concepts taken from software engineering for aiding the development of an SMS. Specifically, the use of DFDs ensures that the SMS comprises a properly connected set of processes, and the use of standard syntax for the formulation of safety responsibilities ensures proper connectivity between the safety actors and their required actions. This is illustrated using practical examples from ATM. The approach has the potential to yield the following benefits at various points in the lifecycle of an SMS within any industrial sector:

- Initial design of the SMS is represented in a visual, detailed way that allows interested parties to understand and comment on its structure.
- All levels of design can be visualized and their consistency verified because the complete hierarchy of 'process levels' from regulatory requirements down to the internal structure of individual SMS processes can be represented.
- Development of the SMS can be more easily managed. By representing and managing process interfaces, new safety processes and existing quality management processes can be correctly integrated.
- Validation that a developed SMS is complete and coherent can be performed retrospectively by capturing the design from the suite of SMS documentation, thus providing a means of independently assessing the SMS structure.
- Maintainability is enhanced because the implications on the rest of the SMS of modifying a given procedure can clearly be seen.

Notes

1. In effect, this requires the responsible person to develop their own Safety Principles and procedures.

2. The <> symbols are used here to delimit the three syntactic components and would not be documented in the SMM.

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Assessing Safety Culture - Where do I start?

by Vicky Gliddon

Safety culture is an important topic in safety-critical industries, where it has received a great deal of coverage. However, for many it can seem daunting to know what to do and where to start to understand the safety culture of their own organisation. Here, we provide advice from Greenstreet Berman Ltd's practical experience for an effective approach to conducting safety culture assessments, as well as tips for implementing targeted improvement following the assessment.

What is Safety Culture and Why is it Important?

Safety culture can be described as attitudes and perceptions that influence safety behaviour within an organisation.

A positive or negative safety culture can have a huge impact on the safety performance of any organisation. It underwrites the attitudes towards safety behaviour and influences the workforce's opinion on the importance of safety, and thus, how they act with regards to safety. Poor safety culture has been identified as a contributory factor in a number of high profile disasters including Piper Alpha, the Nimrod aircraft crash and the Ladbroke Grove rail crash.

The Benefits of Safety Culture Assessment

There are many benefits to assessing safety culture at whatever stage of safety culture maturity your organisation is at, such as:

• Identifying improvements that can make your organisation as safe as it aspires to be;
• Mitigating the risk of harm to employees through safety management;
• Remaining alert to potential emergent issues;
• Learning lessons from your organisation, both good and bad;
• Gaining insight into how effective your safety management systems are, and how effective these are perceived to be;
• Periodic reviewing the effectiveness of improvements.

Plan Plan Plan ...

It is important to make a plan for assessing safety culture before delving in to the assessment itself. This helps to ensure that the outcome of any assessment, does provide answers to the questions you had in the first place.

A well-planned and well-executed assessment can, for example, achieve response rates to questionnaires of 70% or more. A poorly planned and under-supported assessment may get very low response rates (for example, around 15%), and greatly reduce the value of the assessment.

In addition, creating a plan will help you to outline key assessment questions are, by summarising what you hope to achieve from performing an assessment of safety culture.

The undertaking of an assessment can (by itself) affect staff opinions for better or worse, whilst also providing information on which to make improvements to safety. Consequently, an assessment of safety culture should only be contemplated when senior management effectively support it and follow up on the results.

So, what should you be considering at this stage of planning?

First of all, define the context and purpose. Clarify why you are motivated to assess your organisations's safety culture. This will help you to scope out what you intend to achieve through conducting an assessment of safety culture, and will help you to formulate a strategy and framework to do this effectively. The following are points to get you thinking about the context of your assessment:

• Has something happened that has identified issues in organisational safety culture which you wish to address? E.g. Has a procedure been ignored which played a part in an incident?
• Does a particular department have a poor safety performance record?
• Are you interested in conducting an assessment on the entire organisation or only selected departments or functions?
• Do you want to follow a staged approach, conducting assessments on various business areas one at a time or, conduct a company-wide assessment all at once?
• Do you wish simply to measure what the level of safety culture maturity is

based on peoples' attitudes and behaviours, or to go further to understand why this is by exploring the drivers and reasons behind this?

