New approaches to assessing vulnerability and resilience

Introduction

Identifying who exactly are the vulnerable people in the community has been accepted for some time as a necessary part of effective emergency and disaster planning. With the introduction and general commitment throughout Australia to a risk management approach to emergency management, the need to identify vulnerabilities has been given impetus (Salter 1997). The authors are particularly interested in developing the concept of vulnerability and of improving methods for assessing that vulnerability. However, it seems to us that there is still a limited understanding of what the terms vulnerability and resilience include.

This lack of understanding often constrains the effective practice of emergency management. As well as dealing with a variety of potential risks, emergency managers have to deal with a range of potential needs and potential capacities to cope of individuals, groups, communities and agencies about which they have only a partial and incomplete understanding. This necessarily limits the options that can be developed to reduce risk to the community. Equally, individuals, communities and agencies have an equally demarcated understanding of risks, hazards, vulnerabilities and capacities. As a result, understanding of options for effective risk management as well as for supporting local capability are also limited.

Some people, of particular note Ken Granger and his colleagues engaged in the Cities Project (Granger et.al. 1999), are developing a better and more detailed understanding of risk and vulnerability. However, we believe that there are a number of additional facets to resilience and vulnerability that need further exploration as we discuss below.

In this paper we identify specific issues that are central to a proper and complete understanding of vulnerability and resilience.

As we progress in our study of vulnerability and resilience we hope to incorporate these elements into a coherent framework that is capable of systematic application by emergency managers and community members to generally inform

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the process of risk assessment and risk management planning more thoroughly than is now possible. This will be a practical and applied aim.

We also expect to develop a better theoretical basis for the understanding of vulnerability and resilience and to integrate with other disciplines such as community development, social psychology, community economics and environmental management.

Background

Recent events in Victoria and elsewhere have stimulated an interest in assessing vulnerability that had recently become evident and which was developing in significant ways. The January 1997 bushfires in the Dandenong Ranges was a generally well managed community support and recovery process. The lead taken by local government, and the level of support provided by the local community to its own members, serves as a model of local coordination and management.

However, there are some indications that it took some time for the recovery process to identify all vulnerable groups. In particular single parent families, usually with low incomes and typically with constraints upon the time of the sole parent and comprising just over 10% of the total population, may have lacked opportunities to fully participate in some community recovery activities. Following the East Gippsland floods of June 1998 it also became apparent that there were a number of distinct groups that had special needs.

Families in remote areas lacked access to child care facilities (other than a traveling child care support group whose funding was shortly due to cease); other people in remote areas had very consi-derable distances to travel to access services and support; in some of the farming areas an aged population faced difficulties in recovering from their losses and the whole area was made more vulnerable through the effects of 2 years of drought preceding the floods.

Vulnerability was as much a result of exposure to 2 years of drought and many years of environmental alteration, and the effects of isolation (extended travel time, poor communications and so forth), as it was to the passing effects of the flood itself.

The Gas Shortage of September 1998 in Victoria also highlighted particular vulnerabilities in the community when gas restrictions were applied. Aged people, new born babies and infants, people with particular medical conditions or with terminal illnesses requiring palliative care, people on life support systems, and the disabled all had special requirements for support. Yet many of the aged who were expected to be vulnerable actually coped better than was expected by emergency managers. The elderly had experience and coping strategies not available to younger people, that they had gained from working through previous life difficulties such as the Great Depression and the Second World War.

Of less immediate priority were a number of other groups. People laid off from work that experienced an unexpected reduction in income, businesses forced to close temporarily and people that needed to purchase electrical cooking and heating.

On a broader scale still, there were groups of people that required specialist information on dealing with the effects of the loss of gas in terms of alternative cooking and heating options, the safe disposal of food and other putrescible materials, and safe methods of heating and using water for bathing.

These events, and the ways in which they have highlighted community needs occurring in the context of a change from a hazard based focus on emergency management to a risk based focus, set a starting point for our consideration of vulnerability as it applies to emergency management.

Definitions

The glossary produced by Emergency Management Australia (Emergency Management Australia 1998) defines **vulnerability** as:

The degree of susceptibility and resilience of the community and environment to hazards. The degree of loss to a given element at risk or set of such elements resulting from the occurrence of a phenomenon of a given magnitude and expressed on a scale of 0 (no damage) to 1 (total loss).

Elements at risk is defined as:

The population, buildings and civil engineering works economic activities, public services and infrastructure, etc. exposed to hazards. (Emergency Management Australia 1998)

But there is no reference to people, their community and social associations, networks and processes which underpin and facilitate life in our society.

Despite these limitations we accept this as a working definition of vulnerability, although the subsequent references in the glossary as:

vulnerability analysis: *see hazard analysis, and*

vulnerability assessment: *see hazard analysis.* (Emergency Management Australia 1998)

suggest an emphasis on the hazard agent rather than on the consequences of interactions between the hazard agent and community, property and the environment.

