

GENERATIVE RISK MANAGEMENT TECHNIQUES

Gaye E Francis
Richard M Robinson
R2A Pty Ltd
Level 1, 55 Hardware Lane
Melbourne 3000

ABSTRACT

'Generative' technique is a term adopted from James Reason's work in the risk area. In terms of the Engineers Australia Safety Case Guidelines online paradigm model, it generally refers to the "Risk Culture Concepts" paradigm. It has much to do with morale and the willingness of people to constructively speak up and for the organisation to respond positively. In a legal sense it provides assurance after the event that no one can say, "I knew that but nobody listened".

Three generative techniques in common use and the experiences with each will be described: Transparent Independent Rapid Risk Reporting, Generative Interview Techniques and the Generative Solutions Techniques.

SAFETY CASE GUIDELINES

A safety case is a demonstration that all reasonable, practical precautions are in place. To act effectively as both a technical and liability management tool, safety cases need to have an initial argument for the approaches selected to demonstrate effective safety management. Chapter 2 of the R2A Text outlines eight paradigms for assessing risk and three inquiry methods of "risk sign off". These are also described in the Victorian Chapter of the Risk Engineering Society of Engineers Australia Safety Case Guidelines. The best methodologies to use in the implementation of each of the paradigms are illustrated in the following table:

Technique>> Risk Management Paradigm		Expert reviews	Facilitated workshops	Selective interviews
1.	The rule of law	Yes (Legal opinions)	Yes (Arbitration, moot courts)	Yes (Royal Commissions)
2.	Insurance approaches	Yes (Risk surveys, actuarial studies)	Yes (Risk profiling sessions)	Yes (<i>especially moral risk</i>)
3.	Asset based, 'bottom-up' approaches	Yes (QRA, availability & reliability audits)	Yes (HazOps, FMECAs etc)	Difficult
4.	Threat based 'top-down' approaches	Difficult in isolation	Yes (SWOT & vulnerability)	Yes (Interviews)
5.	Business (upside AND downside) approaches	Yes (Actuarial studies)	Difficult in isolation	Yes (Fact finding tours)
6.	Solution based 'good practice' approaches	Difficult to be comprehensive	Difficult to be comprehensive	Yes (Fact finding tours)
7.	Simulation	Yes (Computer simulations)	Yes (Crisis simulations)	Difficult
8.	Risk culture concepts	Yes (Quality audits)	Difficult	Yes (Interviews)

Risk Management Paradigm - Technique Matrix

JAMES REASON ET AL

James Reason is an English psychologist who has written extensively on risk. In 1993 he suggested a 7-point rating scale for overall organizational risk control:

- i) *Pathological*
barest minimum industry safety practices
- ii) *Pathological / low reactivity*
one step ahead of regulators, some concern re adverse trends
- iii) *Worried / reactive*
anxious about a run of incidents or accidents
- iv) *Repair /routine*
sensitive to events, safety data collection /analysis but local repair only
- v) *Repair / some proactivity*
wide range of auditing but "technocratic" remedial measures
- vi) *Reform / generative*
aware that engineering, selection, training not enough, looking for better
- vii) *Truly generative*
proactive measures in place, safety measures under continuous review, range of diagnostic/remedial measures being considered, not complacent or self-congratulatory, still afraid of the hazards.

Reason (1997) noted three types of risk models:

The Person Model

The Person Model is exemplified by the traditional occupational safety approach. The main emphasis is upon individual unsafe acts and personal injury accidents. It is usually policed by safety departments. The most widely used counter measures are 'fear appeal', unsafe act auditing, new procedures, training and selection.

The Engineering Model

The Engineering Model is system based and quantified where possible. Counter measures are engineered into the system using devices such as HazOps, FMECA's etc. Measures include quantified individual risk and societal risk.

The Organisational Model

The Organisational Model is allied to crisis management. Human error is a consequence and not a cause. Countermeasures aim at an 'informed culture'. Safety may be measured as quality.

