MacKensie, 1972)

Level in hierarchy	Time spent managing (delegating)	Time spent operating (doing)
CEO	90%	10%
Executive managers	70%	30%
Middle managers	50%	50%
Front-line supervisors	30%	70%
Operational staff	0%	100%

This variation in the amount of delegation stems from a more fundamental issue, that is, which type of output each level produces as part of the organisation. There are three levels commonly used in military organisations, search and rescue organisations and other organisations that manage crises. These levels of output are strategic, tactical and operational (Home Office, as cited Martin, 2005).

The strategic level concerns those who formulate overall policies and strategies (Martin, 2005). These people prioritise and try to meet tactical demands from those in the level down at a more strategic level. People at this level liaise with other organisations and are likely to be distanced from where operations take place. For the purposes of organisational management, these people are the CEO and other executive managers.

The tactical level concerns implementing the policies and strategies from the strategic level by turning them into tactics. Tactics in this context are actions that implement the strategies. The tactical level is responsible for prioritising these actions to implement the strategies, and allocating resources (money, people, or equipment) for their completion. These people would be middle managers in the context of organisational management.

The operational level concerns those who are responsible for implementing the actions outlined at the tactical level, or are responsible for coordinating the implementation of those actions. These people often have a similar set of routine tasks and do not have control over what actions they make or their priority. In the context of organisational management these people are operational staff and frontline supervisors.

This approach allows SMS responsibilities and accountabilities to be split by output. This is more suitable from the organisational management point of view, but also more suitable as an international framework. Hofstede (1997) outlines that national cultures supersede organisational cultures. This means that organisations function differently based upon their national makeup, and may even vary from country to country if they have multiple offices. This presents issues around using ICAO's "one-size-fits-all" approach, as it may not apply to every national culture. For example, some national cultures are individualistic (emphasise the importance of individual responsibility), whereas others are collectivist (emphasise the importance of groups). By separating SMS elements by output rather than by concept, national culture's norms and assumptions will have less impact on results.

The delegation of each particular element to an organisational level in its hierarchy is a function of human resource management. The other aspects of an organisation's profile (i.e. those other than size, scope of operations, industry, profitability, or structure) are also largely managed through human resource management.

The overarching strategy of an organisation is usually its competitive strategy. This is because it will determine the majority of the company's profile (Martin, 2005). Often organisations see a disconnect between safety and competitive strategy, i.e. they do not believe that safety can produce a sustainable competitive advantage (Lutchman, Maharaj, and Ghanem, 2012). This results in a perceived inferiority of safety, as it is not the overall purpose of the organisation; establishing a competitive advantage is. The conventional framework of SMS does little to overcome this cultural assumption. This is because the conventional framework assumes that an SMS is a management system, which is managed in conjunction with other separate systems. This interpretation is widely used by aviation regulatory authorities throughout the world (CAANZ, 2012; FAA, 2014; CAA-UK, 2010; CASA, 2013; Transport Canada, 2009). The issue with this approach is it separates safety management from the overarching strategy: competitive advantage. This prevents the perpetuation of safety into every aspect of the organisation's profile and culture. This dissertation would argue that an SMS should be part of overall organisational management, and thus frameworks should be adjusted so as to help organisations to customise their own SMS and adjust their organisational profile to incorporate safety into every aspect of the organisation. This will lead to a deeply and widely held culture that supports safety.

To use safety in conjunction with strategic management can be beneficial to the organisation's stakeholders in a number of ways. The key to an organisation establishing a sustainable competitive advantage is to produce a product or service better than competitors in such a way that it cannot be easily imitated or replicated (Porter, 1985). SMS, when implemented correctly, become organisation specific, which makes them very difficult to imitate. SMS offer an organisation several potential advantages over competitors. The main advantage is obvious: organisations with SMS are safer than those without, resulting in cost advantages due to less accidents and incidents. However, there are also less tangible advantages to having an SMS. Such examples include improved public image and greater employee morale. Another type of potential advantage, which is not sustainable, but still potentially significant, is the first mover advantage. First mover advantages are those obtained by an organisation due to it being the first to offer a product or service. In this sense, the first organisation to implement a comprehensive SMS, such as that recommended by this dissertation, may receive short-term advantages over second movers and later comers. Shimizu (2012) outlines four potential advantages that could come about from being the first-mover, three of which are relevant to SMS:

- Technological leadership (e.g. patents and accumulated knowledge)
- Pre-emption of scarce assets (e.g. location, inputs, skilled workers)
- Cost-advantages (e.g. shorter learning curve, less investment)

This dissertation would advocate that the potential benefits of integrating SMS with organisational management and competitive strategy are sufficient to justify reviewing the conventional SMS framework accordingly.

Human Resource Management

Human Resource Management (HRM) for the purposes of this dissertation shall be defined as a strategic management process concerning the alignment of human resources (i.e. employees) with business strategies (Walker, 1992). By logical extension of business strategies, it can be deduced that HRM covers safety management strategies. In this sense, human resources must be aligned with an organisation's SMS for the SMS to have full effect. This is logical from a practical standpoint too: it is only through humans that safety can be realised. The way in which human resources are managed influences the organisation's culture, behaviour and performance (Martin, 2005; Berber and Yaslioglu, 2014). Therefore, to have a safe culture, safe behaviour, and safe performance, an organisation must effectively manage its human resources.

HRM encompasses a number of functions that must be designed to meet the organisations strategic goals. These functions are focused on how to manage human resources in a way that they work to meet the organisation's goals. Essentially, the argument is that no other element of an organisation can add value, as every other element (such as a policy or piece of equipment) has no value until an interaction occurs between the human and that element to bring it into action (Fitz-enz as cited in Rowley and Jackson, 2012). In this sense, the policies and strategies of an SMS cannot be realised until the organisation's staff enact those policies. Rowley and Jackson (2012) describe 50 concepts covered by HRM and categorise these into four key functions. Each function will be discussed below with a list of concepts (with a brief description) covered in each function. Rowley and Jackson (2012) has been recognised as an appropriate source for HRM definitions as the edited book has 12 well-qualified contributors and being peer reviewed.

The first function of HRM is employee resourcing. This function can be broadly summarised as consisting of those concepts that concern how employees come to work for the organisation and how they can be used to resource organisational strategies (Rowley and Jackson, 2012). In the context of an SMS, this function concerns who becomes part of the SMS, and how the responsibilities of the SMS will be delegated to employees and departments in order to meet organisational strategies. This function consists of the following concepts:

- Assessment (assessments, appraisals and reviews to assess whether employees are performing sufficiently)
- Contracts of employment (locking staff in for certain amounts of time to ensure that the organisation's strategies can be appropriately staffed)
- Discrimination (preventing discrimination against employees on non-job related issues)
- Human resource planning (to ensure that the organisation offers the right jobs, hires the right people, and hires the right number of people to align with business strategies)
- Induction (ensuring that employees settle in so as to add value to the organisation)
- Job planning (job analysis and planning for specific roles)
- Organisational exit (managing the exit process so as to minimise the impact and learn from mistakes)
- Recruitment (finding suitable people to fill job vacancies)
- Resourcing (staffing and enacting business strategies)

- Retention (retaining the services of those employed by the organisation)
- Selection (choosing which applicants will be employed)
- Talent management (adding value to the organisation by ensuring continued access to talent)

The second function of HRM is employee rewards. The concepts within this function concern how and why employees choose to remain employed by an organisation as well as how managers can attract, retain, motivate, and reward employees (Rowley and Jackson, 2012). This function is important for SMS realisation, as certain employees are crucial to an organisation for safe operations. Furthermore, rewarding employees for exceptional performance can be a powerful motivation force. This function consists of the following concepts:

- Compensation strategies (strategies to ensure that employees of all levels receive suitable remuneration, perks, recognition, and benefits for work undertaken)
- Executive rewards (executive in large firms are to be rewarded differently to ensure that they enact the owner's wishes, such rewards are often stock based rather than cash based)
- Expatriate pay (rewards to ensure that expatriates working for the organisation are not disadvantaged compared to if they had been working in their home country)
- Information systems (processes to allow for automation of certain HR processes, such as rewards)
- Labour markets (process to manage fluctuations in in the availability of labour)
- Motivation and rewards (managing the interaction between motivation and rewarding employees)
- Non-monetary rewards (processes to recognise employees without using financial means)
- Pensions and other benefits (systems that allow employees to retire, to have their income protected, to afford medical treatment, to take paid leave, and to receive miscellaneous other benefits in order to strengthen the psychological bond between employers and employees)
- Performance and rewards (a process to reward performance that is deemed to be exceptional through the concepts of assessment and performance management)
- Valuing work (the idea that employers must value employees' inputs into the organisation by rewarding them some form of outcome)

The third function of HRM is employee development. The concepts within this function concern how employees add value to themselves and their organisations, as well as how managers obtain, maintain and develop people with the skills necessary to meet the organisation's needs (Rowley and Jackson, 2012). This is a fundamental area for SMS realisation as employees must be able to perform their roles within the SMS both effectively and efficiently. This function consists of the following concepts:

- Human resource development (process for developing employee knowledge, skills and abilities)
- Career development (a process to prepare employees for future jobs within the organisation)
- Cross-cultural training (a process to train employees to work in cross-cultural environments and assist the organisation in adapting to new and changing cultural environments)
- Cultural and emotional intelligence (the ability of employees to effectively adapt to new cultural contexts)

- Knowledge management (a process to identify, acquire and maintain organisational knowledge)
- Leadership development (methods to develop effective leaders)
- Frameworks of HRM (simplifying complex HRM processes into seemingly easy frameworks)
- Organisational learning (a process to ensure the transfer of knowledge, expertise and information across the organisation, as well as to ensure that the organisation is adaptable)
- Performance management (a strategic and integrated approach to increase the effectiveness of organisations by developing the capabilities of employees and teams)
- Teams (a group of people with complimentary skills who are committed to a common purpose, performance goals and approach for which they hold themselves mutually accountable)
- Training and development (a process to ensure the acquisition of knowledge and skills to ensure HR policies can be implemented)

The fourth function of HRM is employee relations. The concepts within this function explain how perspectives between management and employees may differ and for how negotiation and management of the employment relationship might take place (Rowley and Jackson, 2012). For an SMS to be realised, management and employees need to be working towards the same goals. These concepts help manage the relationship between managers and employees to ensure that the interaction is positive. This function consists of the following concepts:

- Collective bargaining (regulation of the terms of employment relations through negotiation and consultation)
- Conflict management (managing divergent interests between staff, especially between management and subordinate staff)
- Dispute settlement (the process of resolving disputes and conflict)
- Employment relations (managing the relationship between employers and employees)
- Employee involvement and participation (managing the degree, level, range and form of employee participation so as to meet the organisation's goals)
- Frames of reference (an approach to employment relations to help management understand the differences between methods of managing employees)
- Grievance and discipline (process and procedures to organisational and employee failures)
- Occupational health and safety (the management of workplace risk that may lead to accidents, injury or ill health)
- Legal aspects (policies and practices designed to meet legal obligations, especially concerning property and contract legislation)
- Management styles (different approaches to managing labour at individual and collective levels)
- Psychological contract (a set of unvoiced expectations, promises and obligations between employers and employees, where neither party is fully aware that they exist)
- Trade unions (institutional agents that act to emphasise the collective nature of employment relations)

Organisational Culture

In order for an SMS to be effectively implemented and sustained, the organisation must have an established safety culture that supports the goals of the SMS (Lewis, 2008). Piers, Montijn& Balk (2009) define Safety Culture is the set of enduring values and attitudes regarding safety issues, shared by every member at every level of an organisation. Safety Culture refers to the "extent to which every individual and every group of the organisation is aware of the risks and unknown hazards induced by its activities; is continuously behaving so as to preserve and enhance safety; is willing and able to adapt itself when facing safety issues; is willing to communicate safety issues; and consistently evaluates safety related behaviour" (Piers, Montjin and Balk, 2009, p. 2). Safety culture is a component of a wider organisational culture as Gillespie, Gwinner, Chaboyerand Fairweather (2013) found in health care organisations, stating that optimal performance and safety culture were dependent on an organisational culture that supported these concepts. Schein (1988) defined organisational culture as a pattern of basic assumptions, invented, discovered, or developed by a given group, as it learns to cope with its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore is to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. Therefore, in order for an organisation to effectively implement an SMS, it must develop a supportive safety culture and this is achieved through actively managing the organisational culture in which it exists.