- Do you want objective evidence of behaviours in addition to subjective measures of attitudes?

Consider these types of questions to set out a clear scope for an assessment. The scope will then guide you to select appropriate methods of assessment.

What Safety Domains are you Interested in?

Past accidents have shown that safety attitudes and behaviours can vary from one safety domain to another. The Chemical Safety Board's (CSB) incident report (the *Baker Report* [1]) stated: "BP has emphasized personal safety but not process safety" and, "…a very low personal injury rate at Texas City gave BP a misleading indicator of process safety performance".

Attitudes and behaviours may be divergent across different areas of performance. In our experience, differences have also been found between occupational health and occupational safety, such as high levels of fatigue being 'tolerated' despite robust occupational safety management. This does not mean that all organisations have domain-specific safety attitudes. An organisation may adopt a holistic view of safety, with equal expectations for occupational and major hazard safety.

From a practical perspective, preliminary work such as a small number of workshops, can verify how the organisation conceptualises safety. Is a singular concept of safety pursued, or are there multiple safety domains? If there is clear evidence that a singular concept is espoused, then a single measure of safety culture may be valid. If there are multiple safety domains, then you may wish to either assess both in parallel or focus on one.

Either way, a definition of the area of safety being assessed should be agreed and stated at the outset of any assessment tool, ideally with examples of safety policy and practices. This ensures all staff are thinking of the same safety area(s) when responding to questions.

Allocate Resource

Once you have a plan in place to define the scope and depth of assessment, you can allocate the appropriate resources.

Do you have the necessary capability in-house to complete an assessment from the planning stage through to targeted improvement? If not, you may want to consider outsourcing all or part of the assessment to an independent organisation with the relevant experience and qualifications to support you in assessing safety culture.

In the case of assessment methods such as, workshops, observations and interviews it can be particularly important to have independent facilitators. Do you think your employees are likely to speak honesty about safety if they are being asked questions by the health and safety manager? Whilst this may not deter some from speaking openly and honestly, you are unlikely to get a true view of your employee's perceptions and your data will not be reliable.

An independent organisation with safety culture expertise can also review your plan and provide advice on your strategy for assessment at the early stages. It is also important to utilise the resource you have in-house. Outsourcing to an independent organisation, doesn't mean you won't need to use your own resources. If you have an internal team who focus on communications or employee engagement, get them on board to help

plan and communicate the assessment.

Communication is Key

Poor communication of an assessment prior to roll out, can be a huge drawback. The engagement of employees and responses for participation are affected by how well you communicate the purpose of the assessment, what it involves, the role of employees, and the aims and objectives of completing an assessment of safety culture.

This communication should be targeted to all levels of the organisation. An initial communication activity should be conducted to inform those at a more senior level of the impending assessment, giving them a chance to ask questions and raise any concerns. Involving them in the early stages can gain their approval, giving the assessment their endorsement and cascading this through the organisation. This senior management support will help minimise resistance and gain buy-in to the assessment across other levels of the organisation.

Select Methods for Assessment

A host of methods can be applied to assess safety culture, and which of these you select will depend on the intent of your assessment, and the nature and demographics of your organisation. Each method has different advantages and limitations. For example:

- Staff questionnaires are a cost effective, repeatable option for measuring and comparing attitudes across departments in large organisations, over time;
- Workshops help to explore staff perceptions and attitudes, elicit examples of behaviours and the drivers behind these behaviours;
- Observation of behaviours and communication, e.g. during meetings, can provide objective evidence of behaviour but do not reveal attitudes or reasons for behaviours and can be intrusive (and limited to observable behaviour);
- Reviews of safety documentation, such as policy and procedures, can indicate management intent, but do not prove implementation;
- Reviews of leading and lagging safety culture indicators, such as rates of procedural non-compliance, can be objective but do not reveal reasons for behaviour and may not measure all aspects of culture;
- Critical incident and root-cause analysis can assess actual behaviours; however, they can be skewed to poor performance and incidents may not have occurred in recent years. This can, to some extent be balanced by seeking examples of positive behaviour.
- Focus groups can explore the reasons for observed and perceived attitudes and behaviours.