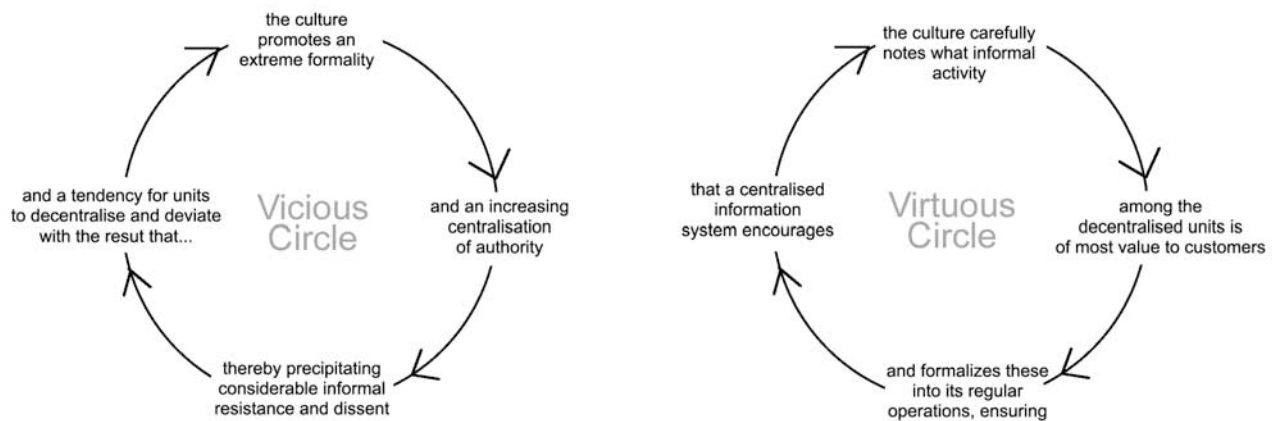
Audit systems can often be seen to favour one or more of these models.

Reason also notes three types of culture, each having particular characteristics:

Pathological Culture	Bureaucratic Culture	Generative Culture
<ul style="list-style-type: none"> • Don't want to know • Messengers are 'shot' • Responsibility is shirked • Failure is punished • New ideas actively discouraged 	<ul style="list-style-type: none"> • May not find out • Messengers are listened to if they arrive • Responsibility is compartmentalized • Failures lead to local repairs • New ideas often present new problems 	<ul style="list-style-type: none"> • Actively seek it • Messengers are trained and rewarded • Responsibility is shared • Failure leads to far reaching reforms • New ideas are welcomed

Three Risk Cultures after Reason (1997)

Reason is not the only author to notice the importance of culture. Charles Hampden-Turner has a notion of virtuous and vicious circles, shown below.



Vicious and Virtuous Circles

GENERATIVE CULTURE

For Reason, an informed (generative) culture = a safety culture. It has the following components: a reporting culture, a learning culture, a just culture and a flexible culture.

A Reporting Culture

Disincentives

- Extra work
- Skepticism that anything constructive to prevent it will happen
- A desire to forget all about it
- Lack of trust and
- Fear of reprisals