What is Safety Culture?

Below are examples of manifestations (observable actions) of safety culture.What can be deduced are certain characteristics of a safety culture that indicate its health. Piers, Montjin and Balk (2009) incorporated recent research to conclude that there are 6 main characteristics of a safe culture. These areas are closely related to management actions, especially those of the CEO and human resource management. These characteristics need to perpetuate throughout the organisation's wider culture, as a "safety culture" cannot be managed independently of the "organisational culture".

Commitment

This area refers to the extent to which every level of the organisation has a positive attitude towards safety as well as recognising its importance (Piers, Montjin and Balk, 2009). Senior management need to be genuinely concerned about organisational safety and must be able to motivate their employees to also be genuinely concerned. Key indicators that the commitment characteristic of safety culture is present are as follows:

- Management concern
- Perception of importance of safety
- Prioritisation of safety
- Safety procedures and requirements
- Personal involvement and responsibility for safety

Behaviour

This area refers to each employee behaving as such to maintain and improve safety levels across the organisation (Piers, Montjin and Balk, 2009). Behaviours are a manifestation of culture. Therefore, one can judge the strength and effectiveness of organisational safety culture by looking at the behaviour of its employees with regard to safety. Key indicators that the behaviour characteristic of safety culture is present are as follows:

- Employee behaviour with respect to safety
- Mutual expectations and encouragement
- Job satisfaction
- Adequate equipment

Awareness

This area refers to the awareness of all levels of the organisation to the risks to themselves and to others according to the organisation's operations (Piers, Montjin and Balk, 2009). Vigilance is required by senior management and by operational staff in regard to existing and potential safety issues. Key indicators that the awareness characteristic of safety culture is present are as follows:

- Attitude towards unreported hazards
- Awareness of job induced risk
- Concern for safety

Adaptability

Refers to the organisation's willingness to learn from the past and to take actions as necessary in order to enhance the level of safety within the organisation (Piers, Montjin and Balk, 2009). It can happen that after an organisation has implemented an SMS that it is not changed or adapted according to circumstances or new information that suggests changes may be in the best interests of organisational safety. Key indicators that the adaptability characteristic of safety culture is present are as follows:

- Proactivity to prevent negative happenings
- Actions with respect to negative happenings
- Employee input

Information

This area refers to the availability and correct distribution of information to the appropriate people within an organisation (Piers, Montjin and Balk, 2009). Communication and approachability amongst employees are key to success of this area. Many organisations suffer when dealing with this aspect because management remove themselves from hearing concerns from lower down employees (known as the ivory tower approach). Another common problem is silo effect, where organisational departs fail to communicate with each other because they are each operating within their own 'silo'. Key indicators that the information characteristic of safety culture is present are as follows:

- Availability of information
- Communication of work related information
- Training
- Safety reporting system
- Willingness to use the reporting system
- Consequences of safety reports
- Communication of safety related information
- Information exchange about safety issues

Justness

This area refers to the way in which safe behaviour is encouraged or rewarded, mistakes are accepted, and malicious behaviour is discouraged or punished (Piers, Montjin and Balk, 2009). This area refers to the outdated terminology of 'just culture'. The reason that this is no longer referred to as a separate type of culture is because it is an integral part of safety culture. How an organisation treats its staff according to their actions can reinforce commitment, behaviour, awareness, adaptability, and information. Key indicators that the justness characteristic of safety culture is present are as follows:

- Evaluation of safety related behaviours
- Perception of such evaluation
- Passing of responsibility

Levels of Culture

Schein (1988) outlined the levels of organisational culture, i.e. how deeply it is held and manifested within an organisation. As safety culture is simply a sub-facet of organisational culture, these levels are highly relevant. Schein (1988) believed that there were three levels of organisation culture: artefacts (visible organisational structures and processes), values (strategies, goals, and philosophies), and underlying assumptions (unconscious beliefs that are often taken for granted). While this is an older framework, it is more practical than many modern references that tend to pick up on rare, and often trivial, levels that fall in between these three. Another reason this framework is practical is that it outlines that every characteristic of an organisational culture must be held at the least abstract level (artefacts) to begin with before it can become more entrenched within an organisational culture. In this sense, the safety culture characteristic of information will likely start as an artefact, there will be set procedures set in place to ensure the flow of information. After time, and with the correct reinforcement from management, this can become a value. This means it would become part of the ordinary thinking of the organisation and a genuine goal. Following additional time, it may become an underlying assumption, this means that it is no longer thought about, it simply happens. This is the best place to have good cultural characteristics. However, the deeper cultural characteristics are held, the more difficult it is for them to be changed. For this reason, safety culture will always be slow to change. Quick changes can only be brought about dismissing those who hold the undesired culture at the deepest level.

Strong and Weak Cultures

In a strong organisational culture, the organisation's core values are both intensely held and widely shared (Robbins and Judge, 2008). Conversely, in a weak organisational culture, the organisation's core values are neither intensely held nor widely shared. Safety culture relates to the organisation's core values that relate to safety. Therefore, to have a strong safety culture, the 6 characteristics of a safety culture as outlined by Piers, Montjin and Balk (2009) need to be intensely held (ie at the underlying assumptions level of Schein's (1988) framework) and widely held (i.e. communicated and not subject to misinterpretation). It should be noted that strong cultures are different to effective safety cultures. An organisation wants a strong and effective safety culture that is deeply held. A strong culture that is ineffective and deeply held is potentially worse than a weak and ineffective culture as it is ineffective and difficult to change.

Overview of SMS Frameworks in Transport Industries

ICAO's conventional SMS framework has already been outlined, however, every signatory state is able to adapt this framework according to their national differences. This has resulted in a multitude of variations between countries. ICAO's framework can also only be considered conventional in the context of aviation. Many other transport industries also have SMS frameworks. This section of the literature review analyses frameworks presented by national aviation regulatory authorities, international aviation organisations, and other transport industries. Each framework will be compared to ICAO's and an outline of its relevance to aviation organisations will be provided.

Civil Aviation Authority of New Zealand (CAANZ)

At the end of 2012 CAANZ released an advisory circular on SMS that contained the draft CAANZ framework of an SMS, and more importantly, an acceptable means of compliance for the likely future regulation. The CAANZ framework consists of 13 interdependent elements:

1. Safety policy and accountabilities
2. Coordinated emergency response planning
3. Development control and maintenance of safety management documentation
4. Hazard identification
5. Managing risk
6. Safety investigation
7. Monitoring and measuring performance
8. The management of change
9. Continual improvement of the SMS
10. Internal audit programme
11. Management review
12. Safety training and education programme
13. Communication of safety critical information

    (Source: CAANZ, 2012)

How is this framework different to that of ICAO?

Unlike ICAO, CAANZ has removed the idea of components in lieu of having only elements to form an SMS. The first element of the CAANZ system combines the first two elements of ICAO's and forms a quasi-component in that it consists of many areas associated with the first component of ICAO's framework. This quasi-component approach is perhaps less desirable in the sense that it detracts from the importance of senior management and their commitment to safety. There are two additional elements to ICAO's SMS: Safety investigation, and Internal audit programme.

Safety investigation incorporates several areas:

- Internal safety investigations
- Responsibility for conducting safety investigations
- Defining the scope of an investigation
- Steps of an effective safety investigation
- Selecting and educating investigators

  (Source: CAANZ, 2012).

These areas are principally concerned with CAANZ Part 12 legislation. It was likely this element was added to the ICAO SMS so that the principles outlined in Part 12 could be incorporated in SMS for New Zealand aviation organisations.

Internal audit programme refers to organisations ensuring compliance and monitoring safety performance by auditing their own system. It is not just about whether policies and procedures are being followed but also whether they are effective (CAANZ, 2012).

What applicability does this framework have to aviation organisations?

This framework has relevance to aviation organisations due to its addition of the elements "safety investigation" and "internal audit programme'.

Safety investigations provide organisations with causal information that may allow the organisation to implement corrective measures in the hope of preventing additional safety occurrences. Each nation will have different procedures associated with this (for example in New Zealand safety investigation requirements are outlined in CAR Part 12), however, the key point to make is that organisations will have to perform safety investigations regardless of whether they have an SMS or not. For this reason safety investigation should be incorporated within an organisation's SMS to maximise resource allocation and ensure that safety investigation objectives remain safety focused (rather than liability focused).

Internal audit programmes are a form of self-regulation to assess the organisation's performance against documented standards. These audits identify defective areas within an organisation and allow for corrective measures to be implemented.

Both of these elements link to continuous improvement. It appears that ICAO has overlooked the usefulness of reactive improvement measures in providing organisations with corrective actions. Preventative measures put in place by organisations will at times fail, resulting in a safety occurrence. Corrective actions will then influence reviews of current preventative measures and/or generate new preventative measures. Internal safety audits are another reactive process as there must already be a deficiency for them to improve the organisation's safety. Both these reactive processes should not be implicit under the element continuous improvement, but rather explicitly and directly managed as separate elements in an organisation's SMS.

Civil Aviation Safety Authority (CASA)

CASA, the regulatory body in Australia, produced an AC about developing SMS for aerodromes. CASA (2013) stress that this is framework is generic to all aviation organisations and claim that the specificity of the AC to aerodromes is to offer additional guidance due to their unique operating environment. This AC contains an SMS framework consisting of 4 components and 15 elements. Below is a summary of the framework:

1. Safety policy and objectives and planning:
    i. Management commitment and responsibility
    ii. Safety accountabilities
    iii. Appointment of key safety personnel
    iv. SMS implementation plan
    v. Third party interface
    vi. Coordination of emergency response planning
    vii. Documentation
2. Safety risk management:
    i. Hazard identification process
    ii. Safety risk assessment and mitigation process
3. Safety assurance:
    i. Safety performance monitoring and measurement
    ii. Internal safety investigations
    iii. Management of change
    iv. Continuous improvement of the SMS
4. Safety promotion:
    i. Training and education
    ii. Safety communication

    (Source: CASA, 2013)

How is this framework different to that of ICAO?

While the components and twelve of the elements of the CASA SMS resemble that of ICAO, there are three additional elements in the CASA system: SMS implementation plans, third party interface, and internal safety investigations.

SMS implementation plans detail all areas to do with the development and implementation of an SMS (CASA, 2013). SMS implementation is not anexpeditious process, and therefore must be planned. CASA (2013) outlines that an SMS implementation plan should cover safety strategy, safety objectives, safety management processes and activities, resource implications, training, safety promotion and time lines. Once an SMS has been implemented it does not remove an SMS implementation plan as an element. This is because continuous improvement demands that the SMS be implemented with improvements as the system matures. Each improvement therefore needs an implementation plan that covers the same aspects as when the original SMS

was implemented. SMS implementation plans should also take into account safety processes that are already in existence and try and integrate them within an SMS. For example, many airports or airlines likely have hazard reporting systems already in place, and these system can simply be integrated within the SMS as part of the SMS implementation plan.