The glossary continues by defining **vulnerable groups** as:

Categories of displaced persons with special needs, variously defined to include: unaccompanied minors, the elderly, the mentally and physically disabled, victims of physical abuse or violence, and pregnant, lactating or single women. (Emergency Management Australia 1998)

In our view this is a limited and restricting list.

Resiliency is defined as:

A measure of how quickly a system recovers from failures. (Emergency Management Australia 1998)

Again we have no inherent disagreement with this definition, so far as it goes. But it fails to identify that individuals, groups and communities may each possess degrees of resilience which will vary over time and within each of these categories.

We need to understand the resilience of each of these levels, in fact of all elements that have a bearing on the life of the communities that we are investigating.

We accept that argument with any definition is possible and we do not relish pedantry. However these definitions and the emphases they place (or, just as importantly, do not place) do indicate a particular view of the world and a view of what matters or which elements have priority. These limitations to these concepts have clear potential to affect planning and management in practice.

The new approach to emergency management, of assessing risk, evaluating a range of management options and of directly involving the community in the process, rather than emphasising prevention and control of the hazard agent only is still developing. In this circumstance we can hope that these concepts and definitions will be refined as the new approach is increasingly adopted and progressively evaluated.

Some of these issues are clarified, or at least identified, in the definitions of risk and associated terms given in the glossary. 'Risk' as a key concept in this new approach has a tendency to embrace associated issues, such as vulnerability and resilience, and although the definition of 'risk' itself clears up some issues there also needs to be a comparable clarification for terms such as vulnerability.

- **risk:** a concept used to describe the likelihood of harmful consequences arising from the interaction of hazards, communities and the environment. The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood. A measure of harm, taking into account the consequences of an event and its likelihood. For example, it may be expressed as the likelihood of death to an exposed individual over a given period. Expected losses (of lives, persons injured, property damaged, and economic activity disrupted) due to a particular hazard for a given area and reference period. Based on mathematical calculations, risk is the product of hazard and vulnerability.

- **risk analysis:** systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences. The systematic use of available information to study risk.

- **risk assessment:** the process used to determine risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels or other criteria. (Emergency Management Australia 1998)

The final point that we want to make

about definitions refers to types of vulnerability.

Vulnerability is often taken to be an absolute measure of loss, usually given in dollar terms and expressed as potential or actual losses, as for existence in damage caused by cyclones, earthquakes, bushfires and floods. An equally important aspect of vulnerability is the relative vulnerability of groups, that is the amount lost (or at risk) compared with the amount that another group may risk; where amount can refer to dollar values, amounts of goods such as household items and so on. This aspect is important in setting priorities for limited resources when they have to be allocated to different groups or areas.

An often neglected definition refers to loss relative to the goods and capacities required to sustain at least a minimum level of safe and healthy living. For some people this level of loss may be slight, in dollar terms, but in terms of their capacity to replace losses and to sustain acceptable living conditions it may be very important.

What we indicate here is that a qualitative assessment of the significance of the goods that may be lost needs to be included in any consideration of vulnerability. In this sense a $1M home in affluent Toorak has the same value as an $80k home in the working class suburb of Footscray; both are the abode of a person or a family. In this sense they are identical. The home in Footscray may actually be of greater value to the residents if their income is low and they have fewer resources to divert to replacement or repair or even to take out adequate insurance in the first place.

We do not deal in this paper with hazard assessment, which is an integral part of the risk management process and which is directly relevant to assessing vulnerability. Hazard analysis and assessment are well understood processes — even if the hazards themselves are still difficult to understand and predict in terms of location, timing and behaviour — and so we refer readers to the relevant literature and sources for hazard assessment techniques.

We also need to mention that vulnerability is often taken to be 'community vulnerability', that is the personal (life, safety, wellbeing and personal and family property) vulnerability of individuals, families and small groups. The exposure to damage of services, infrastructure and economic activity is frequently ignored. Yet these are vulnerable to damage themselves. When damaged the resulting loss to people of services and amenities

may in itself increase or generate vulnerability and need.

Therefore we believe that these elements also needed to be included in a vulnerability assessment of the community and as well as their own vulnerability needs to be assessed.

Current approaches to assessing vulnerability

While vulnerability assessment has been accepted for some time as a requirement for the effective development of emergency management capability the concept has generally been applied simplistically.

Vulnerability has usually been taken to refer to groups of individuals. Typically these are taken to be:
- the elderly
- the very young
- the disabled
- people who speak a language other than the dominant language (in Australia's case English)

At best this is a very limited list and it looks at only one dimension of vulnerability. Groups are identified basically as first existing outside place (with any location specific mix of hazards, (such as close to chemical plants), community facilities (which may reduce vulnerability) and so on). Second as being outside time (variations in vulnerability over time as periodic changes such as across the year or across repeating events such as drought or economic downturn), third as being independent of social and economic trends.