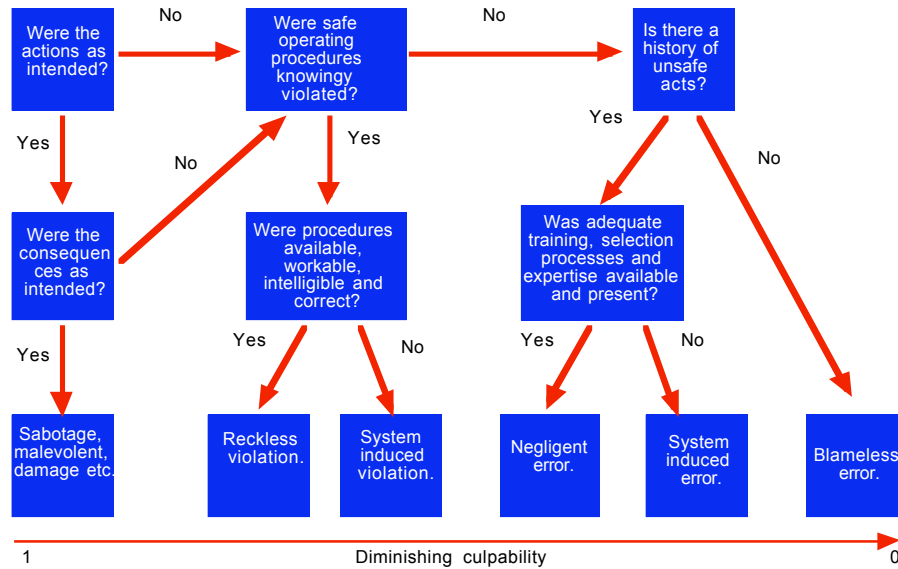
Incentives

- Indemnity against disciplinary proceedings
- Confidentiality or de-identification
- The separation of the agency or department collecting and analysing reports from those bodies with the
- Authority to institute disciplinary proceedings and impose sanctions
- Rapid, useful, accessible and intelligible feedback to the reporting community
- Ease of making a report

A Learning Culture

- Observing (noticing, attending, heeding, tracking)
- Reflecting (analysing, interpreting, diagnosing)
- Creating (imagining, designing, planning)
- Acting (implementing, doing, testing)

A Just Culture



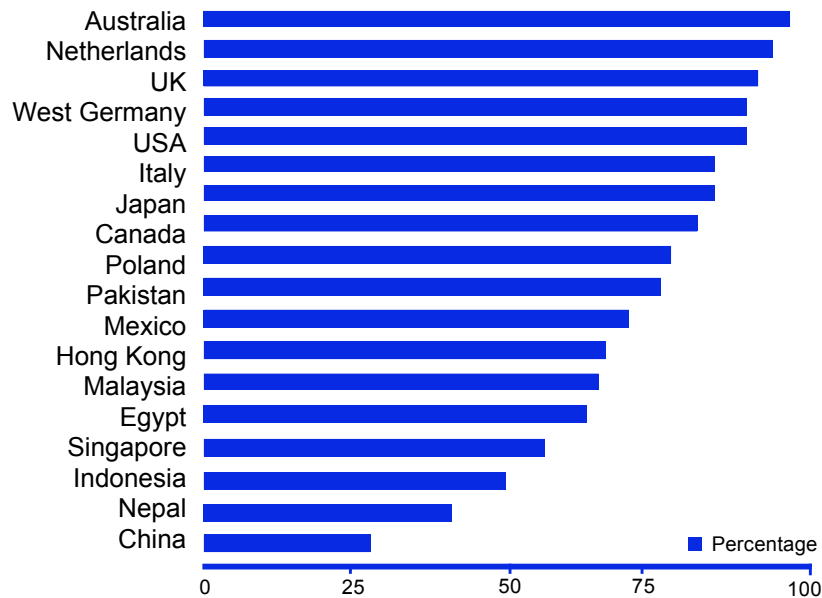
A decision tree for determining the culpability of unsafe acts (after Reason 1997)

A Flexible Culture

- A culture that favours face-to-face communication
- Work groups made up of divergent people (with shared values and assumptions)
- Able to shift from centralised control to decentralised mode in which the guidance of local operations
- depends largely on the professionalism of the first-line supervisors

AUSTRALIAN SAFETY CULTURE

An interesting application of the cultural risk paradigm arises when considering safety in Australian industry. A major study endeavouring to determine why Australia has a good commercial aviation safety record documented aspects of Australian culture that affect safety performance [6]. The graph below reflects the answers that staff gave to a request from their manager to help paint his house. Australians have the highest likelihood (up to 95%) of any of the interviewed nations of saying, "No".



"No" Responses to the question "Would you help paint your manager's house?"

Australians tend to be individualistic and to have a low "power-distance". That is, actions or instructions from others have a comparatively limited effect on the way in which they act. They perceive a relatively flat power gradient between manager and subordinate.

For example, on aircraft flight decks junior crew members feel able to speak up without loss of face to the senior crew or other repercussions, if they think an error has occurred. This facilitates initiation of effective additional checks.

In industries with different management styles, difficulties can arise. If a person being directed does not believe that the directive is either practical or safe, then that person will tend to assess the situation and do it his/her own way. The person may do so without declaring his/her intention or discussing the intended change to procedures with management.