Third party interface relates to how contractors influence the overall safety level of the operation (CASA, 2013). Supplies, services and inputs provided by third parties must not erode the safety level of the operation. Therefore as part of an SMS, senior management must consider the safety records of third parties to be of at least equal weight to other deciding factors such as the price, quality and timeliness of using the third party. It is essential that third parties understand the SMS of the organisation and can comply with it.

Internal safety investigations are part of the CASA SMS protocols because they allow an organisation the ability to avoid or mitigate serious accidents and incidents from occurring (CASA, 2013). Each major accident will have many contributing factors. Internal safety investigations of reported events may allude to factors that otherwise may have led to a serious accident.

What applicability does this framework have to aviation organisations?

This SMS framework has relevance to aviation organisations due to it addition of the elements "SMS implementation plan", "third party interface" and "internal safety investigation".

SMS implementation plans are a useful utility to ensure that the implementation of SMS elements are structured and well planned. Implementation plans are also an on-going process to ensure that measures identified from continuous improvement are appropriately implemented.

Third party interfaces are an important aspect that has been overlooked in ICAO's SMS framework. Third parties have the potential to compromise the safety of the organisation that they are interacting with, thus such interactions must be appropriately managed.

The inclusion of internal safety investigation echoes that of CAANZ' (2012) framework, further strengthening the argument to include this element as part of an organisation's SMS.

Civil Aviation Authority of the United Kingdom (CAA-UK)

CAA-UK outlines an SMS consisting of four components and 13 elements. It is as follows:

1. Safety policy and objectives
    i. Management commitment and responsibility
    ii. Safety accountabilities
    iii. Appointment of key safety personnel
    iv. Coordination of emergency response planning
    v. SMS documentation
2. Safety risk management
    i. Hazard identification
    ii. Risk assessment and mitigation
    iii. Internal safety investigations
3. Safety assurance
    i. Safety performance monitoring and measurement
    ii. The management of change
    iii. Continuous improvement of the SMS
4. Safety promotion
    i. Training and education
    ii. Safety communication

(Source: CAA-UK, 2010).

How is this frameworkdifferent to that of ICAO?

The CAA-UK, much like CASA, include internal safety investigations as an additional element in their framework. Their justification is the same as CASA's (see above). All other elements in the CAA-UK framework resemble ICAO's framework.

What applicability does this framework have to aviation organisations?

This framework addresses internal safety investigations, much like CAANZ (2012) and CASA (2013). This once again echoes the importance of including such an element.

Federal Aviation Administration (FAA)

Safety Policy — Establishes senior management's commitment to continually improve safety; defines the methods, processes, and organisational structure needed to meet safety goals

- Establishes management commitment to safety performance through SMS
- Establishes clear safety objectives and commitment to manage to those objectives
- Defines methods, processes, and organisational structure needed to meet safety goals
- Establishes transparency in management of safety
    - Fully documented policy and processes
    - Employee reporting and resolution system
    - Accountability of management and employees
- Builds upon the processes and procedures that already exist
- Facilitates cross-organisational communication and cooperation

Safety Risk Management (SRM) — Determines the need for, and adequacy of, new or revised risk controls based on the assessment of acceptable risk

- A formal process within the SMS composed of:
    - Describing the system
    - Identifying the hazards
    - Assessing the risk
    - Analysing the risk
    - Controlling the risk
- The SRM process may be embedded in the processes used to provide the product/service

Safety Assurance (SA) — Evaluates the continued effectiveness of implemented risk control strategies; supports the identification of new hazards

- SMS process management functions that systematically provide confidence that organisational outputs meet or exceed safety requirements
- AVS SMS has a dual safety assurance focus:
    - AVS organisations
    - Product/service providers
- Ensures compliance with SMS requirements and FAA orders, standards, policies, and directives
    - Information Acquisition
        - Audits and evaluations
        - Employee reporting
    - Data Analysis
    - System Assessment
- Provides insight and analysis regarding methods/opportunities for improving safety and minimizing risk
- Existing assurance functions will continue to evaluate and improve service

Safety Promotion — Includes training, communication, and other actions to create a positive safety

culture within all levels of the workforce

- Safety promotion activities within the SMS framework include:
    - Providing SMS training
    - Advocating/strengthening a positive safety culture
    - System and safety communication and awareness
    - Matching competency requirements to system requirements
    - Disseminating safety lessons learned
- Everyone has a role in promoting safety

(Source: FAA, 2014).

How is this framework different to that of ICAO?

The FAA SMS framework shares the four core components with that of ICAO's. However, rather than compartmentalise the components into elements, the FAA have developed "quasi elements" to describe the components. Because the FAA's framework lacks the explicit elements of ICAO's, the processes and actions undertaken under each component are described differently when compared to ICAO's SMS. However, the "quasi elements" in the FAA's framework are far more comprehensive in their explanation of intended functions than ICSO's elements, removing some ambiguity for strategic objectives.

The FAA has taken a similar approach to ICAO when developing their SMS as it highly strategic in nature. It provides little consideration for the tactics that will be required during the implementation of policy and how these will be managed operationally.

What applicability does this framework have to aviation organisations?

This framework lacks applicability to aviation organisations, as it is lacks completeness as a management system. The FAA has replicated the core concepts of ICAO's framework in its four main components. Both SMS suffer from two suffer from two fundamental flaws that determent their abilities to be easily adapted to an organisation: they are overly strategic and overlook tactical and operational functions, and they lack explicitly in relation to each element. These two limitations result in little guidance on how the framework is to be adapted to each organisation and introduce a wide scope of operational flexibility during implementation. Failing to consider tactical and operational functions causes difficulties in developing assessment tools such as gap analyses. If there are no explicitly set standards for these functions, then logic would suggest that it is very difficult to assess their effectiveness.

The lack of the explicit elements in the FAA's SMS removes the compartmentalisation of the four core components in the framework. This results in the components being more difficult to manage due to their larger and more complex nature (Schiebener*et al.*, 2014).

The FAA's (2014) claim that SMS safety policy involves building upon the processes and procedures that already exist is misleading, incorrect and is another inhibiting factor in relation to its applicability to an organisation. SMS often involves development or creation of new policy, processes or culture (Lewis, 2007).

This can occur when entire sections of elements are found to be completely non-existent within an organisation, therefore, new policy is required which will not build upon existing policy.

Transport Canada

Transport Canada have developed an SMS with 6 components and 17 elements, one of which is standalone.

SMS: Compliance document, gap analysis, and project plan

1. Safety management plan
    - Safety policy
    - Non-punitive reporting policy
    - Roles, responsibilities and employee involvement
    - Communication
    - Safety planning, objectives and goals
    - Performance measurement
    - Management review
2. Document management
    - Identification and maintenance of applicable regulations
    - SMS documentation
    - Records management
3. Safety Oversight
    - Reactive processes
    - Proactive processes
    - Investigation and Analysis
    - Risk management
4. Training
    - Training, awareness and competence
5. Quality assurance
    - Quality assurance
6. Emergency preparedness
    - Emergency preparedness and response

(Source: Transport Canada, 2009).

How is this framework different to that of ICAO?

Transport Canada has developed a framework that is different to ICAO in how it divides the elements. Many of the elements resemble ICAO with the addition of non-punitive reporting policy, identification and maintenance of applicable regulations, records management, reactive processes, proactive processes, investigation and analysis, and quality assurance. In addition to this, Transport Canada requires an SMS to be accompanied by a compliance document, gap analysis and project plan.

Non-punitive reporting policy goes back to the idea of continuous improvement. CAANZ, CASA, and CAA-UK all talk about safety investigations. These can be for minor incidents, but by investigating them, the circumstances

under which they happened may come to light and prevent a major accident from occurring or another minor incident from recurring. Similarly, hazard identification, which is an element in most SMS frameworks, can prevent accidents and incidents from occurring. Both of these important elements require a non-punitive reporting policy so that staff will not fear reporting safety concerns. The non-punitive policy should go as far as to protect staff from blame for accidents. Deliberate and malicious safety violations are not covered under this policy and these should be dealt with using harsh consequences.

Identification and maintenance of applicable regulation is an important aspect to be considered for an organisation. While this report would recommend that organisations should aim slightly higher than compliance, regulation is required to know what standard must be met for an organisation to set its safety goals and objectives.

Managing records is important for organisations to complete safety-related trends analyses. Some records have regulatory minima associated with how long they must be kept. Even if a document is not required to be legally kept for an extended period of time, if it has safety pertinent information then an organisation may still decide to keep it. A system for managing safety pertinent records is one element of the Transport Canada approach.

Reactive and proactive processes vary not in function but in how they work. Both ultimately are aimed at reducing the likelihood of future incidents and accidents by continually improving the SMS. Reactive processes are those such as accident investigations (Transport Canada, 2009). Something has already happened, and the goal is to prevent something similar from happening again by improving the SMS. Proactive processes aim to seek out potential accident and incident causations and prevent them from ever occurring (Transport Canada, 2009). An organisation must have both types of processes in place if it is to do a good job of preventing accidents and incidents as part of its SMS. These processes could be implied as being part of the ICAO framework under continuous improvement of the SMS, however, Transport Canada is different in that it explicitly mentions them as separate elements.

Much like the other regulators mentioned in this report, Transport Canada includes investigation and analysis as part of its SMS.

Quality assurance is an integral element of the Transport Canada SMS. This makes their framework unique from several other regulators who suggest that quality assurance and QMS are different to SMS. Quality assurance aims to provide compliance, conformity and monitoring to the quality of the service or product offered. CAANZ (2012) suggest that ideally quality assurance should form part of an SMS. The justification of CAANZ (2012) is that organisations should try and minimise additional resource use for an SMS by integrating other systems into the SMS. The difference is that this will be up to the operator in New Zealand rather than legally required. Specifically CAANZ (2012) identifies that quality assurance and SMS double up on the following areas:

- Both depend upon measuring and monitoring

- Both strive for continual improvement
- Both use similar tools, such as auditing.

For this reason, it seems logical that an SMS should integrate quality assurance as an additional element so that safety as well as the quality of the service and product offered can be mutually improved using the same resource allocation.

What applicability does this framework have to aviation organisations?

This framework provides some fresh perspectives on what could be included as part of an SMS. Some of the elements that are additional to Transport Canada's SMS framework are very logical in terms of both safety improvements and resource maximisation. This framework is more explicit than ICAO's and is also more business conscious. For this reason many of its ideas are applicable to an aviation organisation during the development of an SMS. Specifically, the inclusion of quality assurance as part of the SMS framework illustrates Transport Canada's practical understanding of the interaction between quality and safety. The integration of quality management and safety management results in a framework that maximises resource allocation and is ultimately easier to manage than having two independent systems.