These groups may well be vulnerable to the impacts of hazards. Though how and why they are at greater risk than others is not identified or evident from a simple statement of the class of people as vulnerable. Is it because, say, they are aged or is being old indicative of other factors that are more directly relevant to emergency management? Such as reduced income, reduced physical strength and mobility, limited opportunity (in terms of the time available) to recover from major financial losses?

This approach also looks at vulnerability as an attribute of the group being assessed. Clearly this is the case for some issues. However, there are circumstances where a vulnerability may be imposed and may not be linked to the people affected in any significant way. Damage to infrastructure, to community facilities and amenities and damage to the businesses and economy of an area can impact directly on people who may not be immediately or otherwise affected by the event, such as damage to a transport network impacting on commuters and tourists and damage to a public transport network will impact more severely on those people who do not have private transport than on those who do.

An alternative approach to assessing vulnerability and resilience.

As we mentioned earlier, our approach is still being developed and we hope to first identify a greater range of issues that need to be taken into account in assessing vulnerability and resilience. Secondly, to integrate these into a robust operational structure and third, to develop a theoretical framework for this approach and its methods, integrating it with other relevant social science, economic, political science and environmental management approaches.

Our work so far has drawn on the existing literature, essentially that relating to emergency management, with its subdivisions of social science, management and psychology as they apply to emergency management, and community development.

We have also relied on our own experience in emergency management, emergency management planning and emergency operations, as well as community development and community action, and the experience and knowledge of numerous people from agencies which include the fire services, police, emergency services, human services, non-government organizations, community organizations and local government.

We also worked through a considerable number of scenarios provided by a range of agencies. We found these of variable usefulness. Our experience suggests that scenario analysis is useful either when it is applied to a limited situation in great detail and worked through systematically and comprehensively. In this case it can act as a useful reality check, as a means of testing operational capacity against a likely event that is understood in some detail. The other situation where scenario analysis is useful is when it is applied as a mind clearing exercise or as reconnaissance activity. In this case the purpose is to identify the boundaries of the problem and the most prominent features of the topography.

We used both techniques. We found difficulty when we applied the process of reconnaissance hoping or expecting to come up with a detailed survey of the terrain.

In this paper we try to develop a series of perspectives, each of which can throw into relief different aspects of vulnerability identification and in ways that can be developed as a coherent structure as well as being useful in planning, management and operations.

The following lists can be used independently or linked in a matrix to identify priorities in service requirements, support needs or to distinguish between the relative needs of groups.

What we propose, and are working towards developing is a framework for assessing vulnerability that:
- includes multiple levels of social life— individual, family, group, organization, community and infrastructure and services
- includes multiple perspectives on vulnerability and resilience, with these different perspectives capable of forming various matrices as analytical and predictive tools for the community and emergency management agencies

Groups at risk

We acknowledge that there are likely to be some groups that are more susceptible to loss, or have less resilience than other groups, see *Table 1*, while acknowledging that vulnerability has to be considered in functional terms and in response to the hazard type.

This list is neither exhaustive nor exclusive. Nor is it set out in priority order. Actual groups at risk will depend on the specific circumstances (location, community demographics, time of year etc.)

Its principal value lies, we believe, as an aide memoire, as a prompt to those who are undertaking a vulnerability assessment.

What it does not do explicitly is indicate how or why these groups are vulnerable.

Needs

The range of hazards and the consequences of their impact on communities are varied and *Table 2* indicates items of likely greatest need. Again, this is neither an exhaustive nor inclusive list and the ranking of needs will vary on the nature of the event and the nature of the people affected.

This list also serves as an aide-memoire and as a road map of the sorts of issues that need to be identified and canvassed when assessing need and vulnerability.

Special services (identifying vulnerabilities)

It became apparent through the gas shortage that there are particular sets of people who are in special need from utility failure. Often these groups have few members and are not groups in the sense that the members interact with each other,

Vulnerability—groups at risk

1. Aged (particularly the frail)
2. Very young
3. Disabled (mental and physical)
4. Poor/people with limited resources to meet essential needs
5. Non English Speakers (NESB)
6. Indigenous Australians.
7. Socially isolated
8. Physically isolated
9. Seriously ill
10. People dependent on technology based life support systems
11. Large families
12. Single parent families
13. Workers at risk from machinery/equipment failure
14. People with limited psychosocial coping capacity
15. People with limited financial resources
16. People with inadequate accommodation.
17. People on holiday and travelling (particularly those in tent and caravan resorts).
18. Tourists from overseas.
19. People living close to areas of hazard (e.g. floodplains, chemical processing plants, areas of potential landslip.
20. People affected by the impact of a hazard (e.g. people who are trapped, people made homeless)

Table 1: groups that are more susceptible to loss

Vulnerability—needs

1. Home/shelter
2. Safety (personal security and freedom from physical and psychological threats)
3. Health/wellbeing (maintenance of 'normal' conditions of day to day life and interactions)
4. Medical services (including hospital and medicines)
5. Food
6. Uncontaminated water
7. Sewerage
8. Social links (established means of communication and interaction within and between communities
9. Information (about the event, possible personal and group reactions and support and assistance measures
10. Access (to services)
11. Income/economic opportunity (income maintenance or supplementation, business continuity etc.)

