Safety Management and Safety Culture
The Long, Hard and Winding Road[1]

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1.0 Introduction

Safety seems so easy – just make sure people don't get hurt. In practice it is a lot harder to achieve a safe organisation that is capable of sustained safe performance in the face of significant hazards. This paper will examine the role of systematic management systems in helping to ensure that organisations become safe and stay that way. The possession of a management system, no matter how thorough and systematic it may be, is not, however, sufficient to guarantee sustained performance. What is also needed is an organisational culture that supports the management system and allows it to flourish. This paper discusses the notion of a safety culture and how it might be constructed. The bad news is that creating a management system and keeping it alive is not a particularly easy task. The good news is that it is worthwhile, both in terms of lives and in terms of profits. Finally the other good news is that it is not as hard as it may seem.

This paper will examine briefly the history of systematic safety management systems and safety cases, drawing on my personal experience of the petrochemical industry and Shell in particular. While I attempt a balanced view, my experience has been constrained to the Oil and Gas industry and, more recently, the commercial aviation environment. It will take the view that, while safety management has a long tradition, what has often been lacking was a systematic basis for safety management that allowed organisations to see if they had any gaps in their coverage. To proceed further it is necessary to develop organisational cultures that support processes beyond prescription, such as 'thinking the unthinkable' and being intrinsically motivated to be safe, even when there seems no obvious reason to. The paper will examine the notion of Safety Cultures and High Reliability Organisations and put them in a context accessible to small and medium-sized businesses. Finally the paper concludes with a discussion of how to achieve such a safety culture and of the pitfalls that await the unwary. This will include a look at the regulatory environment that can encourage the development of systematic safety management and safety cultures without burdening those organisations that are supposed to be being helped. The road to safety may seem long and hard, and appear to wind, but the destination makes it well worthwhile.

[1] This paper could not have been written without considerable help from my colleagues, Dianne Parker and Gerard van der Graaf, and the tireless assistance of Suzanne Croes and Matthew Lawrie in uncovering the details of safety cultures. I also thank an anonymous referee for pointing out the importance of workforce involvement in any safe endeavour.

2.0 The History: From Flixborough to Piper Alpha

The requirement for organisations to develop Safety Management Systems grew out of the aftermath of a number of disasters, predominantly in Europe. The Flixborough accident in 1974, when a whole village was blown away as a result of an explosion at Nypro Ltd's caprolactam production facility, let to the first requirement for petrochemical companies to present a Safety Case. The Control of Industrial Major Accident Hazards legislation (CIMAH) was restricted to UK onshore facilities. The Seveso incident in 1976 resulted in the European directive 82/501/EEC, known as the Seveso directive, which has been brought up to date with the Seveso II guidelines as required by the Council Directive 96/82/EC. After the Piper Alpha disaster in 1987, Lord Cullen identified the requirement for systematic *safety management*, with the Safety Case proving that a management system was in operation and was effective (1). Cullen's requirements were consistent with the previous legislation and also developed the goal-setting approach first laid out in the report of the Robens Committee (2) that resulted in the UK Health and Safety at Work Act in 1974.

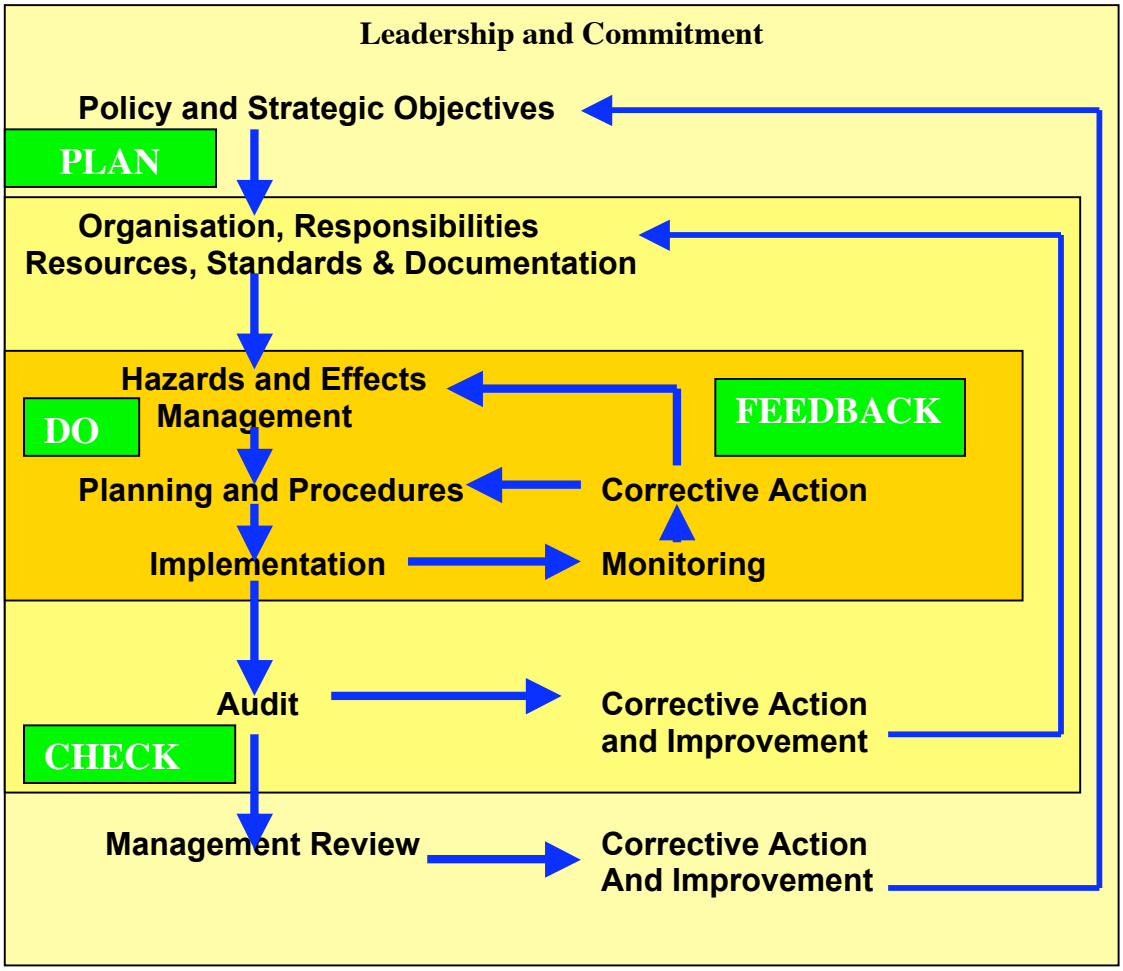
Up to the mid-eighties the Oil and Gas business had been commonly regarded as a dangerous one in which hard men took risks, a stance still taken today in many industries such as mining and construction. Shell had started to progress past this point by first realising that safety was important and that it was not just a matter of individual personal responsibility. Borrowing on the nearly two centuries of experience of the world industry leader, DuPont, Shell developed a set of eleven principles of Enhanced Safety Management – ESM (3). These principles set out requirements, such as having a leadership committed to safety, to having competent safety advisors, to investigating accidents etc. that should and did ensure considerably improved performance as measured in terms of injuries and fatalities (See Figure 4).