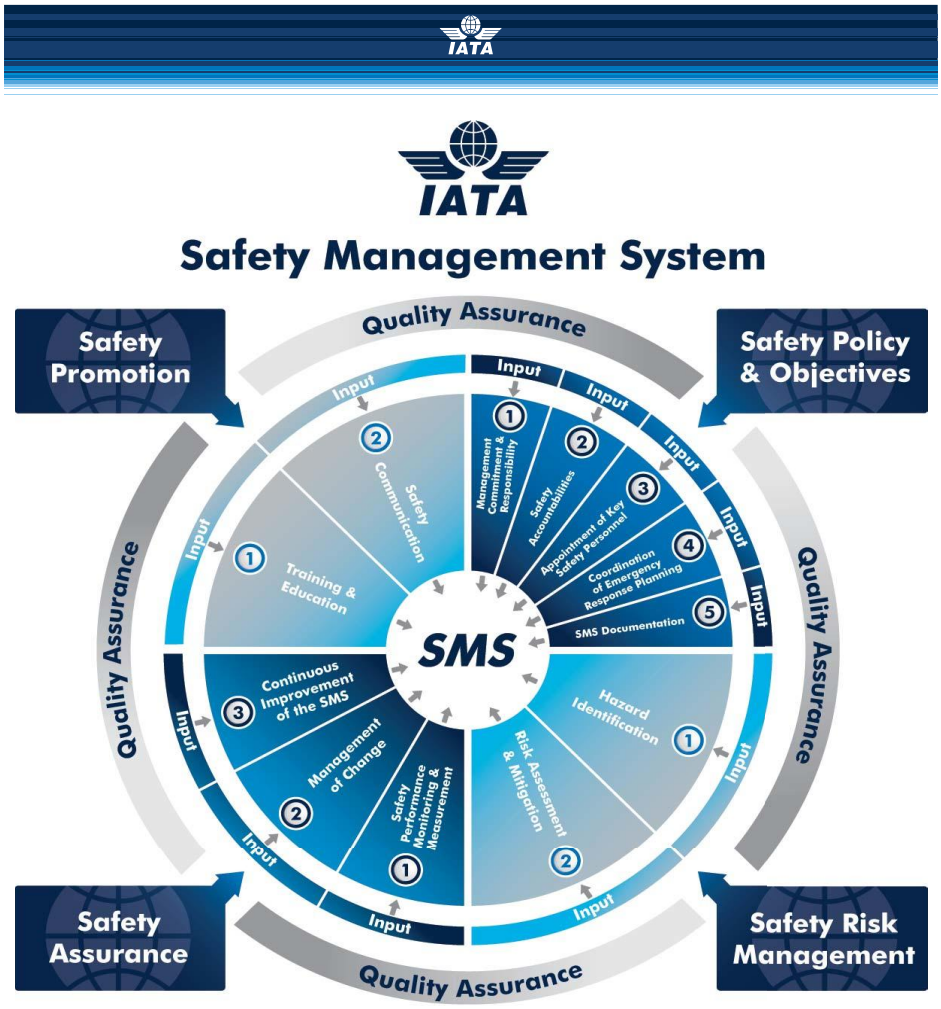

Figure 1. IATA's SMS framework (IATA, 2014)

How is this framework different to that of ICAO's?

This framework does not differ from ICAO's SMS framework.

What applicability does this framework have to aviation organisations?

This SMS framework is endorsed by IATA who are a credible organisation in the aviation industry. IATA's exact replication of ICAO's SMS framework shows consensus between ICAO and IATA on how SMS should be developed.

Airports Council International (ACI)

ACI (n.d) claim that their SMS framework is made up of five main parts: SMS Elements, SMS Development, SMS Implementation, Risk Assessments, SMS Resources LEAD, PLAN, DO, CHECK, REVIEW. It is unclear how ACI believes these to be incorporated in the system below.

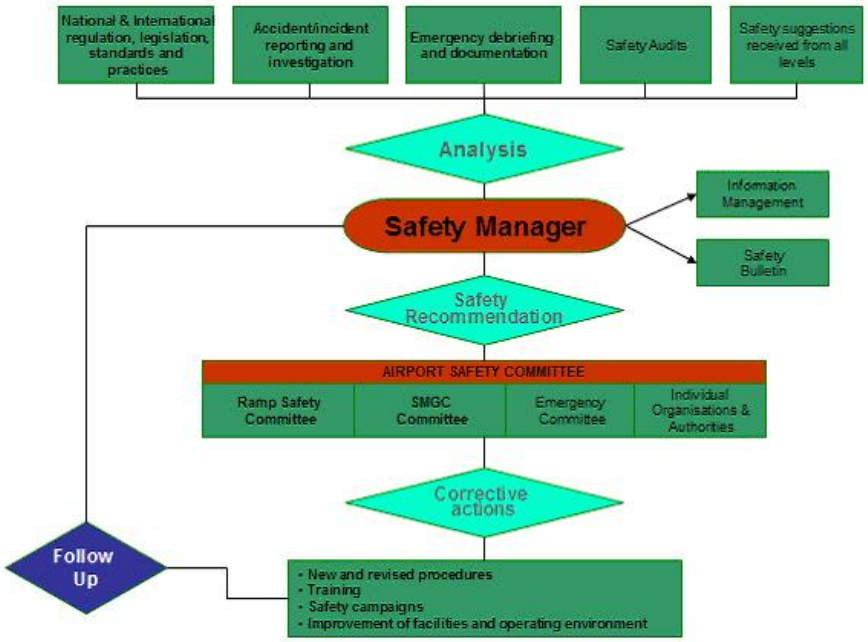

Figure 2. ACI's SMS framework (ACI, n.d.)

How is this framework different to that of ICAO?

The Airports Council International (ACI) framework takes a more macro approach to the overall SMS process than ICAO's framework. It is made up of five main parts: SMS Elements, SMS Development, SMS implementation, risk assessment, and SMS resources. ICAO's framework does not consider the development of SMS elements and the implementation process. ICAO's SMS framework states each element but gives no direction on the actual means of achieving these. ACI's SMS framework incorporates the implementation process as a component of the system. ICAO designated this as a separate process and offered no guidance on how it should take place. ACI provides direction and examples of how to develop each element as well as the support systems required for successful implementation.

The ACI SMS framework includes an airport safety committee that takes recommendations from the safety manager and offers solutions at the implementation stage of the system. ICAO's framework does not contain such an element. ACI developed this element at a more operational level and elaborated upon ICAO's "continuous improvement of the SMS" by detailing how exactly this will take place at the ground level. ACI also

provide a more detailed explanation of data collection and outline of where certain roles and responsibilities fit into the SMS (I.e. Safety manager, members of the airport safety committee).

ICAO place significant emphasis on the responsibility of senior management and their commitment to the SMS. ACI have developed a bottom-up rather than top-down approach such as that of ICAO. In doing so, they have overlooked the importance of senior management's commitment to the SMS and the significant influence that commitment has over how successful the system will be. The safety manager is not the only member of the management team that should have input into the SMS and this is an area of ACI's framework that falls short of ICAO's

ACI have added accident/incident reporting and investigation, and safety auditing as elements in their framework. ICAO list safety reporting as being a part of the safety policy, however ACI's framework shows incident/accident reporting and investigation as an important input in the SMS safety analysis process. ICAO does not specifically cover auditing under their SMS framework.

The ACI SMS framework is very reactive due to the nature of its design. Even the fact the SMS framework is formatted as a top-down process rather than a continuous rotating system, suggests it does not seek continuous improvement in a proactive manner. The framework incorporates five inputs, at least four of which are reactive (excluding safety audits). The framework lists the actions it generates as being "corrective" actions, which is reactive terminology. ICAO's SMS framework has inputs throughout the system and uses far greater proactive methodology to seek continuous improvement rather than correction.

What applicability does this framework have to aviation organisations?

Implementation of the SMS is as important as the development of the SMS itself. A poorly implemented system will be unlikely to succeed and therefore the implementation process is a crucial aspect of the overall SMS process. CASA (2013) include this under the component *safety policy, objectives and planning*.

ACI's SMS framework is designed specifically for airports and as such incorporates elements unique to airport operations such as the ramp safety committee and surface movement, guidance and control committee. Therefore, this framework is less applicable to other types of organisations in the aviation industry. This framework also lacks consideration for the size and complexity of an organisation, as some may not require committees for each operational area, rather a single representative. These representatives will help form a holistic interpretation of the safety environment for the entire organisation.

ACI's framework is operational in nature and lacks strategic consideration. In the context of airports, airside safety is not the only concern and so it must ensure the business, as a whole, operates safely. Aerodrome and organisational safety is not limited to operational factors such as the movement of air traffic. Organisational safety must include sundry factors such as, third party contractors, human resource management, commercial activities and the end user of the product or service. An SMS that considers all aspects of the organisation's operations is key to ensuring safe operations for the organisation as a whole.

Accident/incident reporting and investigation is a key part of this model, echoing other aviation organisation's adaptations of ICAO's SMS framework.

Airport Cooperative Research Programme (ACRP)

Figure 3. ACRP's SMS framework (ACRP, 2007)

How does this framework differ from that of ICAO's?

ACRP includes culture as an element in its SMS framework. Neither ICAO nor any of the other SMS frameworks examined in this report have listed culture as part of their framework.

This framework incorporates auditing, both internal and external, as a significant part of its safety assurance component. The ICAO SMS framework does not include any auditing processes.

ACRP have created an element "organisational structure", ICAO have not directly addressed this but have an element of similar relevance "appointment of key safety personnel". ACRP have taken a much broader approach than ICAO and looked at the entire organisational structure rather than simply positions directly related to safety.

ACRP's framework is more simplistic than ICAO's and lacks the two tiered approach that ICAO and many of the other major SMS frameworks use. Rather than having components and then sub elements under each, ACRP has essentially combined the components and elements to make their framework less specific but also less complicated. This may make the framework more appropriate for smaller organisations but will lack the specificity and scope required by larger organisations.

CRP have replaced ICAO's element "safety risk assessment and mitigation" with "corrective action". "Corrective action" is reactive by nature and has connotations that actions will only be taken after an incident takes place. Risk assessment and mitigation is far more proactive as risks will be identified in the previous element, hazard identification and these will then be assessed and mitigated *prior* to an incident or accident occurring.

What applicability does this framework have to aviation organisations?

Taking a more holistic approach to safety in organisational structure is relevant to all organisations as safety is the responsibility of allpersonnel within any organisation.

The consideration of culture in the SMS is applicable to any organisation as this is a shortfall of the other SMS frameworks examined in this dissertation. Culture is a vital component for achieving a successful SMS for a number of reasons and the relevance of culture is not limited to aviation organisations.

Firstly, the organisation's culture must support the SMS and encourage personnel to adapt to it, at first there will possibly be resistance to change but the culture must be able to adapt to these changes (Schein, 1988).

Secondly, if there are persons within the organisation that cannot adapt to the change due to their current cultural values, norms and beliefs being held at a level that is too deep to change in a suitable time frame, then such people may have to be removed from the organisation (Schein, 1988). This may require restructuring the organisation.

Thirdly, the organisational culture must encourage the continual improvement and development of the SMS after it has been implemented (non-punitive and transparent to encourage safety reporting).

Therefore, in order for any organisation to implement a successful SMS, organisational culture must support the SMS and the undertaking of all of its elements by all members of the organisation and relevant third parties.

This SMS framework is straightforward and concise in comparison to that of ICAO. This will add to its applicability to some organisations and limit its effectiveness with others. Smaller and less complex organisations may find this SMS to be appropriate for their needs. However, larger, more complex organisations will require a more comprehensive and strategic SMS to ensure regulatory compliance and safe operations.