Table 2: items of likely greatest need

but groups only by virtue of a common need.

It seems to us that identifying these people can be achieved by reference to special services provided day to day to help people maintain the basic conditions of a safety and well-being.
These services include:
· Meals on Wheels
· Home help
· Supported accommodation services
· Nursing homes
· Hospitals
· Royal District Nursing Service
· Hostels
· Infant Welfare Centres
· Ethnic and Koorie Welfare Agencies
· Community Health Centres

Management perspectives

Despite their utility as aide-memoires, the above lists, and the needs and services they identify, are difficult to work with.

The elderly, for example, may be particularly vulnerable. However there is nothing we can do to make them young. We cannot make the young mature, the poor rich or, in the short term, the sick well.

We therefore need to consider these groups in terms of their needs that are relevant in practical ways to the situation (vulnerability) and which indicate how those needs can be met.

We suggest that the following issues are germane to the emergency management community in so far as they are a way of thinking about service provision in management and operational terms rather than simply in terms of the particular assistance measure or in terms of the simply stated need.

Information

For example about: hazards, preventative and preparedness activities.

About the impacts and consequences of an emergency if one occurs:
· information and advice about assistance measures and how to access them
· the normal biopsychosocial reactions that can be expected and how they can deal and cope with these reactions for themselves, members of their family and their community
· how to make sense of the event in terms of its cause and fitting it into their 'view' of the world

Resources

For example, what resources are required, and owned by members of the community

For prevention, preparedness, protection and recovery activities.

Management capacity

This refers to people's capacity to manage their own affairs with limited outside help and includes:
· time and opportunity e.g. to undertake recovery activities
· physical capacity e.g. which may include the support of other people, machinery or other support where there is a particular need
· access to services e.g. through establishing transport systems, locating service centres close to affected areas or access in terms of translator, interpreter or other language and media services
· expertise e.g. access to specialist services such as tradesmen, financial counsellors and other professional services

Support

This refers to personal support services as well as support programs that provide intangible or common services to the community (i.e. non-financial or material goods service to individuals)
· personal support e.g. outreach services, personal advisors and counsellors, specialist support services, advocates and gatekeepers
· community support e.g. community development officers, support at home, domiciliary care and similar services

Involvement

This applies to the need for people to engage with their local community and recognizes that community involvement is an integral part of effective plans and management
· consultation in developing and implementing emergency management programs
· encouragement in making a contribution to policy and program development
· engagement in monitoring and auditing the progress of community services
· engagement with other members in terms of provisioning mutual aid

These lists are also not exhaustive. They address the practicable aspects of reducing vulnerability.

Using these factors we can assess a person's needs in terms of the types of services that they require to meet the need. It allows us focus on the critical factors determining a person's vulnerability.

This analysis also allows us to identify alternative measures to support the need. So, for example, for an elderly person whose house has been destroyed and who is having difficulty rebuilding, the central

issue is not likely to be that they are aged. It is more likely to be that they have reduced strength and mobility; they are no longer working and so have reduced income. It may be a variety of factors which we can deal with, whereas age in itself in intractable. Equally, an elderly millionaire whose house is destroyed is even less constrained by age or even reduced physical capacity. He or she has the resources, in this case money, to purchase services, in this case a builder to rebuild the house.

Services and infrastructure

These elements which include infrastructure such as roads and bridges, utilities such as telecommunications, power, gas, water and sewage systems, other public facilities such as hospitals and schools and community health centers as well as services provided by agencies and local government can all be damaged by hazard impact.

In this way the utility service providers are vulnerable themselves and since they provide an essential public function the extent of their vulnerability, and appropriate protective measures, needs to be assessed.

However, the loss or diminished capacity of any of these also has an impact on the community itself. This in turn exposes those people who are direct and current service recipients to greater risk immediately and increases the vulnerability of others.

It is important therefore to see utilities and services not simply in terms of their own exposure but more significantly in terms of their social and community value.

This suggests an iterative approach to assessing vulnerability. First we need to assess the direct impact of a hazard and then the indirect losses to the community and its members when services are no longer available.

Levels of vulnerability and community inter-relationships

Often vulnerability is assessed just for the individual or family group, sometimes also for particular utilities or services.

Linking the latter to the former is undertaken less often. There are also other elements at risk in the community that co-exist with these. Community and social organisations such as sporting clubs or recreational facilities, groups that share a common interest, may all be impacted by an event. These groups and associations, ranging from loosely associated groups to formal and structured clubs and service associations, have in our

experience all played a role in supporting the community, particularly in recovery activities.