The problem with ESM was that it was essentially an unstructured list of eminently reasonable things to do. None of the principles are wrong, management commitment is as important as ever, but none of the principles show *how* one should act. Furthermore there is no guarantee that what is being done will actually work or, even, that more is done than is really necessary. In this environment regulation, both from without and within the organisation, was invariably prescriptive, defining what to do and how to do it. The prescriptions were defined top-down by those who knew best, and refined by experience from accidents. Typically hardware and procedural requirements could be traced back to specific accidents and over time the requirements tended to increase. Regulators forced companies to defend themselves and their employees in ways that were often contrary to common sense or even sound engineering practice. The net result was paternalistic legislation and enforcement, and the ensuing responses, that can often be observed today. The Flixborough and Seveso disasters led to more stringent requirements, but essentially of the same top-down nature. Auditing processes involved checking that requirements were met, such as counting the number of fire extinguishers to ascertain whether there were as many as the law required. Auditing did not check, except indirectly, whether safety was assured.

The Piper Alpha disaster changed all that, at least for the Oil and Gas industry I am most familiar with. Lord Cullen proposed extending the goal-setting regime, which meant that society sets overall goals and organisations can find their own ways of meeting those goals. Such an approach was inherent in the Robens report (2) and also the Norwegian Petroleum Directorate's (NPD) legislative basis. The NPD's

approach was influenced by the Ekofisk Bravo blow-out in 1977, that resulted in considerable pollution, and the Alexander L. Kielland disaster in 1980 in which 123 lives were lost (4). Goal-setting placed control back to those who 'possessed' the hazards, allowing them to manage their own hazards in ways best suited to their capabilities. But Cullen also required that the management of safety be systematic, referring to the ISO 9000 and BS 5750 standards for general management systems (1). Figure 1 shows such a management system. Finally Cullen required that the concept of a Safety Case serve as a proof of assurance that the goals were being met by the management system, be revived. Safety cases were originally required after Flixborough and Seveso, but fell into disrepute because such documents were usually still-born and only collected dust on bookshelves after they had been written. Cullen wanted the Safety Case to be a living document, providing assurance that safety management was active and serving as a basis for continuous safe operations.

Figure 1. A generic Safety Management System The elements of a Safety Management System (SMS). A number of important elements are specified that have to do with the setting of policy and creation of plans and organisational capacity to realise that policy (PLAN) , the analysis of hazards and effects leading to planning and implementation of those plans in order to manage the risks (DO) and the control on the effective performance of those steps (CHECK). A number of feedback loops are specificed to see where the information gained should be sent (FEEDBACK).



3.0 Shell's Approach to Developing Safety Management Systems and Safety Cases

Multi-national Oil and Gas companies, forced by the legal requirements that spread quickly to many parts of the world, set to work to develop offshore Safety Management Systems (SMS). The first fears were that SMS, like the previous safety case regime, would create a vast amount of paperwork and prove to be very expensive to set up. Consultants probably fed this fear when they offered to take on the work and release the company's own staff back to productive work. Some companies decided to wait and see, given the length of time available before the safety cases had to be presented. Others, especially Shell, decided that they would rather decide their own future rather than have it forced upon them. There was a degree of internal variation, given the freedom operating companies had within the Group. In the UK, where Cullen's requirements became law first, the feeling was that a SMS and associated Safety Case would have to be massively detailed to pass and allow operations to continue. The Corporate view was that the SMS had to be structured and systematic, and the Safety Case had to provide clear assurance, but they did not need to be overly large. The Corporate approach finally prevailed, partly because Group-wide auditing practices were to be defined in terms of the Corporate vision, but also because they decided early on to require the approach be applied to both offshore and onshore exploration and production operations. Over the years it has become clear that a systematic approach can mean both clarity and brevity.

Shell's approach was based upon an analysis of the hazards, as these constrained the safety goals. The Hazards and Effects Management Process (HEMP) consists of four steps:

- Identify what hazards can be found in the operation?
- Assess how important are these hazards
- Manage how are the hazards to be controlled?
- Recover what will be done if hazards are released?

3.1 Identification

In order to uncover which hazards should be considered, a Hazards Register was collected. Hazards range from releases of hydrocarbons, building fires, releases of toxic gases such as H_2S, to hippopotamus, crocodile and grizzly bear attacks and heavy falling objects during construction. In the offshore environment one hazard involved structures being hit by vessels such as fishing boats and container ships that are completely out of the control of the organisation. Onshore a hazard that was identified involved military air-plane crashes on facilities. It became clear that many of these were real, in certain operations, and exotic in others. A register allowed a simple look-up approach to be supplemented by brainstorming, analyses of accidents etc. When a new hazard was identified it could be added to the register to save others the work.

Previous regulations subsequent to the original Seveso directive (89/391/EEC) had indeed required employers to maintain such a register of hazards and had a wider interpretation. They had also included hazards to long-term health rather than just to safety. Such hazards could produce chronic rather than just acute problems for employees. The split which still existed, in the early days of SMS implementation, between safety, environment and occupational health, together with the imperative to produce offshore safety cases, meant that it has been only recently that such hazards

have been taken up in the *systematic* management system. This is not to say that there was no interest, but it was confined to the company medical services that had always guarded their autonomy jealously. The general approach as exemplified in the risk potential matrix still applied, but until recently (ca. 1998 onwards) Occupational Health remained the 'runt of the litter'.

Consequence				Increasing Probability				
				A	**B**	**C**	**D**	**E**
Rating	*People*	*Assets*	*Environment*	Never heard of in industry	Incident heard of in industry	Incident heard of in company	Incident happens several times per year in company	Incident happens several times per year in a location
0	No injury	No damage	No effects	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
1	Slight injury	Slight damage	Slight effect	Low Risk	Low Risk	Low Risk	Med/low Risk	Med/low Risk
2	Minor injury	Minor damage	Minor effect	Med/low Risk	Med/low Risk	Med/low Risk	Med/low Risk	Med/low Risk
3	Major injury	Local damage	Localised effect	Med/low Risk	Med/low Risk	Medium Risk	Medium Risk	**High Risk**
4	Single fatality	Major damage	Major effect	Medium Risk	Medium Risk	Medium Risk	**High Risk**	**High Risk**
5	Multiple fatality	Extensive damage	Massive effect	Medium Risk	**High Risk**	**High Risk**	**High Risk**	**High Risk**