New South Wales (NSW) Government Roads and Maritime Service

The 12 sections of NSW Government's Maritime SMS are:

2. General.
    - The name of your company;
    - The address and contact details of your company;
    - Names and contact details of senior management;
    - Name and contact details of the designated person (DP);
    - What your company does, for example, charters, fishing trips, dive trips;
    - Where it operates, for example, Sydney Harbour, Port Stephens; and
    - The number and type of vessels operated, for example, two ex-navy minesweepers; catamaran charter vessel; or high-speed adventure vessel.
3. Safety and Environment Policy.
    - Understanding what is required for safe operations and legislation that is relevant to each organisation's operations.
4. Company Responsibilities and Authorities.
    - This section shows how your company is organised. It explains who does what in your company.
5. Designated Person DP.
    - The Designated Person (DP) looks after the safe operation of your vessel(s) and is responsible for the SMS. The DP is a link between your company and the people working on your vessel(s);
    - In some cases, particularly in larger companies, the DP is shore based and is in direct contact with management. In other cases, for example, one person operations, the DP might be the owner operator;
    - It is very important that the DP understands what their responsibilities are.
6. Master's Responsibility and Authority.
    - This section says that the Master of your vessel is responsible for understanding the SMS and making sure it is used on the vessel;
    - It says the Master is responsible for communicating effectively with crew and passengers;
    - It says s/he has complete authority to do what s/he thinks is necessary to keep the vessel, passengers and crew safe.
7. Resources and Personnel.
    - What qualifications they need;
    - How they are trained and who trains them;
    - Where training records are kept;
    - How long the records should be kept (minimum 5 years).
8. Operational Procedures.

- The systems on the vessel;
- Start-up / shut down procedures;
- Not only “what” to do also “how” to do it, for example, embark/disembark passengers;
- Who is responsible for doing particular jobs;
- How to maintain a safety culture; and
- How and where records are kept (for a minimum of 5 years).

9. Emergency Procedures.
    - Who is responsible for doing particular things in an emergency;
    - How you practise for dealing with emergencies by doing drills;
    - How you check emergency equipment
    - How and where you record drills; and
    - How often you do drills.
10. Reporting Accidents / Incidents.
    - How you identify things that could be a problem (hazards), eg water
    - How you identify things that could happen because of this (risks), eg falling in and drowning
    - What you do to reduce the risks (controls), eg handrails
    - How you report something on the vessel that needs repairing, eg on a work request form, in the log
    - Who is responsible for fixing it
    - How people are told that it’s been fixed
    - What you do if someone gets hurt on your vessel
    - What you do if your vessel is involved in an accident or an incident
11. Maintenance and Recording.
    - When and how you check and test emergency equipment;
    - How you make sure the equipment you use meets Occupational Health and Safety legislation requirements;
    - What you do on a regular basis on your vessel, for example, daily engine checks;
    - How you follow a maintenance schedule and manufacturer’s instructions;
    - How and where you record maintenance that has been carried out, for example, an engine room log; and
    - How you might train crew in the use of some equipment, eg fire pump.
12. Documentation.
    - How you make sure documents are in the right place;
    - How you make changes to documents and record them;
    - How people are told changes have been made; and
    - How you get rid of out of date documents and record that you’ve done it.
13. Review and Evaluation.

- How often you will review your SMS;
- How you will make any changes and keep a record (minimum 5 years); and
- How you will tell people changes have been made

(Source: New South Wales Government, 2012)

How does this framework differ from that of ICAO's?

This is a far more instructional type of framework than ICAO's SMS and essentially offers guidance on how to translate each element into practice. This framework is designed for use by individual truck and maritime operators, it therefore lacks the collective organisational approach on the scale that is required for aviation organisations.

This framework contains maritime specific elements such as "master's responsibility and authority", this is the equivalent to the "management's commitment and responsibility" and "safety accountability" in ICAO's framework.

The NSW Government has included a "general" element identifying the details of the company and its operations. This would usually be a part an organisation's exposition and safety policy rather than a separate element. The scale of most commercial operators in aviation is such that this information will already be documented outside of safety documentation and will not be required in the SMS.

An area overlooked by ICAO and by all of the other international frameworks studied in this dissertation is an environmental plan. This is included in the NSW Governments maritime SMS framework as environmental factors can impact safety.

What applicability does this framework have to aviation organisations?

The maritime industry is in the business of transport, which is also one of the core businesses of commercial aviation. Therefore there are many elements in the framework above that are highly relevant to aviation organisations. Examining SMS frameworks from other industries helps to identify areas that may be overlooked or neglected in aviation and also provides alternative methods of explanation and design that can be adapted into SMS frameworks in aviation.

Environmental factors such as aircraft pollution, noise pollution, meteorological conditions and hazardous waste disposal are relevant for aviation organisations. All of these factors have the potential to impact safety and must be managed effectively. Integrating the environmental plan as part of the SMS minimises conflicting objectives and helps minimise unnecessary resource expenditure that both occur when systems are managed independently (CAANZ, 2012).

The operational nature of this framework gives a more detailed explanation of exactly how relevant operational elements are translated into actions at an operational level. Many aviation organisations will require a more strategic SMS than the one stated above due to their size and complexity.

European Railways Agency (ERA)

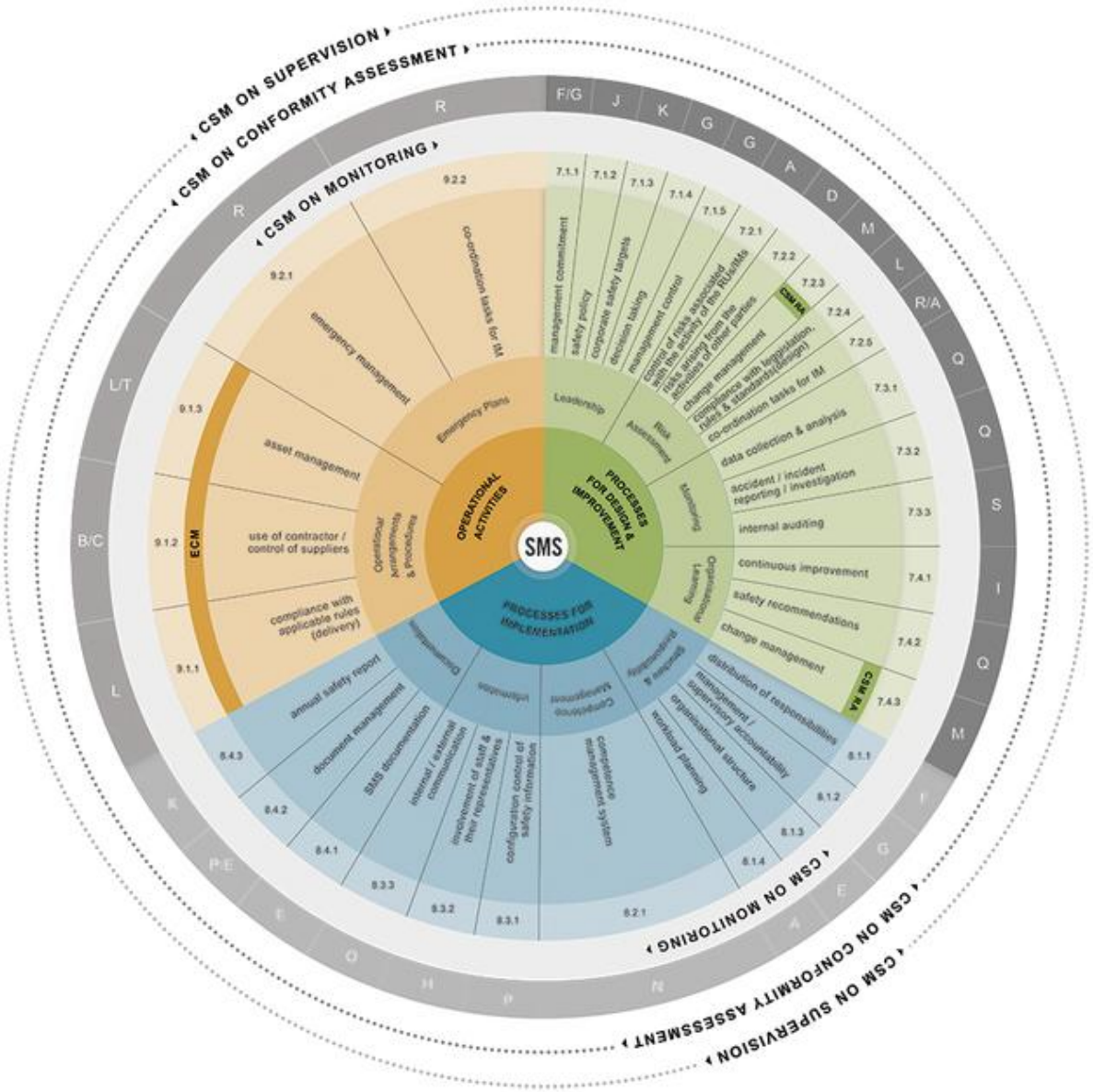

Figure 4. ERA's SMS framework (ERA, 2013)

How does this framework differ from that of ICAO's?

The greatest difference between ERA's SMS framework and that of ICAO's is its structure and design. ERA has generated a framework that is not just applicable at a strategic, tactical and operational level, but also which encompasses the implementation and the on-going operational activities of the SMS. ICAO does not separate its SMS framework by function. Because ERA's elements are highly function specific, ICAO does not include many of the elements in the ERA's framework. (However, some elements are shared or similar in both frameworks such as; emergency management, SMS documentation, management/supervisory accountability and annual safety report)

ERA's framework for SMS incorporates a number of new elements in addition to lacking some stated in ICAO's framework. ERA separate management commitment, decision making and management control into individual elements rather than ICAO's single "management commitment and responsibility".

This framework includes two elements under risk assessment that are specific to railway operations and relate to compliance with railway specific legislation and hazards associated with railway operations.

A major point of difference is between ERA and ICAO is ERA's inclusion of risks arising from the activities of external third parties. This is a significant shortcoming of ICAO's framework and highly relevant to aviation organisations, in particular aerodromes.

Much like the Airports Council International's SMS framework, ERA has included accident/incident reporting and investigation. ICAO have not included in their framework as a separate element, rather a subsection of the safety policy as safety reporting.

What applicability does this framework have to aviation organisations?

The result of ERA incorporating implementation and on-going operational activities is a much more complete system that offers guidance, not only for the design of the SMS,but also for how it translates for organisations. This is a fundamentally different approach to SMS and views it as more than simply the documented element design process. Aviation organisations and organisations in other industries will benefit from a more complete framework that can be easily implemented and managed.

The organisational nature of ERA's framework would be beneficial as it provides guidance on exactly what the SMS means for each specific organisations at each level of their operations.SMS frameworks should clearly illustratetheir implications for the organisation and how these translate into reality. This framework clearly illustrates what is required of senior management, and other levels throughout the organisation.

Using aerodromes as an example, the inclusion of risks arising from the activities of other third parties is very relevant. The diverse range third parties that work either for or in conjunction with an aerodrome means that a thorough understanding of that aerodrome's SMS is required to ensure that there is a consistent safety standard across the all parties.

ERA's inclusion of accident/incident reporting and investigation, and internal audits as elements is highly relevant aviation organisations. Not only does ICAO fall short of what is required for a reporting and investigation process, this process is crucial for continual improvement of the SMS and for the general safety of all organisational stakeholders. Internal audits are also imperative for identifying areas where improvement is needed and relate to continual development of safety systems.Certain aviation regulatory authorities also echo ERA's suggestions in this regard.