Their relationships with each other, with the community and with government and private sector agencies is not well documented in this area. However, any damage to these groups can result in a corresponding loss or reduction of service.

These groups may be damaged in a variety of ways. Physical damage to their assets such as club rooms and facilities is the most obvious. But splits within the community that may occur after events along lines of policy, resource allocation, perceived local interests, can all divide members of local groups and associations. Also losses suffered by the members themselves will reduce their capacity to contribute. This may be taken to be a less tangible loss, one of capability of the group to maintain normal services to its' members and others and a reduced capacity to sustain local relationships and networks.

Networks within a community may also be damaged when community groups, individuals and families experience losses and normal communication channels and protocols are disrupted or supplanted by emergency specific systems, processes and networks.

But these networks are vital to effective community functioning. Change has to be managed to ensure transition to another effective pattern of networks.

Identifying and assessing these non-tangible systems and networks can be difficult, but it is not impossible. Assessment in terms of key players, information sources, points of exchange, protocols of behaviour and communication, frequency and volume of exchange are all tools that can be applied to assessing the less formal, but critical, elements of community life.

These are the structures, processes and interactions that support everyday life for most people, provide them with personal and community support, offer them essential services when required and, for other people, provide them with the critical health and care services required to maintain health and wellbeing.

Change of conditions generating vulnerability

Vulnerability is often assessed only at a particular point in time, usually prior to or as part of the emergency management planning process.

Vulnerability, either for individuals, groups or organisations needs to be

assessed at particular points. There are periodic times, across the year when certain vulnerabilities may increase, which suggests that mitigating programs also need to be scheduled—whether these are programs targeted at communication, self-protection, planning or others.

Social conditions may alter locally, say with the onset of particular environmental or economic changes such as episodic drought or economic downturn, and these processes are likely also to alter the conditions generating vulnerability

Also, after disasters, changed conditions—damage to homes or income earning assets, damage to the networks of the community or to infrastructure—may generate new conditions of vulnerability that require a re-assessment of potential or actual vulnerabilities. The actual length of time over which the event occurs may be significant in changing social conditions and may itself represent a period when dramatically changed social relations exist.

Social conditions

The social conditions that generate and maintain vulnerability are not well understood in detail.

We do have some sense that certain situations may generate or magnify vulnerability. Remoteness as distance from services, low income as reduced capacity to acquire resources or services, difficulty of access in terms of ethnicity or language, economic decline of areas are just some of the factors that can affect vulnerability. They affect the vulnerability of individuals, communities and agencies. For example, 2 years of drought in east Gippsland prior to the floods of June 1998 appears to have reduced the capacity of both individuals affected by the floods and the community broadly to recover quickly and effectively. The drought did not influence the occurrence of the flood, nor perhaps the damage it caused (except for soil erosion), but it clearly reduced the recovery capacity of the area.

Understanding the dominant social and economic conditions of an area that are relevant to vulnerability will allow us to better target measures to reduce vulnerability.

We also need to be able to translate these conditions into issues and tasks that we can address in a practical way. The drought increased vulnerability through reducing incomes, lowering community morale, reducing the 'emotional strength' of people. These are issues we can deal with.

However, the underlying conditions for

purposeful local activity existed as evidenced by local commitment to the 'A Future for Rural Australia' program; the job of emergency managers is to draw out such latent capacities in local communities.

Norms and values

It is a given of emergency management that self-reliance, individual and local preparedness, awareness of the risks faced are all elements that are important in reducing vulnerability and increasing the coping capacity of the community.

We have at this time only a rudimentary understanding of what values are relevant or of how values may affect behaviour.

We have encountered events where local self-reliance has such a high value placed upon it that the affected community is resistant to assistance from outside. In other events some sectors of the community hold values of self-reliance, independence and oppose accepting what they see as charity or welfare from recovery agencies that inhibit them from seeking help even from their neighbours. In some events blame has been attached to some members of the community and this has resulted in splits within the affected population. The damage to local networks and services and the energy given to the conflict has reduced the immediate effectiveness of recovery services.

So we need to understand the values and norms that influence vulnerability. Not necessarily so that we can modify or override them—our business is to support the community not to usurp it—but so that we can identify measures that can be explained to, and offered to, the community and built into their own structures and set of values.

In one instance we had a prominent local leader reject additional staff resources. He perceived the staff as 'do-gooders' and as irrelevant to the practical issues of recovery. When it was explained to him that they would be local people employed as a resource for the community to manage, and that their focus would be practical and focusing on specific local issues, needs and tasks, he was receptive to the proposal.

Capability assessment

The capacity of social groups such as sporting associations, Non-Government Organisations and agencies tasked with a role in providing support to the community all have role to play in minimising vulnerability and supporting resilience.

The capacity of these to provide support services to the community, in planning, preparedness, protection and recovery, will bear directly on the vulnerability of the community.

If these groups are exposed to hazards, if their own operational capability is at risk, then there will be corresponding increase in vulnerability.