TRANSPARENT INDEPENDENT RAPID RISK REPORTING

A number of organisations have developed transparent, independent-of-line-management rapid risk reporting systems. Such systems have two prime aims:

- i) To enable rapid reporting of matters like critical near misses that give individual employees a 'chill'. A number of organisations have noted that just before something really serious happens someone somewhere in the organisation develops premonition which if promptly reported can prevent a disaster, and;
- ii) To deal with issues that normal, day to day, line management systems have repeatedly failed to address. For example, remote monitoring systems that persistently fail despite the IT department's recurring efforts to sustain them. Rather than let frustrated employees develop hidden independent fixes outside of the ken of line management which can easily create latent conditions, one last risk communication system can be invoked.

One common approach is a weekly Red, Amber, Green (RAG) report. All employees should be able to access the RAG report to flag emergency risks, near miss / unsafe conditions and systemic failure. Typically this is by email to a central coordinator. The report is sent electronically to all managers and board members weekly.

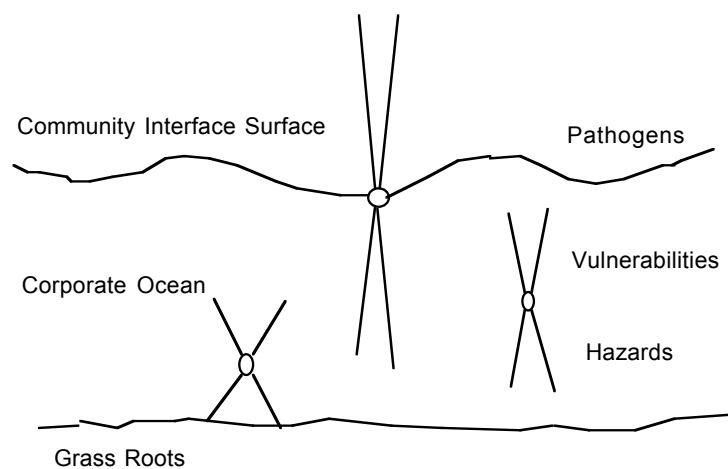
If a critical issue is identified that requires immediate attention then it is entered into the RAG report and identified as a 'red' risk. A review and/or investigation is then conducted to examine the extent of the problem resulting in the problem being actioned and moved to either the Amber (under review) or Green (fixed) section. Once it is Green it is deleted. If the emerging risk is ongoing, then the risk should be transferred from the RAG report to the usual risk register database for ongoing monitoring.

Such a process is peculiarly open and powerful since it is routinely steps outside normal day-to-day line management decision-making and real alerts are gratefully acknowledged. It does not appear to be abused since false alarms are personally damaging and not repeated.

GENERATIVE INTERVIEW TECHNIQUES

This is a top down enquiry and judgment of unique organisations rather than a bottom up audit for deficiencies and castigation of variations for like organisations. The object is to delve sufficiently until evidence to sustain a judgment is transparently available to those who are concerned. (Enquiries should be positive and indicate future directions whereas audits are usually negative and suggest what ought not to be done).

The diagram below shows a stylised picture of the 'corporate soup'. Individuals have different levels of responsibility. For example, some are firmly grounded with direct responsibility for production and maintenance. Others work at the community interface surface with responsibilities that extend deep into the organisation as well as high into the community.



Interview Depth

The idea is that a team interviews recognised 'good players' at each level of the organisation. If a commonality of problems and, more particularly, solutions are identified consistently from individuals at all levels then adopting such solutions would be fast and reliable.

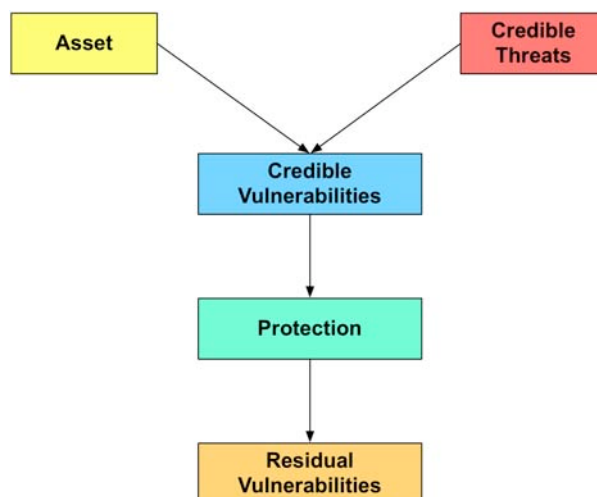
Other positive feedback loops should be created too. The process should be stimulating, educational and constructive. Good ideas from other parts of the organisation ought to be explained and views as to the desirability of implementation in other places sought. The following questionnaire has been used as a general basis for such an interview process.