Queensland Trucking Association (QTA)

1. General obligations
2. Management commitment
    a. Workplace health and safety policy
    b. Resourcing for safety
    c. Accountability
    a. Promoting safety
3. Consultation with employees
4. Safe work procedures
    a. Identifying hazards
    b. Assessing risks
    c. Control measures
    d. Implementing control measures
    e. Monitoring and review
5. Particular workplace risks for road freight transport
    a. Contractor management
    b. Dangerous goods
    c. Drugs and alcohol
    d. Electrical safety
    e. Emergency planning
    f. Fatigue
    g. First aid
    h. Hazardous substances
    i. Manual tasks
    j. Noise
    k. Personal Protective Equipment (PPE)
    l. Plant and equipment
    m. Restraining Loads
    n. Slips, trips & falls from height
6. Training and supervision
    a. Training
    b. Certification and licensing
    c. Supervision
7. Reporting
    a. Incident reporting and investigation
    b. Monitoring and review
    c. Performance indicators
8. Injury management

a. Workers' compensation
b. Rehabilitation and return to work

(Source: QTA, 2009)

How does this framework differ from that of ICAO's?

The QTA's first component is general obligations of the organisation. This element could be considered to be a part of the safety policy (for safety obligations) and included in the organisation's exposition rather than listing it as a separate element.

"Consultation with employees" is an element not seen in ICAO's SMS framework nor any of the other frameworks examined in this dissertation. Some frameworks list communication as an element but "consultation with employees" is a more specific function as "communication" is an ambiguous term in this context and could refer to, or be between, a range of different people and stakeholders. This element is implicit under ICAO's safety communication element and therefore requires clarification. If this element is not explicit then it cannot be actively managed and its effectiveness cannot be ensured. Consulting with employees affects the level of ownership and pride that they feel towards their position within an organisation (Robbins and Judge, 2008). Robbins and Judge (2008) claim that this will impact the effectiveness of the workforce, stating that if employees take pride in the organisation and true ownership of their role, they will personalise the goals of the organisation and pursue them out of personal desire.

QTA have merged the functions of ICAO's components "safety risk management" and "safety assurance" into safe work procedures. However, the QTA's framework lacks the continuous improvement element of ICAO's framework and has added "implementing control measures". ICAO has assumed implementation as part of their SMS monitoring and control elements.

This framework incorporates workplace risks specific to road freight transport. All of the elements listed above under this component are highly relevant to aviation organisations and airport operators in particular.

The QTA include an entire component for safety reporting and investigations in their SMS. This is a major drawback of ICAO's framework, which does not include safety reporting. This is a crucial aspect for identifying dangerous trends and hazards and is a key part of continually improving the SMS.

Injury management is another component included in the QTA's SMS framework. ICAO does not include this as their framework is designed at a more strategic level than that of the QTA's, which is far more operational.

Overall the greatest differentiating factor is the operational nature of the QTA's SMS framework. This framework is intended to be understood by truck drivers working the front line and therefore is designed to be directly translated into functions in an operational context. ICAO's SMS framework is intended for implementation at a strategic level and provides overarching framework under which an organisations' can develop their own safety systems, rather than providing direct guidance on how to do this. The QTA's

components and elements are more closely related to standard operating procedures and recommended practices that enhance safety, rather than strategic processes that promote a safe work environment.

What applicability does this framework have to aviation organisations?

It is imperative that aviation organisations consider the significance of effective communication with employees and that employee's value and take ownershipof their positions within the organisation. This is crucial for safety, as employees must feel that they play a key role in achieving organisational safety goals. If an organisation can successfully programme the organisational safety goals to be held at assumption level of its organisational culture as defined by Denison (1990), then such goals induce subconscious actions and organisational goals can become personally held by employees. Effective employee communication and involvement is important for creating a feeling of pride and making employees feel part of the organisation. This is essential for the achievement of organisational goals and in particular, safety goals.

The QTA framework incorporates workplace risk associated to trucking. Many of these elements are applicable to organisations in the aviation industry, but are too operational in nature to be included in the overarching SMS framework. These would be covered under a broader, more strategic element of hazard identification. Such factors are more relevant considerations of OSH than an SMS. Whilst the workplace risks listed by the QTA are still relevant to aviation organisations as they are hazards that occur outside of the trucking industry, they are not at the macro level required from an SMS.

The QTA framework highlights a potential type of design that may be suitable for trucking, but is too operational in nature and lacks the strategic oversight required for aviation organisations. This framework presents itself as standard operating procedures relating to safety or OSH requirements, rather than a safety management system. It fails to represent a managerial approach to safety; rather it aims to ensure specific safe operating practices, limiting its applicability to organisations in the aviation industry.

Methodology

This dissertation has reviewed literature from several disciplines in business and safety management. From this review, a number of discussion points have been raised concerning both deficiencies in the conventional SMS framework as well as potential improvements that are present in other SMS frameworks. Additionally, this dissertation has identified organisational issues that have not been addressed by any existing SMS framework. From this review of existing literature, this dissertation will propose an SMS that addresses deficiencies in ICAO's conventional framework, adopts useful improvements from other existing SMS frameworks, and produces original concepts based upon the principles of organisational management. This dissertation aims to produce a complete SMS framework including guidance on the development of core utilities (gap analysis and implementation plan).

The methodology for developing a new SMS framework can be summarised into a simple step-by-step process:

1. Each deficiency from ICAO's conventional framework will be discussed separately and a possible solution for each deficiency will be deduced from existing literature, techniques and current practices in the aviation industry and other disciplines.
2. Each potential improvement outlined in other existing SMS frameworks will be critically examined for efficacy against existing literature, techniques and current practices in the aviation industry and other disciplines.
3. The recommendations provided by steps one and two will be added to the existing ICAO framework, as this framework is incomplete rather than incorrect.
4. Recommendations will be provided on how to define each of the elements of the proposed SMS in order to develop a gap analysis tool and implementation plan.

Results

The results in this section are based upon existing literature, techniques and current practices in the aviation industry and other disciplines.The results will be split into five areas as per the methodology outlined in the previous section.

Solutions to Deficiencies in ICAO's Conventional SMS Framework

This area addresses the deficiencies identified in ICAO's SMS framework. Each deficiency will be systematically discussed and using existing literature, techniques and current practices, a solution for each deficiency will be deduced.

The most crucial failing of ICAO's SMS framework is its lack of regard for organisational management. There were several points highlighted in the literature review that must be addressed. Each of these will have its own discussion and a solution or series of solutions will be outlined for each one.

ICAO's SMS does not directly address a number of organisationalsupport function, only implying their significance, and failing to directly manage these functions (e.g. HRM, finance, legal).There is evidence to suggest that when functions and their goals are implicit, they will not be actively managed, the intended results will be inconsistent and potentially undesirable (March and Simon, 1993; Schiebener*et al.*, 2014; Rowley and Jackson, 2012). The solution to this problem is to explicitly outline these support functions as necessary for the implementation of an SMS by either incorporating such functions as elements, or by outlining them as being premise to having an SMS. This dissertation would recommend that HRM be incorporated as an element of the SMS framework, and that financial resourcing should be a premise of having an SMS. Legal issues will be directly addressed by national aviation regulations will likely be actively managed without being a part of the SMS framework.

ICAO's SMS is overly strategic and policy focused. It is a widely accepted notion that organisational management systems must provide means of implementation for strategies and policies (Rowley and Jackson, 2012; Martin, 2005; Lutchman, Maharaj, and Ghanem, 2012; Porter, 1985; Shimizu, 2012; Walker, 1992; Lewis, 2008). The solution to this deficiency is to incorporate additional elements that support implementation of policies, and to separate elements by their output (i.e. whether they are strategic, tactical, or operational outputs).

ICAO's SMS takes a "one-size-fits-all" approach that does not allow adaptation to individual organisational profiles. A more suited approach would be to allow for flexibility in the core determinants of an organisation's profile. Martin (2005) outlines that these core determinants are size, age, industry, technology, management style, structure, scope of operations, management preference, profitability, culture, employee characteristics, job design, patterns of employment, and location. ICAO has left the adaptation of its SMS framework to national regulators. This has resulted in inconsistencies in the interpretation and application of mediating factors that allow for organisations to adapt the system to their profile. Typically, regulators have only addressed size, industry and scope of operation as reasons for adaptation. Failure to address other aspects of

the organisation's profile can lead to compromises in the efficacy of the SMS. CAANZ, for example, has failed to address financial or cultural areas of risk during certification interviews (Office of the Auditor General, 2010; Henderson, 2014). Insufficient resourcing of the SMS will result in compromised performance (Lutchman, Maharaj, and Ghanem, 2012). The solution to this problem is to incorporate organisational profile determinants as mediating factors when applying an SMS. This dissertation would suggest several solutions to this problem that should be applied together (i.e. neither one fully addresses the problem, but combined,all aspects of organisational profile will be addressed). The first solution is toseparate elements by their type of output (i.e. whether they are strategic, tactical, or operational outputs). This will allow the adaptation of the SMS to suit various organisational structures, job designs, and locations. The second solution would be to include HRM as an element as this addresses management style, structure, management preference, culture, employee characteristics, technology and patterns of employment. The third solution would be to integrate safety as part of competitive strategy. If safety is seen as a means of attaining a sustainable competitive advantage, then it will become closely associated with the characteristic of profitability (i.e. to be profitable the organisation must be safe). The fourth solution involves incorporating the characteristics of size, scope of operations and industry into the gap analysis utility to accompany the SMS framework. This is already commonplace due to regulator interpretations of ICAO's framework.

Additional to deficiencies in the area of organisational management, there are several other failings of ICAO's framework. These primarily concern the conception of what an SMS is. Several inconsistencies exist between existing literature and ICAO's model over what an SMS' purpose is and how it should be developed.

One area of misconception is the idea that SMS are an extension of QMS. This is fundamentally flawed due to the conflicting purpose and objectives of the respective systems (FAA, 2014). The solution to this problem is to integrate quality management as an element within the SMS framework in order to realign its purpose and objectives with those of the SMS. In doing this, quality management becomes a subordinate function rather than an equal function.

ICAO's conventional SMS framework assumes that an SMS is an independent business system that interacts with other business systems (ICAO, 2013). This presents issues when defining the parameters of which systems it is to interact with and the nature of those interactions (i.e. which system is seen as more important). This can also lead to problems when resourcing the SMS as it may be seen as a cost when compared to allocating resources to other business systems. The solution to this problem is to integrate the SMS within existing management systems. This prevents the separation of safety from any of the organisation's activities.

ICAO (2013, xii) refers to SMS as a "systematic approach to managing safety". This is then contradicted when ICAO (2013, 2-15) refers to SMS as a holistic and integrated organisational management system. A systematic approach is a step-by-step procedure that isperformedidentically regardless of the situation (Kinnison and Siddiqui, 2013). A holistic and integrated approach would suggest that there are multiple interdependencies between elements which result in several being performed simultaneously in different ways, but for the same

overarching goal: safety. The solution to this problem is to operate off the premise that SMS are holistic and integrated and are not systematic in nature.

Improvements Based Upon Other Existing SMS Frameworks

This area addresses differences between ICAO's framework and that of other frameworks reviewed in this dissertation. Only those differences that concern the addition of elements that are perceived to be improving upon ICAO's framework will be discussed.

A major improvement made to ICAO's framework by many regulators is the addition of the element "safety investigation" (CAANZ, 2012; CASA, 2013; CAA-UK, 2010; Transport Canada, 2009; ACI, n.d.; NSW Government Roads and Maritime Service, 2012; ERA, 2013; QTA, 2009). This was a major oversight of ICAO's framework as incident and accident investigations allow for reactive and corrective actions that help ensure continuous improvement of the SMS. This dissertation will include this additional element due to its significance, both practically and in terms of its wide recognition in SMS frameworks.