Consequently capacity to avoid risk to the organization as well as capacity to provide services after impacts and even after impacts that affect the organization itself, need to be assessed and taken into account.

Resilience

While people, communities, agencies and infrastructure may all be exposed to hazards and risks, that is be vulnerable, they may equally possess qualities that reduce vulnerability.

This we call resilience and it is not just the absence of vulnerability. Rather it is the capacity, in the first place, to prevent or mitigate losses and then, secondly, if damage does occur to maintain normal living conditions as far as possible, and thirdly to manage recovery from the impact.

There are a number factors that support individuals, families and communities to minimise the consequences of disasters in terms of supporting preparedness activities as well as supporting and sustaining recovery activities.

Identifying and assessing those positive factors possessed or shared by individuals, families, groups, communities and agencies which support resilience gives emergency planners and managers the opportunity to further develop resilience to increase the 'disaster resistance' of the population.

Some of the elements that support resilience are listed in *Table 3*.

Conclusion

We have proposed a different perspective on how resilience and vulnerability may

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Elements that support resilience

Shared community values, aspirations and goals

including a shared and positive sense of the future, a commitment to the community as a whole and agreement of community goals as well as a shared culture

Established social infrastructure

such as information channels, social networks and community organisations such as sporting and social clubs.

Positive social and economic trends

such as a stable or growing population, a healthy economic base

Sustainability of social and economic life

which embraces a capacity for the community to weather disruption

Partnerships

Partnerships between agencies, between community groups and between commercial enterprises, or any combination of these, may bring innovation, sharing of experience, knowledge and resources and common goals. This applies particularly where the partners play a dominant role in the social and economic life of the town, such as towns dominated by a particular industry or economic activity.

Communities of interest

Where a group may exist over a wide area and be otherwise socially diverse but they share a common area of interest, skill or expertise. This includes communities bound together by faith and religious commitment, cultural groups as well as less formal groups such as business or commercial associations or sporting or recreational clubs

Established networks

Clear and agreed and stable links between people and groups facilitate the exchange of information as well as the sharing of resources and the commitment of skills, time and effort to planning and preparedness

Resources and skills

The resources and skills available locally may be directly relevant to emergency management planning, preparedness and for community support if an emergency does occur. These can be identified by the type of resource or skill, its amount, the cost to use it, its availability and by its location. Where useful resources or skills do not exist then they may be developed or promoted as part of preparedness activities.

Table 3: factors that support individuals, families and communities to minimise the consequences of disasters

be assessed. Some aspects are already accepted or are being adopted by a number of emergency management agencies and agencies with emergency management responsibilities.

The Department of Human Services in Victoria has already issued initial working papers 'Guidelines for Assessing Resilience and Vulnerability' (Department of Human Services 1999) for use by emergency management agencies, local government and the community and the Victoria State Emergency Service is actively promoting community risk management as a means of planning with municipalities. The Country Fire Authority has been working with local communities for some time to develop local capability in responding to fire hazards and to develop better local understanding of fire risk through programs such as Bushfire Blitz and Community Fireguard.

All this is to the good and parallels similar—but we suspect less developed—activities in other western countries.

A further challenge we need to confront is already addressed by many researchers into risk, hazards and vulnerability in the differently developed countries. This is the structural causes of risk and vulnerability.

We have suggested that it is not personal or demographic characteristics that are necessarily the most important in determining vulnerability. Social, economic and cultural factors, profoundly embedded in our community, may be of more importance in terms of understanding, and therefore reducing vulnerability.

Structural determinants of vulnerability are identified in many studies of the differently developed world. Western researchers investigating vulnerability in western countries less readily identify them.

The challenge is this, to look critically (and this does not mean negatively) at our own community to identify and evaluate the deep, long term conditions, processes and relationships which may exist to manufacture and maintain vulnerable populations.

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Disclaimer

This paper does not necessarily represent the views of the authors' agencies and is part of work in progress to more clearly understand the nature of vulnerability and resilience in the context of emergencies.

New Books

Tools of Deconstruction?

Understanding Disaster Aetiology through Cognitive Theory – A Case Study of the Vincennes Incident.

by Simon Bennett

An Occasional Paper from the Scarman Centre, at the University of Leicester, UK.

Reviewed by Colin Fiford

On 3 July 1988 the American Warship Vincennes shot down an Iranian airliner over the Persian Gulf. Two hundred and ninety passengers died. The Vincennes had mistaken the airliner for an Iranian warplane. The incident soured relations between USA and many Middle Eastern countries. Some accused the Americans of deliberately destroying the Iranian airbus.