GENERATIVE SOLUTIONS TECHNIQUES

Hazard based approaches to risk focus on identifying problems, and how they should be controlled. Concepts such as ALARP (as low as reasonably practicable) are often used. Another approach is just to put up solutions, try them and see which work.

Such an approach was used to develop the "best way forward" for Silver Fern Shipping.

A top down threat and vulnerability approach was initially adopted to determine primary issues with regards to potential fires with unmanned engine rooms for the "Taiko" and "Kakariki" following from fires in the "Westralia" and "Helix". The technique is described in detail in the R2A text, especially Chapter 7.



Vulnerability Assessment Process

Such a review concluded (amongst other matters) that stopping all fires from starting is very difficult indeed. But it was also noted that fires in manned engine rooms were generally detected early and managed quickly. Such detection occurred via human sensory detection. In addition to sight and smell, a change in the sound pattern or altered vibrations can also provide early alert. That is, early detection was achieved by more than just typical fire detection systems. The engine room staff actually acted as environmental monitoring devices. This prompted speculation as to the best early detection system. No crisp answer was available. Much expensive research could be undertaken, but this would commit the organisation to an endless series of irresolvable “what if” problems and possibly an untested technology thereby sapping organisational resources and enthusiasm generally.

It was also noted that the ships (marine) engineers received the greatest respect and pleasure from fixing problems and that if they had spare time at sea, there seemed to be an uncontrollable urge to 'fiddle' with things.

In view of this a generative solutions approach was recommended. Basically the two ships chief engineers were each given a budget to buy detection/environmental monitoring equipment. This potentially included sniffers, cameras (thermal imaging & others), vibration monitors (torsional and longitudinal), sound and noise analysers and the like. For the next few months they fiddled and then returned to advise that which worked well on their ship.

This was seen to be cheaper than hiring engineering consultants or researchers to attempt to determine a solution, which might or might not operate in a harsh marine environment. It was also constructive, agreeable and interesting for the crew.

CONCLUSION

There has been a rapid rise in the use of generative risk techniques recently. This seems to have occurred concurrently with the rise of risk culture as a recognised and legitimate source of preventative effort. This is a very positive and rewarding development and appears to support the view that the primary purpose of risk management is to ensure all reasonable precautions are in place rather than the achievement of some risk target.

REFERENCES

Braithwaite G, JPE Faulkner, RE Caves (1997) *Latitude or Attitude? - Airline Safety in Australia*. Paper presented at the 1997 National Conference of the Risk Engineering Society, Engineers Australia, Canberra

Engineers Australia , Risk Engineering Society, Victorian Chapter (2002). *Safety Case Guidelines*. Engineering Guidelines Online. (<http://www.engaust.com.au/epub.html>)

Hampden-Turner C (1990). *Corporate Culture, From Vicious to Virtuous Circles*. Hutchinson Business Books Limited, Great Britain.

Kneller A, R Robinson and D McCann (2002). *A Fire Risk Assessment*. Paper presented at the Pacific 2002 Conference. Darling Harbour, Sydney.

Reason J (1993). *Managing the Management Risk: New Approaches to Organisation Safety* Chapter 1 of *Reliability and Safety in Hazardous Work Systems: Approaches to Analysis and Design*. Eds I Wilpert et al. Lawrence Erlbaum Associates Ltd, East Sussex. ISBN 0-86377-309-5.

Reason J (1997). *Managing the Risks of Organizational Accidents*. Ashgate Publishing Limited.

Robinson RM, K Anderson et al. (2004), *Risk & Reliability - An Introductory Text*, 5th Edition ISBN 0-9585241-3-0