Internal safety audit programmes are part of CAANZ' (2012) framework, yet they are not an element of ICAO's. Internal safety audits ensure continuing regulatory compliance and monitor an organisation's safety performance against their own prescribed standards (CAANZ, 2012). Internal audit safety programmes are crucial for continual improvement of the SMS, as they highlight deficiencies and allow for corrective action to be implemented. Information generated by internal safety audit programmes can also be compiled and analysed for trend analysis, an important process for proactive risk mitigation.

Implementation plans are an additional element included in CASA's (2013) framework. This is due to CASA (2013) taking a less conventional stance on the purpose of an implementation plan. CASA (2013) argue that implementation plans are on-going process that drives continuous improvement through implementing the various policies of the organisation in manageable increments. This dissertation would argue that this stance is proactive and would help considerably with continuous improvement. For this reason, an implementation plan will be included as an element in the proposed SMS framework.

Third party interface is an element included in CASA's (2013) and ERA's (2013) SMS frameworks. CASA (2013) suggests that the presence third parties could compromise safety, and therefore must be managed as part of the SMS. For this reason this element will be included into the proposed SMS.

Transport Canada (2009) include quality assurance as an element of their SMS framework. This supports the arguments made in this dissertation for the integration of quality management with safety management. Quality assurance is the conventional method of managing quality, and for this reason, this dissertation will integrate the element of quality assurance within the proposed SMS framework.

ACRP (2007) include culture as an element of their SMS framework. Culture is an important aspect of organisational management as outlined in the literature review of this dissertation. However, the earlier

suggestion of incorporating HRM as an element supersedes the inclusion of culture as an element because culture is a function of HRM.

ACRP (2007) also include organisational structure as an element in their SMS framework. This is supported by the fact that structure is an important determinant of an organisation's profile (Martin, 2005). Organisational structure has thus been included as an element in the proposed SMS framework.

NSW Government Roads and Maritime Service (2012) include environmental planning as an element of their SMS framework. The purpose of this inclusion is that environmental factors can influence operational safety and thus must be managed as part of the SMS. Furthermore, integration of environmental planning and SMS results in a realignment of objectives and centralises resource allocation. CAANZ (2012) also suggest that environmental safety policy could be integrated within the SMS framework, but that this was not a requirement for certification. This dissertation will include environmental safety policy as an element of the proposed SMS as it allows for management of environmental safety factors, realignment of objective between the two systems, and a centralisation of resource allocation.

QTA (2009) include consultation with employees as an element of their SMS framework. This highlights the operational nature of employment relations that are ultimately a manifestation of HRM policy. Rowley and Jackson (2012) refer to employee relations as the fourth function of HRM. This function produces an operational output, which is different to the other three functions that produce strategic outputs. For this reason, this dissertation has included employment relations as a separate element to HRM, categorised as a different type of output.

Proposed SMS Framework

*Figure 5.*Proposed SMS framework

The illustration above provides a revised approach to the development and implementation of an SMS. Elements have been included based upon deficiencies in ICAO's framework and improvements that exist in other SMS frameworks. This SMS framework allows each level of the organisation to clearly identify their outputs in relation to the SMS (i.e. whether they perform a strategic, tactical, or operational function).

Description of Proposed SMS Elements

This section will outline descriptions of each element, primarily for the purposes of better understanding the framework and how a gap analysis tool could be developed. These recommendations have been developed by the authors of this dissertation and are specific to the proposed SMS framework. Each element will be described and key indicators for meeting this element will be outlined.

Strategic Elements

The elements in this section are primarily the responsibility of senior managers. They concern strategic outputs such as policy and organisation-wide documentation (exposition). For this reason this section's elements are not "one-offs" but rather continuous to allow the constant evolution of the organisation's SMS.

The first element, management commitment and responsibility, is a strategic output that demonstrates to all members of the organisation that the organisation is committed to safety, and that senior managementhave taken ownership of SMS policies.The organisation should define its safety policy which should be in accordance with international and national requirements, and shall be signed by the accountable manager of the organisation. The safety policy should reflect organisational commitments regarding safety, including a clear statement about the provision of the necessary human and financial resources for its implementation and be communicated, with visible endorsement, throughout the organisation. The safety policy should include the safety reporting procedures and clearly indicate which types of behaviours are unacceptable and shall include the conditions under which disciplinary action would not apply. The safety policy should be periodically reviewed to ensure it remains relevant and appropriate for the organisation.

The second element, safety accountabilities, is a strategic output concerning the assignment of accountability to theappropriate persons. The organisation shall identify the accountable executive who, irrespective of other functions, shall have ultimate responsibility and accountability, on behalf of the organisation, for the implementation and maintenance of the SMS. The organisation shall also identify the safety accountabilities of all members of senior management, irrespective of other functions, as well as of employees, with respect to the safety performance of the SMS. Safety responsibilities, accountabilities and authorities shall be documented and communicated throughout the organisation, and shall include a definition of the levels of management with authority to make decisions regarding safety risk tolerability.

The third element, SMS documentation, is a strategic output concerned with explicitly documenting SMS policies in order for them to be implemented throughout the organisation. The organisation shall develop and maintain SMS documentation describing the safety policy and objectives, the SMS requirements, the SMS processes and procedures, the accountabilities, responsibilities and authorities for processes and procedures,

and the SMS outputs. The organisation shall incorporate the SMS documentation into its existing organisation documentation to communicate its approach to the management of safety throughout the organisation.

The fourth element, management of change, is a strategic output outlining the policies and standards to assure that changes are monitored and measured.This is to ensure that they are properly implemented and that risks surrounding change are mitigated or eliminated. The organisation shall develop and maintain a formal process to identify changes within the organisation which may affect established processes and services; to describe the arrangements to ensure safety performance before implementing changes; and to eliminate or modify safety risk controls that are no longer needed or effective due to changes in the operational environment.

The fifth element, management review, is a strategic output concerning the self-evaluation of management policies periodically to ensure that they remain relevant and effective.Management's review of the SMS ensures that the key decision makers in the business are using safety information in their process of governing the organisation and maintaining oversight of safety.

The sixth element, human resource management, is a strategic output concerning the first three functions HRM as outlined by Rowley and Jackson (2012). These functions are employee resourcing, employee rewards, and employee development. These functions produce policies that perpetuate throughout the organisation and for this reason it is critical that their objectives are aligned with that of an SMS. Human resource management covers the appointment of key safety personnel for regulatory purposes, however is extended to also cover the management of organisational culture. The characteristics of an organisation's culture are determined by human resource management concepts such as recruitment, selection, reward systems, induction, training, disciplinary actions, and socialisation. An organisation's culture must therefore be managed effectively to ensure that the organisation's cultural characteristics act to enforce safety management organisation-wide. Safety culture cannot be separated from organisational culture, and for this reason an SMS must take a macro approach and manage the organisation's culture as a whole (Martin, 2005; Berber and Yaslioglu, 2014). Characteristics associated with safety are usually similar to those associated with effective business acumen. It is natural that conflicts between safety and business may still exist, however, these conflicts must be documented and effectively managed. Risk-taking is an example, it may be good for a business to occasionally make risky investments, but it is never good for an organisation to take risks with regard to safety. This element covers who must be hired to manage safety, how HRM functions should work to manage organisational culture, and how conflicts should be documented and managed.

The seventh element, environmental safety policy, is a strategic output concerning the management of potential safety problems that may be encountered as the organisation interacts with its operating environment. Many elements of the natural environment have the potential to jeopardise the safety of flights. Such examples include bird strike, mosquitos, and weather. Additionally, aircraft contain many dangerous fluids and produce dangerous emissions. Aircraft engines also produce huge volumes of noise. These hazards have the potential to affect the health and safety of those working around aerodromes and aviation facilities,

as well as those living in the surrounding area. Accordingly these aspects of environmental safety should be managed as part of an SMS to prevent conflicting objectives between environmental management systems and SMS.

Tactical Elements

The elements in this section are primarily the responsibility of middle managers. These elements produce tactical outputs, middle points between policy and implementation, and thus are important for strategic outcomes. The interaction between senior managers and operational staff primarily comes through middle managers. These elements areomnidirectional and concern both the implementation of strategies and feedback from operations.

The eighth element, coordination of emergency response planning, is a tactical output concerning how an organisation should manage the response to a range of potential emergency scenarios.Coordination must be achieved between its staff as well as many third parties. Correctly planned and documented emergency planning is therefore paramount to successful coordination in the event of an emergency.

The ninth element, managing risk, is a tactical output concerned with understanding and controlling the risks inherent from operating within the organisation's internal and external environments. SMS formalise risk management processes to ensure that they happen with certain veracity and regularity. Managing risk must happen at the strategic level in terms of policy making, and at the operational level through implementation. Therefore,this element is a tactical output as safety policies to do with risks must be enacted by tactical measures that then translate into greater operational safety. Middle managers significantlyinfluence the potential success or failure of this element.

The tenth element, safety investigation, is concerned with identifying the factors that contribute to safety occurrences and developing corrective actions to mitigate or eliminate reoccurrence. This is a tactical element of the SMS as it identifies operational failures and provides feedback to a strategic level. This element aims to improve safety and should not portion blame on any parties involved.

The eleventh element, monitoring and measuring performance, concerns measuring safety performance in order to make assessments against set targets and objectives, and to enable strategy development to mitigate the risk of accidents. In addition to measurement, this element also addresses the monitoring of safety performance to evaluate safety policy and procedures, and ensure continual safety improvement. This evaluation allows for the assessment of resource allocation and the ability to maximise the effect of resource utilitilistation by identifying areas of strength and weakness. This is a crucial element as it allows for assessment of any improvement initiatives that have been implemented as part of the SMS. A key to the success of this element is identification of clear metrics in order to assess organisational performance and set standards for continuous improvement.

The twelfth element, internal safety audit programme, is a tactical output that consists of constant review across all areas of the organisation to determine if activities and operations are being conducted in accordance

with the procedures outlined by the organisation. Safety auditing is a closed loop feedback tool to that is used to enable continual improvement within the organisation. This element should not focus solely on compliance and conformance, but also on the effectiveness of, and participation in procedures. Support processes and subcontractors should also be included within the scope of internal audits.

The thirteenth element, safety training and education, is a tactical element that is concerned with ensuring that all staff within the organisation are trained to effectively perform their roles within the framework of an SMS. Training can be internal or external and requires documented processes. It is a tactical element as it involves looking at strategies and ascertaining whether they can be implemented with current expertise. If not, then training of current staff is one option to solve this problem. Subcontractors and tenants need to also be trained in their responsibilities and roles as part of the organisation's SMS.

The fourteenth element, quality assurance, is a tactical output concerned with fine tuning all processes and procedures of an organisation. This element is a means of self-regulation for an organisation that allows for feedback from the tactical level to the strategic level, which is proactive and ensures operational safety and efficiency. Quality assurance procedures will identify, document and correct instances of safety violation, non-conformance, or non-compliance.

The fifteenth element, organisational structure, is a tactical output concerning how the organisation lays out its hierarchy. It is an important element, as hierarchies that are too flat or too steep have safety disadvantages. To ensure that strategy can translate into reality the organisation's structure must reflect how strategies are to be implemented.

Operational Elements

The elements in this section are primarily the responsibility of operational staff. These elements are critical in the feedback loop as they represent the operational safety realities. Operational staff are the most exposed to hazards and therefore must interact with each other and third parties in accordance with the guidance of senior and middle managers. The enactment of strategies and tactics come at this level and so it is equally as important as the earlier sections.