Figure 2 .The Risk Potential Matrix*. The colours give the regions of risk that require different levels of control to ensure that such an event does not occur. Major safety cases are usually restricted to documentation of the medium and high level risks. However, hazards present still have to be managed even when the risk is low. The risk matrix can be seen together with the bow-tie diagrams that are intended to show exactly how consequences, denoted by ratings 0-5, are to be avoided.*

3.2 Assessment

The hazards identified may be present, but that does not mean that they are sufficiently important to have to be actively managed. In Norway there are few hippopotamus in the fjords, in West Africa temperatures are never low enough to produce freezing conditions. The principle of ALARP – As Low As Reasonably Practicable – also means that very low frequency hazards can be lumped together with non-existent hazards and ignored. Assessment means recognising the high risk Major Hazards and those carrying medium risk but with widespread consequences, such as food and water contamination. The assessment process is supported by the use of an Incident Potential Matrix (Fig. 2). Probabilities are crude, but sufficient to designate hazards as worth considering (Major Hazards = High Risk; medium hazards = medium risk etc.). What assessment does is cut down the risks that have to be considered at later stages to those that are important. A regulator may disagree with the assessment, but the process is transparent.

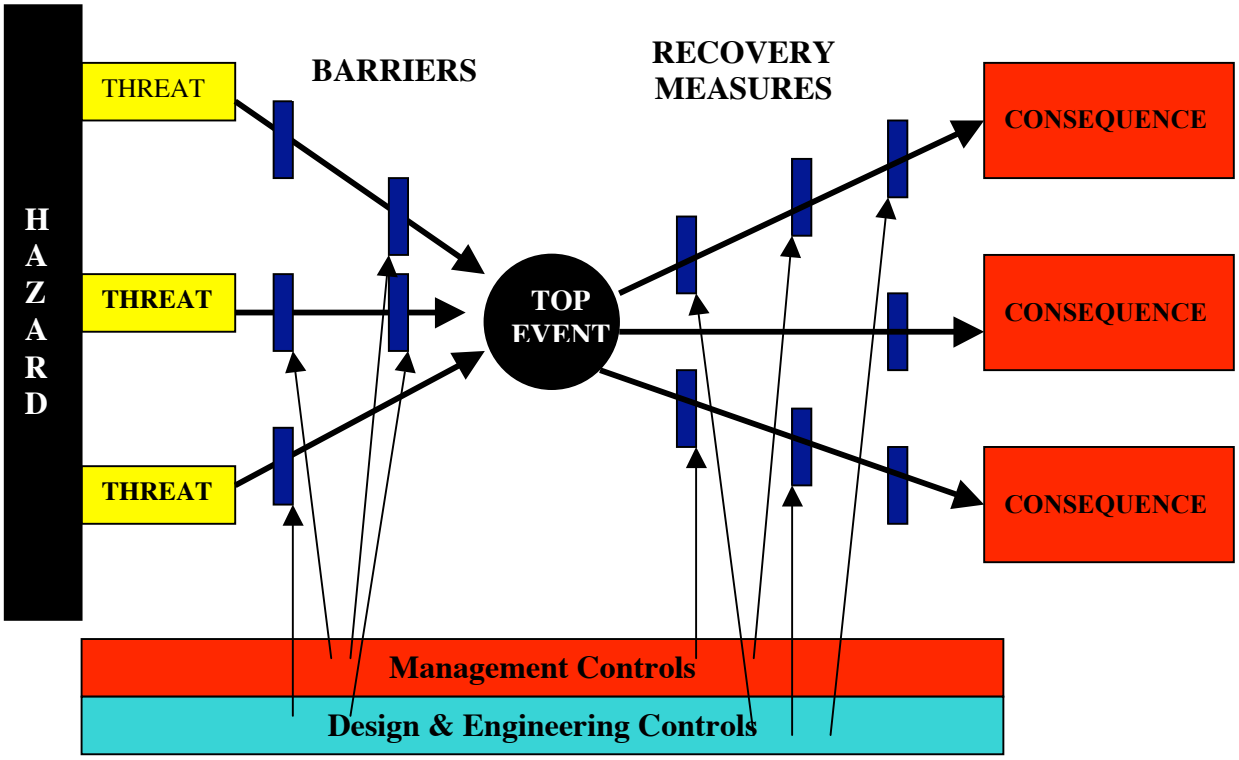
3.3 Manage and Recover

The management of hazards is, naturally, the core of the HEMP process. Shell has developed a specific approach called the Bow-tie (Fig. 3) that is supported by software called THESIS. Central to the development is a bi-directional approach between the effects of hazard release and the types of catastrophic events that can result from failures of defences (barriers and controls). Also crucial is the acceptance that, for whatever reason Murphy thinks of, controls can and will fail, defences will be breached. Recovery measures are intended to ensure that events can be contained or mitigated. During development of the SMS approach, some people argued that with adequate management, recovery was unnecessary. I argued at the time that this was a philosophical stance that was itself dangerous, one I now know to be indicative of, at best, a calculative safety culture.

One lesson that was learnt during the initial stages was that it is difficult to envisage all the processes that need to be considered. The structuring principle was to use the results of a Business Process Analysis to identify safety critical tasks. Constructing a Business Process Model is daunting, especially for those with less resources than an Oil and Gas Major. But really all the Business Process Model consists of is *What we do* and *How we do it*. Smaller companies will have much less complex business processes. Again the use of the Business Process Model meant that only the critical processes need be considered. Furthermore there is no evidence that it is detrimental to business performance to understand what the business is and how the business is performed, especially if it is a hazardous one.

Figure 3. The Bow-tie Diagram.

- **Hazards** form the major ways in which damage or injury can occur.
- **Threats** are the ways in which hazards can be released.
- A **Top Event** is the event one wishes to avoid.
- **Consequences** are the outcomes that have to be avoided (See Risk Potential Matrix).
- **Barriers** are ways in which threats are countered to ensure that a top event does not occur.
- **Recovery measures** are what can be done to ensure that a top event does not result in the unwanted outcomes.
- **Management controls** are ways in which control is exercised by procedures, training etc.
- **Design and Engineering controls** are ways in which barriers and recovery and mitigation measures are built into the system.