The publication *Tools of Deconstruction?* attempts to unravel the mystery surrounding the shootdown. It uses theories from social psychology to try to understand why the Captain and crew of the Vincennes mistook the airliner for a warplane. *Tools of Deconstruction?* concludes that:
- the error resulted from the accidental misinterpretation of radar data, which, in turn,
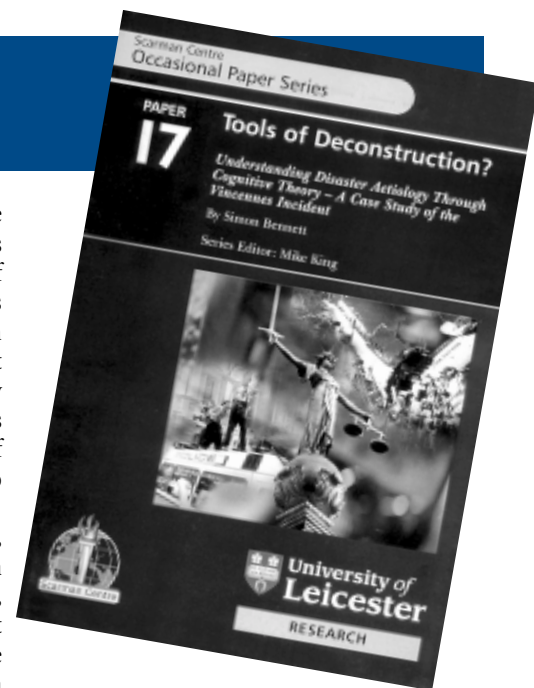- resulted from the crew's expectation of conflict with Iranian forces.

This expectation reflected America's deteriorating relationship with Iran and an exchange of fire between the Vincennes and Iranian gunboats on the morning of the shootdown. 'Tools of Deconstruction?' also argues that the crew's perceptions and actions were influenced by tough US Department of Defence Rules of Engagement (ROE) that required the robust defence of military assets and personnel. The publication suggests that under such circumstances the destruction of the Iranian Airbus amounted to a 'scenario fulfillment'.

Through its analysis of the circumstances of, and reasons for, the incident the publication shows how precedent, rules and regulations, pressures and expectations cause competent personnel to misinterpret information. In the case of the shootdown of Iran Air Flight 655, Dr. Simon Bennett theorises that this most human of failings led to the deaths of 290 civilians.

The paper has two objectives. Firstly, through a case study of the destruction of the Iranian airliner, the publication evaluates three theories of human cognition. These are the *tools of deconstruction*, with regard to the aetiology (the historical and contemporary circumstances) of disaster, which give the paper its title. Secondly, the paper employs the theories of heuristics, paradigms and social schema to develop a fuller understanding of the dynamics of the incident.

The holistic analysis employed in the paper reflects the work of Reason in a 1995 book 'Human Error'. Reason took the view that actions and events may be informed and influenced by historical experience as well as by contemporary circumstances. Simon Bennett's paper accepts that he cannot claim to offer a definitive explanation of the actions of the Captain and crew of the USS Vincennes.

A *heuristic* is defined in the paper as a mental short cut that provides 'a simplifying routine that leads to approximate solutions to everyday problems'.

Paradigm is defined in the words of Kuhn (1962), in 'The Structure of Scientific Revolutions'. A paradigm is 'a strong network of conceptual,

theoretical, instrumental and methodological commitments that inform analysis'.

Social *schema* are cognitive structures that contain knowledge of the social world. They help us to process information about events that facilitate an understanding of our environment. They may be considered as 'cognitive shortcuts'. Schema, says Simon Bennett, are masses of organised past experiences that create a tendency to interpret contemporary data in accordance with the general character of earlier experience. Such cognitive expediency carries with it the risk that responses may be inappropriate to those contemporary circumstances.

Bennett argues that schema, what he calls 'general organising frameworks', are not dissimilar from paradigms, to the extent that both are prescriptive mechanisms. Heuristics, he says, are also grounded in past experience. Bennett quotes Reason frequently and the view that only a detailed understanding of the aetiology of an event can provide a full and comprehensive explanation of why the protagonists developed certain views and behaved in a certain way.

In the third of nine meticulously constructed chapters, Bennett looks at the actual destruction of the Iranian airliner and the antecedent events and trends. He speaks of the United States as 'the dominant economic and political power of the 20th century'. Developed nations, he says, have promoted a new form of colonialism based primarily on economic power. 'The demise of the Soviet system helped the USA's global ambitions. It allowed the USA a monopolistic superpower role'. By the mid-1980's the United States had military alliances with 50 nations and had 1.5 million soldiers, airmen and sailors stationed throughout 117 countries.

Another chapter looks closely at the design, development and capabilities of the USS Vincennes, a Ticonderoga Class cruiser. The radar SPY-1A or 'Aegis' system is analysed in detail, including its target illumination weaknesses, and its costs (each installation costs approx. $200 million). The conduct and ergonomics of the Combat Information Centre (CIC) is a key factor in the shoot down of the Iranian aircraft. In addition, the responses from the aircraft's transponder, and the coded replies, determine whether an aircraft is civilian or military. There was confusion in this regard.