The sixteenth element, hazard identification, is an operational output concerning the identification of hazards. Hazards are the sources of risks. Hazards can interact with operational activities to create safety occurrences. For this reason hazards must be identified by operational staff (or any other employee) so that they can feedback to managers and be managed appropriately.

The seventeenth element, third party interface, is an operational output concerning the interface between the organisation that is enacting the SMS and those organisations that contribute towards its implementation. For example, in the context of an aerodrome, such third party organisations may include tenants, subcontractors, contractors, air operators, regulatory authorities and air traffic control. These organisations must operate under the aerodrome's SMS when applicable. Third parties will ordinarily need to be involved in the organisation's hazard identification and emergency coordination processes.

The eighteenth element, employee relations, is an operational output concerned with the fourth function of HRM as outlined by Rowley and Jackson (2012). Employees and their interactions with other employees and managers provide the implementation of the policies and tactics of the SMS. Therefore, it is worth considering how employee relations manifest themselves at the operational level. This element is essentially the operational manifestation of the strategic element "Human Resource Management" and the tactical element "Organisational Structure". Employees must be able to relate to each other within the bounds of their respective roles and responsibilities. An organisation functions optimally when employees understand the relationship and importance of their role in relation to others. This promotes teamwork and fosters a strong and positive organisational culture. Without the success of this element it is difficult to translate policies from paper to practice.

Multi-Level Elements

The elements in this section are the responsibility of all employees, as they must occur across all levels of the organisation. These elements are important as part of the feedback loop resulting in the adjustment of strategies and tactics in the hope of improving the safety of the operations.

The nineteenth element, continual improvement of the SMS, is a multi-level output. An SMS is not implemented on a one-off basis, it is an on-going process that requires constant monitoring, review and adjustment with the aim of continual improvement. This element must regularly evaluate inputs and processes of the SMS, assessing the implications of these factors and then determine the effectiveness of the system's outputs. These outputs must be measurable to determine their effects. Once the organisation has a clear overview of the current performance of its SMS it must then act upon this information to ensure continuing suitability, adequacy and effectiveness of the SMS. Continual improvement of the SMS takes place across all levels of the organisation, and encompasses strategic and senior management reviews, tactical processes and operational procedures. This element is a continual feedback loop that uses information from all areas of the organisation to monitor and review its SMS and subsequently to take action in order to continually improve it. The organisation shall develop and maintain a formal process to identify the causes of substandard performance of the SMS, determine the implications of substandard performance of the SMS, determine sub-standard performance in operations, and eliminate or mitigate such causes.

The twentieth element, communication of safety critical information, is a multi-level output. This element ensures that the organisation will develop and maintain formal means for safety communication that ensure that all personnel are fully aware of the SMS and safety critical information. They must understand why particular safety actions are taken and why safety procedures are introduced or changed.

The twenty-first element, SMS implementation plan, is a multi-level output. This element recognises that organisations will never have a completely perfect SMS, and accordingly the organisation will need to produce SMS implementation plans regularly as part of continuous improvement. SMS implementation plans must be explicit and based upon SMART (Specific, Measurable, Attainable, Relevant, and Time-Bound) principles. SMART principles have been shown in a number of contexts to improve the likelihood of goal attainment

(Johnson, Moore and Thornton, 2014; Doran, Miller and Cunningham, 1981;Bovend'Eerdt, Botell and Wade, 2009).

Discussion

This dissertation has proposed an original SMS framework that is organisationally focused. It is perceived that this framework, together with gap analysis and implementation plan, is more likely to succeed in a practical context due to its adaptability to organisational profiles and national cultures. This adaptability is achieved through the utilisation of generic organisational management considerations rather than through assumptions that may not apply to all cultural and organisational contexts. There is also significant adaptability in how the gap analysis is conducted allowing for significant variations based upon organisational profiles and national (cultural and regulatory) considerations. Appendix A provides examples of a gap analysis process in a New Zealand context, showing four different elements, each at a different organisation level.

The proposed SMS framework is currently being trialled at two different aviation organisations in New Zealand. Further research should take place to ascertain the benefits (if any) of this framework over the conventional ICAO framework.

Conclusion

This dissertation has critically discussed ICAO's conventional SMS framework in comparison to organisational considerations and existing frameworks. The results of this critical examination suggest the reconsideration of the conventional SMS framework to better meet the principles of organisational management (including HRM, organisational profile and cultural considerations) as well as address some fundamental flaws in the conception of what an SMS is. This dissertation has offered a compelling alternative to ICAO's conventional SMS framework that is currently undergoing trial. It is hoped that this dissertation will form the basis of continued research and development in the area of aviation SMS.

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Appendix A: Gap Analysis Examples

Below are two examples of how elements could be translated into a gap analysis tool for an aerodrome. These examples are relevant to New Zealand regulatory provisions and generic organisational considerations. The tables below provide some context as to how organisational profile and national regulations can be incorporated.

Table 2

Definition of organisational sizes for aerodromes(CAANZ, 2012).

Variable	Small	Medium	Large
Number of staff	Up to 5	6 to 20	More than 20
Nature of operations	Small aerodrome supporting local traffic	Medium aerodrome supporting local and regional traffic	Large aerodrome supporting a range of traffic from small aircraft through to international carriers
Complexity	Few, similarly-sized occupants of the airport, simple infrastructure	Different types of aerodrome occupants, multiple taxiways, sealed runways, etc.	Multiple occupants, complex infrastructure, multiple runways, control tower, etc.

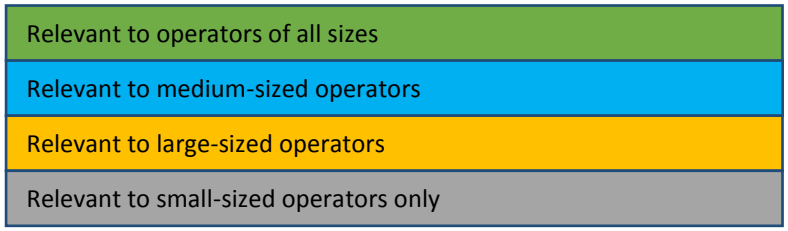

*Figure 6.*Colour code used for gap analysis tool

Example One

4. The Management of Change The organisation shall develop and maintain a formal process to identify changes within the organisation which may affect established processes and services; to describe the arrangements to ensure safety performance before implementing changes; and to eliminate or modify safety risk controls that are no longer needed or effective due to changes in the operational environment.				
Question	In place[1]	Documented[2] Reference:	How it is achieved[3]	Remarks[4]

[1] Yes (Y), No (N) or Partial (P)
[2] Where is it documented in your documentation?
[3] Provide details that describes or demonstrates your response to the question.
[4] Remarks to be provided by auditor (can be internal or external)

4.1 Is there a documented change management process to proactively identify hazards and to mitigate risks during organisational changes?				
4.2 Are there periodical reviews of the safety performance after organisational changes to assure assumptions remain valid and the change was effective?				
4.3 Are pieces of critical equipment and activities reviewed following change to ensure that risk controls are effective? (changes in equipment and people especially)				

4.4 Does the organisation monitor the stability of management systems? (i.e. growth in passenger numbers, changes to type of traffic, etc.)				
4.5 Does the organisation monitor the stability of its operating environment? (i.e. financial status, regulatory changes, weather)				
4.6 Does the organisation look for trends to predict future organisational performance?				

4.7 Does the organisation keep a register of residual risks? (those that cannot be eliminated no matter what measures exist)				
4.8 Does the organisation conduct risk assessments when significant business changes occur?				
4.9 Does the organisation conduct risk management plans for predicted changes?				

4.10 Are all risk assessments and risk management plans tracked until completion?				
4.11 Does the organisation ensure that the safety manager is made aware of all changes that can be predicted?				
4.12 Are third parties/contractors considered in the change management process?				

Example Two

8. Coordination of Emergency Response Planning

This element concerns how an organisation is to plan for the event of an emergency at its aerodrome. Coordination must be achieved between its staff as well as many third parties. Correctly planned and documented emergency planning is therefore paramount to successful coordination in the event of an emergency. Many requirements of CAANZ Part 139 certification are also included in this element.

Question	In place[5]	Documented[6] Reference:	How it is achieved[7]	Remarks[8]
8.1 Does the organisation have an emergency response plan?				

[5] Yes (Y), No (N) or Partial (P)
[6] Where is it documented in your documentation?
[7] Provide details that describes or demonstrates your response to the question.
[8] Remarks to be provided by auditor (can be internal or external)

8.2 Does the organisation have a process to ensure all employees are aware of the emergency response plan's contents?				
8.3 Does the organisation have a process to ensure all employees are aware of their responsibilities as part of the emergency response plan?				
8.4 Does the organisation have a process to ensure that the emergency response plan is regularly reviewed?				
8.5 Does the organisation outline who holds authority in the event of an emergency?				

8.6 Does the organisation have a process to record activities during an actual emergency response?				
8.7 Has the emergency response plan been checked by other stakeholders for compatibility? (i.e. tenants, operators, other aerodromes if applicable).				
8.8 Does the emergency response plan outline every organisation to be liaised with in the event of an emergency?				
8.9 Does the organisation have a process to update contact lists for use in emergency responses? (139.57 (b) (7))				

8.10 Does the organisation practise regular drills and exercises to ensure the emergency response plan will likely be effective in a real emergency?				
8.11 Does the organisation have a procedure for establishing a crisis response centre?				
8.12 Does the organisation have a process for handling media in the event of an emergency?				
8.13 Does the organisation outline its family assistance responsibilities?				

8.14 Does the organisation have a procedure for debriefing employees after an emergency?				
8.15 Does the organisation maintain hard-copy and soft-copy records of all emergency response planning?				
8.16 Does the organisation have a quick reference guide to the basics of its emergency response plan?				
8.17 Does the organisation have a list of other organisations that will be effected by the emergency response plan?				

8.18 Does the organisation practise a table-top exercise at least every year? ('Table top' exercises are where key staff meet for half a day and progress through a pre-arranged scenario. Staff should have to think on their feet)				
8.19 Does the organisation have a quick reference guide for the emergency response plan that outlines all critical details?				
8.20 Does the organisation have a detailed emergency response plan manual?				

8.21 Does it reference all involved staff and external organisations?				
8.22 Has the organisation documented a schedule of planned drills and exercises to practise the emergency response plan?				
8.23 Does this schedule have enough exercises to demonstrate the effectiveness of the emergency response plan?				
8.24 Does the organisation's emergency response plan outline all the emergencies it has planned for? (139.57 (b) (1))				

8.25 Does the organisation's emergency response plan provide procedures to respond to each of the emergencies planned for? (139.57 (b) (2))				
8.26 Does the plan provide sufficient detail to be actionable? (139.57 (b) (3))				
8.27 Does the plan outline every agency to be involved in its implementation? (139.57 (b) (4))				
8.28 Does the plan outline what each agency's responsibilities are? (139.57 (b) (4))				

8.29 Does the organisation have an emergency operations centre and command post for each type of emergency? (139.57 (b) (5))				
8.30 Is it adequately equipped? (139.57 (b) (5))				
8.31 Does the emergency response plan outline what equipment is available? (139.57 (b) (6))				
8.32 Does it outline the location of each piece of equipment? (139.57 (b) (6))				

8.33 Does the emergency response plan provide a grid map of the organisation's aerodrome and its immediate vicinity? (139.57 (b) (8))				
8.34 Does the organisation coordinate its emergency response plan with law enforcement agencies, security providers, rescue and firefighting agencies, medical personnel, and the aerodrome's principal tenants?				
8.35 Does the organisation allow such organisations to provide input in the development and review of the emergency response plan?				