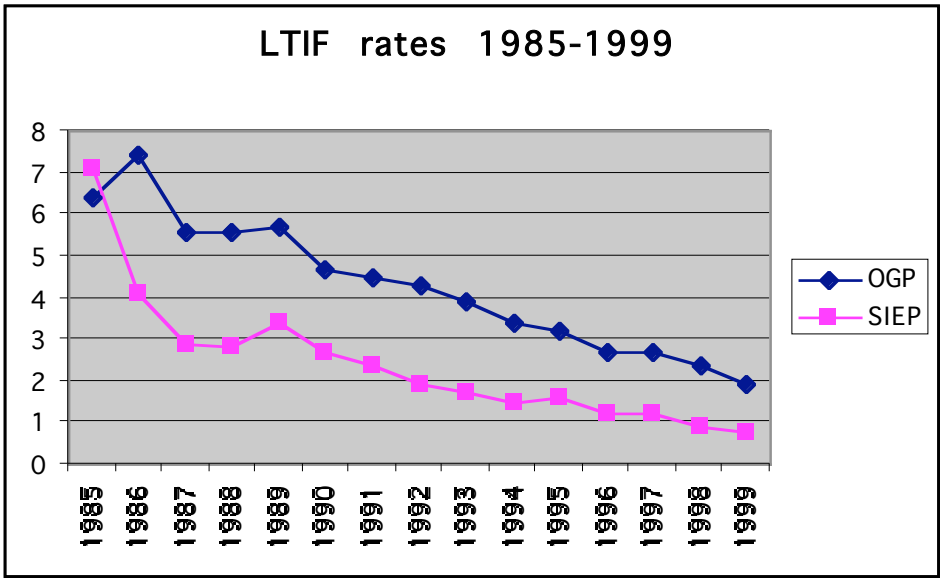
3.4 Lessons Learnt

A number of lessons were learned at this time. The first of these were that it is not necessary to specify everything in the documentation. Where necessary references can be made to specific documents or procedures; what is needed is the overall structure, not necessarily the details. One of the earliest temptations was to over-specify and to attempt to control everything. This is a major reason why SMS were seen as over-complicated and expensive. Experience has taught us that an effective system is possible with much less.

The second lesson was that it is inadvisable to over-generalise, especially in the earliest stages. Some companies decided that, as the basis for SMS was an ISO-9000 type management system, it would be best to manage *everything* with the same system. This temptation has to be resisted; it is necessary first to learn how to be systematic in a part rather than the whole. Safety management can serve as a learning experience; generalisation can come later. The advantage associated with having safety as a starting point is that there is a safety imperative. Other solutions can be put off and problems fixed retrospectively. In safety these luxuries do not exist.

Thirdly, an unexpected discovery was made. Defining existing businesses is hard, because it requires examining what is taken for granted. Setting up new businesses with the SMS/Safety Case approach, however, is easy. Shell quickly learnt that once the initial decision had been made to operate a so-called New Venture, the first step was to define the SMS and then to run the remaining business processes off that structure. This leads to more inherently safe operations and considerable cost savings both up front and over the life span.

Figure 4. *The LTIF rates per million hours for the total industry average(Shell contributes about 30%) as reported to the Oil and Gas Producers organisation, formerly the EP Forum, and Shell International's accident rates. Before 1985 Shell's figures were no better than average.*



Once the basic systems were in place, and after sufficient institutional learning had taken place, it became possible to integrate management systems and to

generalise. Shell has chosen to develop to include both Occupational Health and Environmental management in HSE-MS. Smaller companies in the Oil and Gas business, like Schlumberger, have even added Quality management. The experience suggests that smaller businesses can probably extend the range of processes covered by management systems further than can large ones. The reason for this is probably that smaller businesses are less diversified and have, therefore, smaller and more parallel issues to cope with.

The final lesson learned for an Oil Major was that their contractors also have to have Safety Management Systems and that it is in the interests of both parties to have them. Because smaller companies are more specialised, right down the chain to the one-man specialist, their management systems may be different from larger companies, but it is actually advantageous for larger companies to help their contractors. It may seem surprising that a large company may even help pay for the development of its contractors, but the experience has shown that it pays off.

All in all experience has shown us that it is much easier to implement SMS and Safety Cases than was originally thought. What is important is to share information, such as the idea of a hazards register, and to use support systems like THESIS. We also learned that a good Safety Case is actually quite small, because what is important is having a *systematic* approach as the basis for assurance, not vast amounts of detail that can even obscure the existence of gaps and unwarranted assumptions.

Figure 4 shows the gradual but remarkable improvement of the Oil and Gas industry since 1985. The data can be read as showing how there was a general improvement after 1989, when management systems began to bite. Shell's improvement in 1986 can be related to a major turn-around associated with the introduction of Enhanced Safety Management. The effects of SMS can be inferred, but not proven by such a figure. Another factor that has to be considered is the change from lost work days after to incident to restricted work. Trend analyses of LTIF, Restricted Work Cases (RWC) and Total Reportable Case Frequency (TRCF) in one company showed that a considerable proportion of the reduction in LTIF was due to LTI management shifting to restricted work (5). Over the years, however, this still resulted in a major shift in attitudes towards safety. This shift will be discussed in the next section.

3.5 The Evolution of Safety

Looking back we can see that safety has undergone a development from an unsystematic, albeit well-meaning, collection of processes and standards, to a systematic approach specific to safety. Piper Alpha served as the catalyst for this major change. Once SMS is in place it becomes possible to extend the range to include other elements such as Environment and Occupational Health, leading to an integrated approach to HSE as a whole. The question now is, is there another stage or is the integrated approach the end of the story?

The answer lies in the *way* in which safety management is carried out. Management systems are primarily rational inventions, defined on paper in offices and capable of objective evaluation in audits. The next stage is one in which the aims and intentions can be allowed to flourish, even if there are gaps. This is a situation in which formally undefinable characteristics such as enthusiasm, care and belief are to be found. The kind of organisation that provides this support is a safety culture. In a managed organisation it is still necessary to check and control externally. In a safety

culture it becomes possible to find that people carry out what they know has to be done not because they *have* to, but because they *want* to. It is at this point that worker involvement becomes both meaningful and necessary. Advanced safety cultures can only be built upon a combination of a top-down commitment to improve and the realisation that the workforce is where that improvement has to take place. The workforce has to be trusted and has a duty to inform. What this means in practice is that in an advanced safety culture it becomes possible to reap extra benefits, beyond having fewer accidents, such as reductions in the audit frequency. The next question is, what exactly is a safety culture and how do you acquire one?