Greenstreet Berman Ltd advocates the use of a mixed-methods approach to the measurement, diagnosis and validation of assessment results. Methods such as surveys allow you to measure employee perceptions and attitudes, but do not allow you to fully understand the reasons for those opinions. Diagnostic methods such as workshops allow you to probe into and clarify feedback from other methods, and will give you a richer assessment of safety culture within your organisation. We also recommend having a common set of safety culture elements such as leadership and communications, assessed by each method, to allow results to be collated and compared.

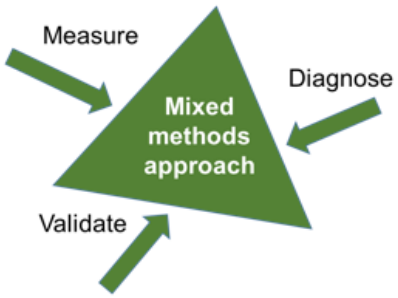


Figure 1: Mixed Methods Approach to Assessment

The validation of results received from one assessment method should be validated by other methods of the mixed-methods approach, allowing you to diagnose as well as measure safety culture. For instance, a workshop can gather people's opinion on safety and how it is managed whereas, observations can validate whether this perception is accurate.

The methods should be selected to be accessible to all participants you wish to be included. For example, if you are doing an assessment of those on the frontline in operations who do not readily have access to a computer, it would be imprudent to issue an electronic survey. More relevant and useful would be a paper survey which can be returned in a sealed box to ensure confidentiality and anonymity of responses, and therefore more likely to yield a higher response rate.

Prepare Methods

Whilst the principles of assessment remain the same, there is no "one size fits all" for assessing safety culture. All assessments should be tailored to the organisation. For instance, a safety culture survey should have content which is relevant and meaningful to employees, such as ensuring that the types of questions it asks are appropriate, and the language and terminology used is understood.

Care should be given to tailor the assessment materials to match the scope of assessment. If you intend to roll out the assessment across the entire organisation but then compare departments to identify similarities and differences, you need to know what department each respondent is within, otherwise this comparison will not be possible.

Tailoring demographic questions to your organisation such that the data collected can be segmented for analysis purposes, is critical at the early stages. Work with your Human Resource team to define the demographics present across the organisation and which will be included and captured within the assessment. Ensure that assessment methods are planned in advance to allow the time to for logistics to be arranged. This includes, ensuring there is sufficient printing time for surveys, to ensuring participants are available and locations booked in time to run workshops. We tend to advocate a few weeks for planning, a few weeks for communications, about six weeks for conducting the assessment and one month for analysis and reporting.

Apply Methods for Assessment and Diagnosis

In addition to a well-planned and properly communicated assessment, it is important to track response rates during the course of the assessment. There are many practical reasons for participation levels varying, such as unforeseen operational demands or unforeseen problems in responding. Accordingly, response rates should be tracked by department and grade during the course of the assessment. In the event of under-representation of any one grade or department, additional actions may be needed, such as extending the time period for questionnaire responses, re-issuing requests to respond to questionnaires, or running additional workshops.
In addition, it is important to check the representativeness and validity of responses. Have all departments achieved a similar level of response? Do examples of behaviours cited in workshops match the assessed level of safety culture maturity? You need to understand what has been assessed, how representative the results are and the reasons for any skews in results. With this understanding, it is possible to weight the results from each form of assessment according to your confidence in each method.

Post-Assessment Analysis

Once the assessment is complete it can be like walking through a minefield to understand what the results mean, and to know where to start with a deluge of data, information and findings.

Go back to the planning of your assessment and use this to guide you through your analysis. Was the purpose of your safety culture assessment to assess the entire organisation? If so, it would be sensible to compare the findings from various departments and business areas to identify any similarities and differences. Did the plan outline one safety domain or more? If it included more than one type of safety (occupational safety and process safety) assess whether there was a difference in findings. Was an issue with safety culture identified prior to the assessment, and was this backed up by the assessment findings?