In his excellent foreword to the 1999–2000 edition of Jane's Fighting Ships, Captain Richard Sharpe's words support and complement many of Simon Bennett's theories. Captain Sharpe says 'the great weakness in command and control development is the assumption that because we can think 'it', computers can represent 'it', as long as we can create the appropriate architecture'.

One of the earliest naval challenges to this orthodoxy, says Sharpe, came in the analysis of low frequency sound in the sea. If a skilled sonar operator could interpret a series of ambiguous and intermittent acoustic signals as coming from a potential target, it followed that a computer could do the job as well, if not better. The answer was that it could not, because an element of artistic interpretation was often necessary to augment the purely scientific data, *in order to sift the nuggets of ore from the oceans of dross*. Humans achieve this, computers cannot.

Is it even desirable to try, bearing in mind the dangers of operators believing that what is on the screen always represents reality?

'The greater the data flow, the greater the vulnerability to misinformation, deception and confusion. Information dominance does not guarantee superior judgment.'

'Janes' goes on to discuss another acronym: CEC (Cooperative Engagement Capability) the latest attempt at better information management at the command and control level. However 'deficiencies existed in the areas off track management, net operations, co-operative engagement, support, composite identification and link interoperability. This is happening at the turn of the century and very little appears to have changed from the Vincennes incident (1988) that is the focus of this review'.

Incidentally, at the beginning of his foreword, Richard Sharpe offers two pages of military analysis that every politician and senior officer globally (and especially in Australia) who is involved in defence affairs, should read and act upon. He speaks of the 'creeping tide of civilianisation' and 'that the lobby for softening traditional military values is taking the line of least resistance, in order to accommodate the social priorities of liberal political establishments'. 'A compensation culture is milking money for perceived injuries, both physical and mental'. But, I digress.

A particularly interesting part of the paper is that decisions are made based on a small screen which provides a data snapshot of the situation. Symbols represent the targets on the radar, but unlike older radars, are digitalised and do not represent the *size* of a target. Even modern vessels like the USS Vincennes, are prone to heel over when carrying out turns at high-speed. In such situations manuals, charts, calculators and other types of unsecured equipment may be flung across their work areas.

This reviewer is reminded of his naval service and of one Captain's alleged comment to the executive officer of a surface ship: 'Are the men at dinner, Number One?' 'Yes Sir!' 'Very good. Starboard 30'.

Bennett quotes Brookes in saying, 'in bygone days old fashioned raw radar returns could be interpreted by a skilled operator to deduce a target size. This was no longer possible with the computer-generated symbols on the Vincennes' screens'. Brookes is quoted as asserting that this reliance on the CIC can lead to decision-makers becoming, as he puts it, 'cut off from reality'.

In the final chapters of this engrossing, and complex, paper the author investigates the actual engagement and the global reaction. Had the CIC picked up a Mode II transponder signal from a military aircraft at Bandar Abbas airfield which led to the classification of Flight IR655 — the Iranian Airbus — as a hostile aircraft?

The tactical information coordinator (TIC) had insisted that the target aircraft was descending towards the Vincennes at a rate of 1000 feet every mile. In fact the aircraft was about to climb from 9000 to 11,000 ft. At one point the operator was 'shouting and yelling', said one report 'as if a kamikaze was running in'.

The *heuristic of availability* was clear, says Bennett, together with the paradigm and schema cognitive mechanisms that are the foci of the paper. The Stark incident had clearly focused the minds of the Vincennes' crew. The Stark incident resulted in the commanding officer being criticised for not taking timely action.

'The crew of the Vincennes obviously lost their cool in the heat of battling gunboats and with the memory of the Stark vivid in the minds'. The radar system was unable to discriminate between an Airbus and a two-seater fighter plane. CIC personnel had to synthesise data from two screens. This had to be done in a situation of some chaos. Human error had a role to play - or as this reviewer prefers to call it "the human element". The author suggests the implementation of human / user-centred-design procedures so that the demands of systems do not exceed user capabilities.

An amazing 56 references are used for this masterly work. Its great strength is in the economy of words and the careful structure. Simon Bennett must have written and rewritten parts of this paper many times in striving for excellence. It is still hard reading because of the many, and frequent, references.

The paper's topic is a very specialist field and the early pages, where the academic foundations of its purpose are laid, should not put off likely readers. History, sociology, military strategy, ship architecture, defence strategy and tactics, geography, crisis decision-making, to name but a few topics. They are all, and more, crammed into these comprehensive 49 pages.

Congratulations to the author Dr. Simon Bennett and to his Series Editor, Mike King.

The reviewer, Commander Colin Fiford, was a naval officer in conventional and nuclear submarines, specialising in navigation and intelligence. He later worked in maritime education and simulation, also curriculum design and educational technology for adult and distance education. He is Senior Education Officer at the Australian Emergency Management Institute, where he is primarily involved with the development and delivery of emergency exercise management and of risk management education. He still serves in the Naval Reserve.