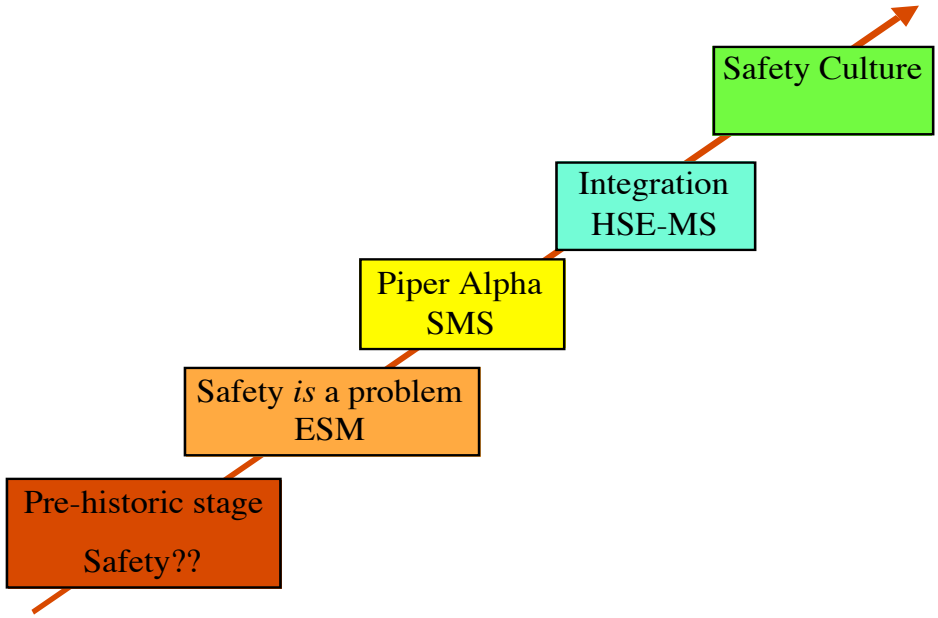


Figure 5 *The evolution of safety in Shell's Exploration and Production function. Safety started by being regarded as an individual's own problem in a dangerous business. Once safety was taken seriously in the early 80's the Enhanced Safety Management Principles (ESM) were introduced. After the Piper Alpha disaster the requirement for Safety Management Systems (SMS) eventually led to the realisation that SMS could be generalised to Health Safety and Environment-MS. The next stage is to develop an organisational culture within which all these developments flourish.*

4.0 Safety Culture

The systematic approach to safety enshrined in OH-SMS is not the end of the road. Recent studies into organisational safety cultures have enabled us to start to understand the notion of a Safe Organisation (6, 7, 8, 9). What we now know is that there is an evolutionary process from unsafe to safe organisations, from the Pathological to the Generative. The Calculative stage, where great value is placed upon systematic and managed approaches to operational safety, is an intermediate stage. The evolutionary process is usually initially driven by legislation, but it is possible for organisations to drive themselves in the beginning. Later, however, we find that the best organisations leave the regulatory drive behind. This development means that the role of the regulator has to change from an enforcer to a facilitator. It also implies that, when things go wrong, the legal framework has to be capable of accommodating a wide variety of organisational attitudes and of responding appropriately. This is not to state that regulators are unnecessary, but rather that their roles should change as a function of what and who they are regulating. Pathological organisations are going to respond, if at all, to more old-fashioned legalistic control and threats. Advanced cultures need to be supported and reminded of their own high standards.

4.1 What is a Safety Culture?

Every organisation has some common, internal, characteristics that we call its culture. These characteristics have often become invisible to those inside, but may be startling to outsiders coming from a different culture. The notion of an organisational culture is notoriously difficult to define, so I take a very general approach and see the organisational culture as, roughly "Who and what we are, what we find important, and how we go about doing things round here". Rousseau (10) defined culture more specifically as "the ways of thinking, behaving and believing that members of a social unit have in common". A safety culture is a special case of such a culture, one in which safety has a special place in the concerns of those who work for the organisation. In one sense safety *always* has a place in an organisation's culture, which can then be referred to as *the* safety culture, but it is only past a certain stage of development that an organisation can be said to take safety sufficiently seriously to be labelled as *a* safety culture.

The notion of safety culture is somewhat different from that of safety climate originally propagated by Zohar (11). Zohar's approach concentrated upon the perceptions of employees, defining organisational climate as the "perceptions held by employees about aspects of their organisational environment, summarised over individual employees". The culture defines the setting within which the climate operates[2].

We can first distinguish culture into its static and its dynamic components. The term *static* refers to what *is*, generally the unchanging values held by the organisation, and the beliefs that permeate its members. The term *dynamic* refers to how the organisation operates, the types of work processes it feels comfortable with. Table 1 shows a set of definitions of the four major components that can be identified

[2] It is a pity that Zohar (11) chose to use the term climate, which would have been an appropriate term to use for what is here referred to as culture. The changeable perceptions could then be referred to as 'weather' in the context of the overall climate.

as constituting corporate culture (12). The distinction between common working practices and problem solving methods is not always drawn, but this may be because researchers tend to study companies in either periods of stability or of great change, but not through both. Operating in a stable world highlights the daily working practices, while periods of change are dominated by problem-solving processes.

A safety culture is one in which safety plays a very important role. Because safety is such a complex phenomenon, it is not enough just to add – "And be safe". The next sections examine the characteristics of a safety culture and look at the types of culture that can be recognised as forming a progression along which organisations develop.

Culture Component	***Definition***
Corporate Values	What the organisation regards as important or even sacrosanct
Corporate Beliefs	What the organisation believes about the world, how the world will react to actions, what the outside world finds important. Beliefs about what works and doesn't
Common Problem-Solving Methods	How the types of problem found in the organisation are tackled, e.g. project groups, consultants, panic
Common Working Practices	The way people go about their work, e.g. small meetings, lots of memos, project management of everything etc.

Table 1*. Corporate Culture definitions.*

4.2 The Characteristics of a Safety Culture

What does an organisational culture that gives safety a priority look like? Reason (13) has identified a number of characteristics that go to make up such a safety culture. These are:

- an *informed culture*-one in which those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole.
- a *reporting culture*: a culture in which people are willing to report errors and near misses.
- a *just culture*: a culture of 'no blame' where an atmosphere of trust is present and people are encouraged or even rewarded for providing essential safety-related information- but where there is also a clear line between acceptable and unacceptable behaviour.
- a *flexible culture* which can take different forms but is characterised as shifting from the conventional hierarchical mode to a flatter professional structure.

- a *learning culture* - the willingness and the competence to draw the right conclusions from its safety information system, and the will to implement major reforms when the need is indicated.

The values associated with a safety culture are fairly straightforward. The beliefs are more complex. Taken together the five characteristics form a culture of *trust*. Trust is needed, especially in the face of assaults upon the beliefs that people are trying their best, such as accidents and near-miss incidents which all too easily look like failures of individuals to come up to the ideals of the organisation. This helps us to identify what beliefs are associated with a safety culture. Table II places safety into the framework set in Table I. Reason's characteristics are the outcome of corporate behaviours driven by the static and dynamic components of the corporate culture.

Safety Culture Component	***Definition***
Safety Values	The organisation regards as safety as sacrosanct and provides the licence to operate.
Safety Beliefs	The organisation believes that safety makes commercial sense; that individuals are not the sole causes of incidents; that the next accident is waiting to happen.
Common Problem-Solving Methods	Risk assessment, cost-benefit analyses, accident analysis as well as investigation, proactive search for problems in advance of incidents.
Common Working Practices	Safety integral to design and operations practice, safety #1 on meeting agendas up to Board level, chronic unease about safety.