Use this analysis to identify trends in safety culture and evaluate the findings to show both positive findings and areas for improvement. Focus on key themes and major differences in results between departments and grades.

Assessing the Results

Greenstreet Berman Ltd uses a pre-defined evaluation scale for evaluating the results of the assessment. The use of a scale is good practice and also advocated by other safety culture tools. Reviews of safety culture models and feedback from industry has led us to adopt a variation of the Pathological to Generative safety culture maturity scale, as per Figure 1. This is a widely used and intuitive scale underpinned by research.

The use of the evaluation scale is beneficial to identify where the organisation sits at in terms of the level of safety culture maturity, and to define where the organisation should practically aim to be. The results are typically collated for the organisation as a whole and split by the demographics (e.g. department) as outlined at the scoping stage to make comparisons.

Feedback Results

It is imperative that the findings are communicated back to the organisation as was identified at the communication stage. This will encourage continued engagement in the assessment and for the improvement of safety culture. The level of information shared with employees at various levels of the organisation is at the discretion of the organisation, and any promises made about the dissemination of results should not be broken.

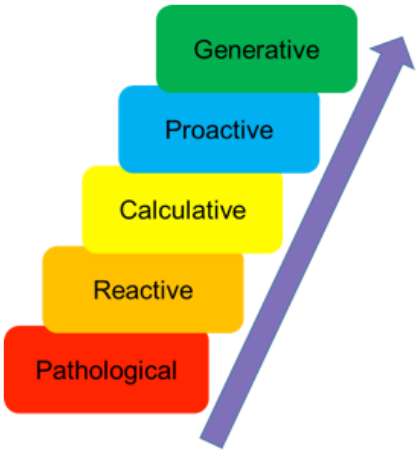


Figure 2: Generative to pathological culture maturity scale

Create a Strategy for Improvement

Once the organisation has determined its level of safety culture maturity, it should articulate what they wish to achieve. Whilst there is no definitive guidance on the required levels of safety culture, our experience suggests that safety critical organisations seek a calculate (managing) culture as a minimum, and more commonly aspire to a proactive culture.

Upon articulating your objective, you can begin to create a strategy for improvement to define how you will reach this level.
The results will guide you to decide where to focus your efforts. For instance, if a particular department was rated to have a lower level of safety culture maturity than others, you may choose to focus on making improvements within that department first of all.

Elements of safety culture, such as leadership versus communications, could be acted on in order of priority by the level of safety culture maturity they were found to be at. Qualitative understanding of the drivers for behaviour can help identify specific improvement actions.

It is also important to identify the stronger areas identified through assessment as this provides lessons learned that can be applied to other departments or other elements. Creating a strategy for improvement will provide direction to address problems and build on the strengths of safety culture in your organisation.

Reassessment

Safety culture should be periodically reviewed to check performance and the effectiveness of any actions coming out of the safety culture assessment. Some safety critical organisations assess safety culture every year, comparing trends from one year to the next. In our experience, the extent and frequency of assessment depends on the level of safety culture maturity and the need for improvement. A more mature and possibly stable, culture may not require annual review or in-depth assessment. A less mature culture, or one with a major improvement programme, might benefit from more frequent and more in-depth reassessment.

References

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Let Me Make Myself Unclear

by John Ridgway

One of the very first books I read as a child (apart from the 'Janet and John' books) was a volume proudly retrieved from the local library. It was called *How Big is Big?* and it sought to demonstrate mankind's scale within the Universe by illustrating a series of objects of ever-increasing size (firstly terrestrial, then extra-terrestrial), finally arriving at the Universe in its totality. It then proceeded to illustrate objects of ever-decreasing size, culminating in the sub-atomic realm. It remains to this day the most influential book I have ever read and, no doubt, set me on a lifetime of scientific curiosity. However, despite my advancing years, I have to admit that I still can't answer the basic question posed by that influential tome. I still can't tell you how big 'big' is.

The problem lies not in my education, but in the inherent vagueness of the term 'big'. It's one of a very large class of words known as degree adjectives. All natural languages are full of them. In fact, most languages would be a pale shadow of themselves if one were to remove all the inherently