Table II. *A Safety Culture defined in terms of the organisational components. Note that the methods and working practices are not restricted to safety, but that safety is intimately involved in the way work is done.*

Table III breaks down organisational cultures into more detail. The internals may be reflected at any cultural level, so managerial style will vary from pathological through to generative (see below). The Walk/Talk headings are intended to distinguish the more passive from the active components. Filling in these components helps define how a culture appears and how a culture should be. The next section discusses a progression of cultures.

TALK		**WALK**		
Communication	**Organisational Attitudes**	**Safety**	**Organisational Behaviour**	**Working Behaviour**
Flow of data and information about safety	Workforce attitudes to management	Organisational status of safety Department	Managerial style and behaviour	Priority setting between production and safety
Management informedness about the true state of affairs	Management attitudes about the workforce	Rewards of good safety performance	Level of care for stakeholders	Risk appreciation by those at personal risk
Workforce informedness about the true state of affairs	Collective efficacy – the belief that people can get things done	Procedures and the use of initiative	Dealing with change	On-site behaviour by the workforce and management
		Design – safety as a starting point	Reaction to trouble when it happens	Environment seen as critical

Table III *The Safety Culture dimensions and internal structure. These are filled in with different descriptions for each level of the safety culture attained. For each cell it should be possible to think in terms of the values, beliefs and practices that apply.*

4.3 Types of Safety Culture

Safety cultures can be distinguished along a line from *pathological*, caring less about safety than about not being caught, through *calculative*, blindly following all the logically necessary steps, to *generative*, in which safe behaviour is fully integrated into everything the organisation does (6, 14, 15, 16). A Safety Culture can only be considered seriously in the later stages of this evolutionary line. Prior to that, up to and including the calculative stage, the term safety culture is best reserved to describe formal and superficial structures rather than an integral part of the overall culture, pervading how the organisation goes about its work. It is obvious that, at the pathological stage, an organisation is not even interested in safety and has to make the first level of acquiring the value system that includes safety as a necessary element. A subsequent stage is one in which safety issues begin to acquire importance, often driven by both internal and external factors as a result of having many incidents. At this first stage of development we can see the values beginning to be acquired, but the beliefs, methods and working practices are still at a primeval stage. At such an early stage, top management believes accidents to be caused by stupidity, inattention and, even, wilfulness on the part of their employees. Many messages may flow from on high, but the majority still reflect the organisation's primary aims, often with *'and be safe'* tacked on at the end.

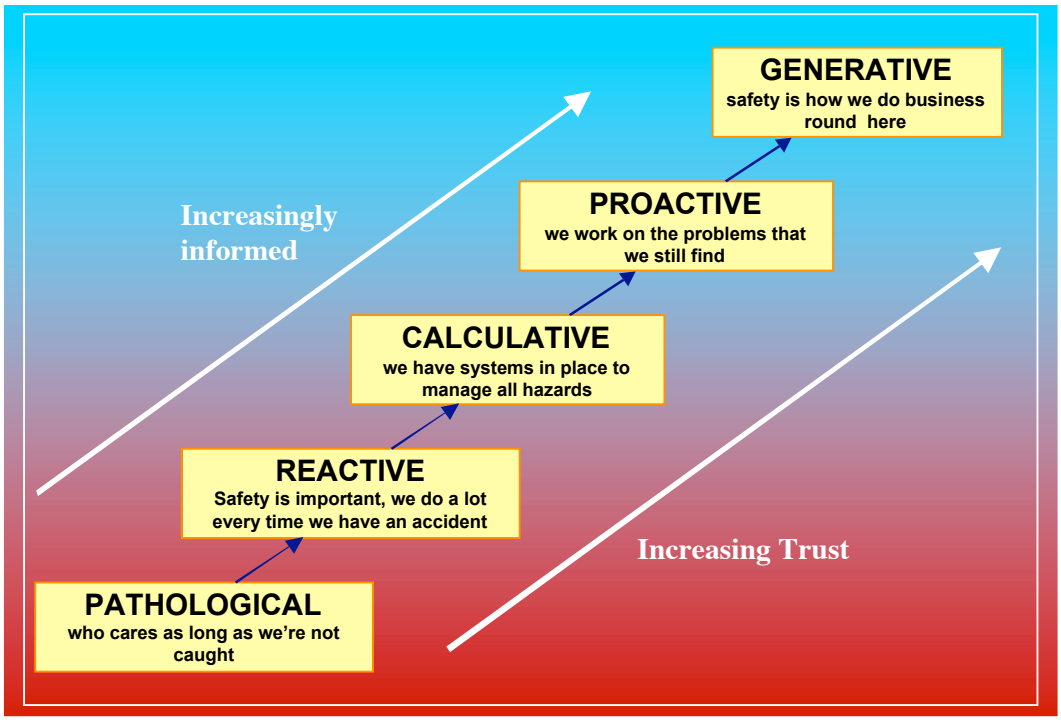
Pathological	Bureaucratic	Generative
Information is hidden	Information may be ignored	Information is actively sought
Messengers are "shot"	Messengers are tolerated	Messengers are trained
Responsibilities are shirked	Responsibility is compartmented	Responsibilities are shared
Bridging is discouraged	Bridging is allowed but discouraged	Bridging is rewarded
Failure is covered up	Organisation is just and merciful	Failure causes enquiry
New ideas are crushed	New ideas create problems	New ideas are welcomed

Table IV. *Westrum's original model. The Reactive and the Proactive stages have been added more recently and articulated in our work in the Oil and Gas industry. Table 5 shows an extended and more practical version that was worked out, in co-operation with Westrum, with the addition of the Reactive and Proactive stages.*

The next stage, one that I feel can not be circumvented, involves the recognition that safety needs to be taken seriously. The term *calculative* is used to stress that safety is calculated; quantitative risk assessment techniques and overt cost-benefit analyses are used to justify safety and to measure the effectiveness of proposed measures. Such techniques are typical problem-solving methods. Often simple calculations suggest that failing to be safe, or at least having incidents, costs money. Furthermore organisations that are seen from outside as being uncaring about safety may have image problems that knock on to the bottom line. Despite this stance, and despite what can become an impressive safety record, safety is still an add-on, certainly when seen from outside. This is the level of mechanical application of a management system. What was sought in the earlier part of this paper is now clear, a true safety culture is one that transcends the calculative and bureaucratic levels.

The foundation can now be laid, nevertheless, for acquiring *beliefs* that safety is worthwhile in its own right. By constructing deliberate procedures an organisation can force itself into taking safety seriously, or can be forced by a regulatory body, but the values are not yet fully internalised, the methods are still new and individual beliefs generally lag behind corporate intentions. This shows us a significant characteristic of a true safety culture, that the value system associated with safety and safe working has to be fully internalised as beliefs, almost to the point of invisibility, and that the entire suite of approaches the organisation uses are safety-based (17). What this also stresses is that the notion of a safety culture can only arise in an organisational context within which the necessary technical steps and procedures are already in place and in operation. Yet again, these are necessary but not sufficient preconditions for a safety culture (7, 18, 19).

Figure 6. *The evolutionary model of Safety Culture*.



5.0 How can you achieve a Safety Culture?

We have been studying the production of safety culture in the Oil and Gas industry and it is clear that, to progress, one has to undergo a process of cultural change. These changes have to take place incrementally. It appears logical, at least, that it is impossible to go straight from the reactive to the proactive without going through the calculative stage if only because the proactive culture includes systems typical of the calculative. Similarly it is probably impossible to go from the pathological straight to the calculative stage.

5.1 Change Management

What has to be done for an organisation to develop along the line towards the generative or true safety cultures is a managed change process. The next culture defines *where* we want to go to, the change model determines *how* we get there. A model for developmental change has been proposed by Prochaska and DiClemente (20). This model was originally developed for getting people off drug and other dependencies such as smoking, alcohol and over-eating. It proposes that there are five stages that the authors have identified. These stages are:

- **Precontemplation** – Not yet at a stage of considering the need for change. In safety terms a complacent belief that what can be achieved has been achieved. Coupled with the belief that further improvement is 'not possible in this business'.
- **Contemplation** – A stage at which the realisation is arisen that further improvement is possible. There is no actual change in behaviour and no steps are taken. Nevertheless the possibility of improvement is entertained.
- **Preparation** – Active steps are taken to prepare for change (in smoking this would be characterised by trying not to buy cigarettes, by not maintaining a stock; in dieting this might involve avoiding certain eating situations, but in both cases without actually smoking or eating less). Characterised by much backsliding.
- **Action** - The stage when the practice built up in the preparation stage is put to work. The beliefs are now that it is important and possible to stop the addictive behaviour. This stage needs to be actively supported while the pull to slide backwards is actively countered (in contrast to the previous stage when backsliding is characteristic).
- **Maintenance** – This stage is vital in maintaining a new, lower baseline of behaviour. This stage needs to be kept up and can often be lost with reversion to the behaviour characteristic of preparation and action.

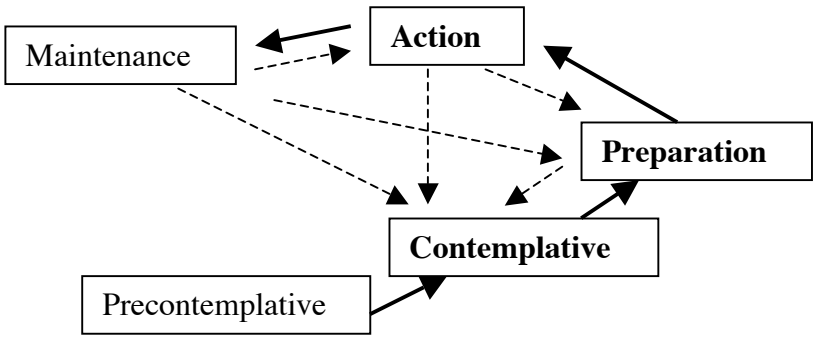


Figure 7*. Prochaska & DiClemente's change model. The dotted lines denote possible ways to fall back. Note that it is not possible to revert as far as the pre-contemplative mode once one has become aware. The remaining stages are, however, unfortunately quite possible as anyone who has tried to give up smoking knows.*

Figure 7 shows the basic set of transitions from precontemplative through to maintenance, with back-sliding as dotted lines. The step back to precontemplative is not possible (i.e. the values remain intact, but beliefs in the possibility of meeting them may be severely damaged). What is contemplated will be different at each stage of safety culture, so the transition from proactive to generative includes concepts, values and beliefs incomprehensible to those at lower stages. The application of this transition process leads to a spiral when we take safety culture into account.

What is important in this model is the recognition of which stage a patient finds themselves in and the methods available to shift them through the transition from one stage to the next. The stages will require the definition of tools to determine which stage individuals and groups (in organisations) are currently in. The *transitions* that have to be made will require change tools. The term stage is used to refer to one of these treatment situations. A transition takes place between stages.

5.2 A Change Model for Organisations

A more articulated model has been developed for managing successful change within organisations. Its strength comes from the fact that it is intended to change both the individuals and the organisations they constitute, and realises that changing the one without the other is impossible. This model, shown below in Table V, puts together the requirements for change of individual beliefs that are so crucial in cultural development. What we have learned is that awareness is not enough, the creation of personal need and belief in the value of the outcome is equally vital in ensuring a successful process for the organisation as a whole.

The model is very similar to any quality system Plan-Do-Check, but the internals of the stages, especially the Awareness and Planning stages, are often missed or treated very summarily. All too often, the active participation of those involved, in the awareness and planning stages, is replaced by a plan of action defined elsewhere. Such models are purely top-down, with plans typically handed down from senior management, external corporate departments or consultants. What are needed are: (I)

the creation of a personal need to change, (II) a belief in the ability to effect such change and (III) the clear understanding that individuals have control over their own process. These are factors that have been repeatedly found in the literature on motivation to influence final outcomes positively. It is just these factors we feel get to the Hearts and Minds of the workforce. When the beliefs and values associated with a new (and hopefully better) state have been assimilated and internalised, then the change has really taken place. This model can apply to safety, but it can also apply to Cost Leadership or any other desirable development in an organisational environment. It gives substance to the oft-heard cries for workforce involvement and shows where and why such involvement is crucial, especially in the later stages of evolution towards a full safety culture.

Pre-contemplation to Contemplation - AWARENESS

- *Awareness* – Simple knowledge of a 'better' alternative than the current state
- *Creation of need* – Active desire to achieve the new state
- *Making the outcome believable* – believing that the state is sensible for those involved
- *Making the outcome achievable*- making the process of achieving the new state credible for those involved
- *Information about successes* - provision of information about others who have succeeded
- *Personal vision* - definition by those involved of what *they* expect the new situation to be

Contemplation to Preparation - PLANNING

- *Plan construction* - creation by those involved of their *own* action plan
- *Measurement points* - definition of indicators of success in process
- *Commitment* - signing-up to the plan of all involved

Preparation to Action - ACTION

1. *Do* - start implementing action plan
2. *Review* - review progress with concentration upon successful outcomes
3. *Correct* - reworking of plan where necessary

Maintenance - MAINTENANCE

- *Review* - management review of process at regular (and defined in advance) intervals
- *Outcome* - checks on internalisation of values and beliefs in outcome state

Table V. *The articulated Change Model for Organisations. Prochaska and DiClemente's original five stages are elaborated to 14 to cover the details required in real settings.*

5.3 What are the barriers to success?

If there were no barriers, the development of a safety culture would never form a problem and safety cultures would abound. Why, then, do attempts fail? The reasons are to be found in the beliefs and practices that characterise an organisation and its members. In many cases organisations will naturally limit their development unless active steps are taken. In the worst cases organisations may actually revert. As all organisational cultures past the Pathological hold safety high in their value

systems, reversion may appear to the participants to be less significant than it actually is. When reverting organisations may trade in beliefs and practices, justifying what they do by reference to values. But as there are few differences in the values between any organisations past the pathological, while the beliefs and practices are critical, this justification has to be recognised as specious.

5.4 Bureaucratic Cultures

One major reason is that the bureaucratic culture associated with the calculative safety culture is a powerful and comfortable one. An organisation that has struggled to become proactive may easily revert, especially in the face of success. Generative organisations have many characteristics that are essentially anti-bureaucratic; the hierarchical structures break down under high-tempo operations (18). What this demonstrates when it happens is that the beliefs, usually of top management, have never really moved on. The move from proactive to generative is also hard to make because, while the calculative and proactive stages may be fairly easy to identify and therefore acquire, the generative stage is more elusive. In a sense every calculative organisation will be the same, or at least very similar, despite differences in the tasks such organisations face. A generative organisation, in contrast, will be structured in ways specific to the tasks it has to accomplish. Therefore every generative organisation is likely to be subtly different from every other one. This makes it much harder to define where one is going when trying to transit from proactive to generative. It also makes it much easier to succumb to the temptation to prefer a well-defined organisational structure over an organisational process that is much harder to regulate.

5.5 Regulators and the Law

The Regulator, possibly surprisingly, forms a barrier to development. This will not be the case in the earlier stages, going from pathological to reactive and on to calculative. The later stages will be harder because they often involve dropping just those facets, such as specialised safety staff and extensive management systems, that regulators require (by law) and that got the organisation there in the first place. Regulators are, with some honourable exceptions, more inclined to the letter than the spirit of the law. This can mean that an experimental improvement, typical of generative and proactive organisations, may well be actively discouraged. The fact that things might well get better is often irrelevant to the legal mind. The simplest remedy for this problem is a goal-setting regime.

The problem faced by an enlightened regulator is that the law allows few distinctions based upon track record in the face of outcomes. What we are looking for is a regulatory regime that is measured against the aspirations of organisations and the degree to which they attempt to attain them. In this sort of regime setting almost impossible standards is laudable, while failing to meet them is not necessarily reprehensible. What counts is the activity and the whole-hearted commitment. In such a regulatory regime meeting low standards might well attract more attention from the regulator than failing to meet high standards. While such enlightened regulatory regimes do not exist, regulators may remain a block to progress by the best.

One approach taken by enlightened regulators is to reduce the audit frequency for cultures that they perceive as more advanced. The trust and informedness characteristic of the advanced cultures means that they are essentially continuously

self-auditing. What regulators need to audit is the culture, not the detailed activities that are performed. The consequence of this is that cost-effectiveness can be increased, just for those organisations that have tried the best.

5.6 Management Failure

Changes in top management, or management's priorities, at critical periods, may prove fatal to the successful transition to a higher safety culture. A cultural change is drastic and never takes place overnight. If a champion leaves, there is often no-one to take up the fight and the crucial top-down impetus is lost. But even without a personnel change there are two threats to the successful transition to a higher level of safety culture. One is success, the other failure. In the case of success, effective processes, tools and systems may be dropped, because the problem is perceived to have gone away. In the case of failure, old-fashioned approaches may be retrieved on the grounds that they worked before. But in both of these cases the new, and often fragile, beliefs and practices may not have become sufficiently internalised to survive changes at the top.

A common problem in organisations that are struggling on the borderline between the calculative and the proactive/generative levels is success. Once significant improvements in outcome performance have been achieved management 'take their eyes off the ball' and downgrade efforts on the grounds that the problems have been solved. But this is behaviour typical of the reactive stance and represents a reversion. Management have to be truly committed to the maintenance of an advanced culture in the face of success, and such commitment is rare.

5.7 Change is hard

One final underlying reason why cultural change often fails to succeed is that the new situation is unknown to the participants. If this is added to existing beliefs, such as the belief that the current situation is as good as it gets, then there is little real need to change and failure is almost certain. If these failures are at the level of the workforce, then strong management commitment may save the day. If the problems lie with management, then there is little hope because they will enforce the old situation, which feels most comfortable, on the most proactive of workforces. A colleague has likened this to learning a new golf swing by changing the grip and the stance (21). At first the new position hurts, the old grip position much more comfortable. It takes time before the benefits of a new grip and the altered stance come through, you have to trust the pro, but you have to do the work! One advantage of this metaphor is that managers often play golf and can transfer their experience of learning a new swing to learning to manage an advancing culture. Change agents are like golf professionals, they can help develop a person's game, but they can't play it for them.

6.0 Conclusion

Safety management systems and associated safety cases can make a big difference. The systematic approach means that the hazards of the business are known, understood and demonstrably controlled. There is considerable evidence that those companies that are most safety-minded are also amongst the most profitable and the amounts of money that an effective safety management system can produce is considerable (22). But the problem with purely systematic management is that such activities can be carried out mechanically. The argument was that the next step is the development of a safety culture that makes a system come alive (9).

The discovery that a safety culture pays, not just by reducing accidents, is crucial. One way a safety culture pays off, as the levels of trust improve, is in the quality of communication between management, and the rest of the company. As communication failures are always pointed to as a source of problems for organisations, having a definitive focus for improving communication can only result in improved performance at all levels. Another way a safety culture pays is in the reduction in time and paperwork devoted to checking whether elementary safety-related actions are carried out. The other main reason why safety makes money lies in the fact that, if one has the guarantee of safety that an effective management system provides, then one can devote resources more effectively and take (profitable) risks that others dare not run. What costs money is not safety, but bad safety management. Once the management of an organisation realises that safety is financially rewarding and that the costs incurred have to be seen as investments with a positive return (22), the road to a full safety culture should be open.

Given the financial inducements, why don't organisations try and develop the most advanced forms of safety culture? The answer seems to be contained in the type of culture the organisation is at the time. Pathological organisations just don't care. Reactive organisations think that there is nothing better and anyone who claims better performance is probably lying. They do what they feel is as good as can be done. Calculative/Bureaucratic organisations are hard to move because they are comfortable, even if they know that improvement is possible. The more advanced cultures, either Proactive or Generative, are probably easier to attain with small organisations. Large ones will inevitably be heavily bureaucratic unless active steps are taken to counter that tendency. The greatest challenge, then, is to shift large organisations.

Small organisations are often frightened to develop management systems, because they feel that they will commit more than they get back. I hope I have been able to argue that this is not the case. Small organisations are smaller, more focussed and flexible. Small organisations are also much more likely to be able to develop past the calculative stage and become generative. The greatest single barrier to success for smaller organisations is the belief that it is too difficult. The opposite view is that, in the long term, it is more dangerous not to.

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